PROCEEDINGS
OF THE
UNITED STATES LIVESTOCK
SANITARY ASSOCIATION

FIFTY-FIFTH
ANNUAL MEETING
Proceedings

FIFTY-FIFTH

ANNUAL MEETING

of the

UNITED STATES LIVESTOCK
SANITARY ASSOCIATION

HOTEL PRESIDENT
Kansas City, Missouri
November 14-15-16, 1951
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United States Livestock Sanitary Association

November 14-15-16-1951

Hotel President

Kansas City, Missouri

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OFFICERS AND COMMITTEES—1951-1952

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A. M. Smiley, Fowler, Indiana
F. C. Smith, Groveport, Ohio
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R. A. Hendershott, Trenton, New Jersey
A. P. Schneider, Boise, Idaho

Alternates
H. G. Geyer, Columbus, Ohio
R. W. Smith, Concord, New Hampshire
R. L. West, St. Paul, Minnesota

REPRESENTATIVE TO POULTRY BRANCH, PRODUCTION AND MARKETING ADMINISTRATION MEETINGS
A. L. Brueckner, College Park, Maryland
<table>
<thead>
<tr>
<th>DATE</th>
<th>PLACE OF MEETING</th>
<th>PRESIDENT</th>
<th>SECRETARY</th>
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<tbody>
<tr>
<td>1. Sept. 27-28, 1897‡</td>
<td>Fort Worth, Texas</td>
<td>*Mr. C. P. Johnson, Springfield, Ill.</td>
<td>*Mr. D. O. Lively, Forth Worth, Texas</td>
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<tr>
<td>2. Oct. 11-12, 1898</td>
<td>Omaha, Nebraska</td>
<td>*Mr. C. P. Johnson, Springfield, Ill.</td>
<td>*Mr. Taylor Riddle, Kansas</td>
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<tr>
<td>5. Oct. 8-9, 1901</td>
<td>Buffalo, New York</td>
<td>*Dr. E. P. Niles, Virginia</td>
<td>*Dr. F. T. Eisenman, Louisville, Ky.</td>
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<tr>
<td>15. Dec. 5-6, 1911</td>
<td>Chicago, Ill.</td>
<td>*Dr. John F. Devine, Goshen, N. Y.</td>
<td>*Dr. J. J. Ferguson, Chicago, Ill.</td>
</tr>
<tr>
<td>26. Dec. 6-7-8, 1922</td>
<td>Chicago, Ill.</td>
<td>*Dr. T. E. Munce, Harrisburg, Pa.</td>
<td>*Dr. Theo. A. Burnett, Columbus, Ohio</td>
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<tr>
<td>27. Dec. 5-6-7, 1923</td>
<td>Chicago, Ill.</td>
<td>*Dr. W. J. Butler, Helena, Montana</td>
<td>*Dr. O. E. Dyson, Kansas City, Mo.</td>
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<td>31. Nov. 30-Dec. 1-2, 1927</td>
<td>Chicago, Ill.</td>
<td>Dr. L. Van Es, Lincoln, Nebraska</td>
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<td>32. Dec. 5-6-7, 1928</td>
<td>Chicago, Ill.</td>
<td>*Dr. C. A. Cary, Auburn, Alabama</td>
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<tr>
<td>33. Dec. 4-5-6, 1929</td>
<td>Chicago, Ill.</td>
<td>*Dr. Chas. G. Lamb, Denver, Colo.</td>
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<td>34. Dec. 3-4-5, 1930</td>
<td>Chicago, Ill.</td>
<td>Dr. A. E. Wight, Washington, D. C.</td>
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<td>36. Nov. 30-Dec. 1-2, 1932</td>
<td>Chicago, Ill.</td>
<td>*Dr. Peter Malcolm, Des Moines, Iowa</td>
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<td>37. Dec. 6-7-8, 1933</td>
<td>Chicago, Ill.</td>
<td>*Dr. E. T. Faulder, Albany, N. Y.</td>
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<tr>
<td>38. Dec. 5-6-7, 1934</td>
<td>Chicago, Ill.</td>
<td>*Dr. T. E. Robinson, Providence, R. I.</td>
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<td>39. Dec. 4-5-6, 1935</td>
<td>Chicago, Ill.</td>
<td>Dr. Edward Records, Reno, Nevada</td>
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<td>43. Dec. 6-7-8, 1939</td>
<td>Chicago, Ill.</td>
<td>Dr. J. L. Axby, Indianapolis, Ind.</td>
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<td>44. Dec. 4-5-6, 1940</td>
<td>Chicago, Ill.</td>
<td>*Dr. H. D. Port, Cheyenne, Wyoming</td>
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<tr>
<td>46. Dec. 2-3-4, 1942</td>
<td>Chicago, Ill.</td>
<td>Dr. I. S. McAdory, Auburn, Alabama</td>
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<tr>
<td>47. Dec. 1-2-3, 1943</td>
<td>Chicago, Ill.</td>
<td>Dr. W. H. Hendricks, Salt Lake City, Utah</td>
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<td>48. Dec. 6-7-8, 1944</td>
<td>Chicago, Ill.</td>
<td>Dr. J. M. Sutton, Atlanta, Ga.</td>
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<td>49. Dec. 5-6-7, 1945</td>
<td>Chicago, Ill.</td>
<td>Dr. C. U. Duckworth, Sacramento, Calif.</td>
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<tr>
<td>50. Dec. 4-5-6, 1946</td>
<td>Chicago, Ill.</td>
<td>Dr. William Moore, Raleigh, N. Car.</td>
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<tr>
<td>51. Dec. 3-4-5, 1947</td>
<td>Chicago, Ill.</td>
<td>Mr. Will J. Miller, Topeka, Kansas</td>
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<tr>
<td>53. Oct. 12-13-14, 1949</td>
<td>Columbus, Ohio</td>
<td>Dr. T. O. Brandenburg, Bismarck, N. D.</td>
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* Deceased.
† This was the last meeting of the Interstate Association of Live Stock Sanitary Boards.
‡ Reprinted in 54th Annual Report.
HISTORY OF THE UNITED STATES LIVESTOCK SANITARY ASSOCIATION

In an endeavor to piece together some historical information pertaining to the Association, one should give consideration to and review some of the history of Texas fever, as this disease and the regulations that were employed because of it, led to the meeting of state authorities to discuss what action they should take to protect the livestock of their respective states and evolved into an Association, now known as the United States Livestock Sanitary Association.

Because of the restrictive regulations imposed upon cattle which were ready for movement from southern states to northern grass or feeding areas, the operators of the Fort Worth Stock Yards invited the state veterinarians of the northern states to come to Fort Worth, Texas, on September 27-28, 1897, to observe a new method reputed to free the cattle from disease-bearing ticks. So the history of the Association is definitely tied to Texas fever or southern cattle fever and an understanding can only be had by reviewing the history of "tick fever" in this country.

TEXAS FEVER

This disease is one of the oldest in recorded history, having been reported in France, Italy, Turkey, West Indies, Mexico, Central America, South America, Australia, Africa, Ireland, Finland, Southern Russia, China, Java, Borneo, Philippine Islands and Rumania. It appears that Texas fever entered the United States through importations of cattle from the Spanish Colonies of the West Indies Islands and Mexico. Although cattle are known to have been imported from these sources as early as 1610, it is not known just when the disease first appeared in the livestock of the Colonies.¹

The first reports of the occurrence of Texas fever did not come from that portion of the southern area of the United States where the disease was supposed to be common but from areas to the north where the disease had been carried by the movement of cattle from the south.

One of the earliest reports of this disease occurs in a lecture by Dr. James Mease on November 3, 1814, before the Philadelphia Society for Promoting Agriculture. Dr. Mease called attention to the fact that cattle being driven northward from a district in South Carolina left a trail of fever in all herds with which they came into contact on their progress to the North. This reference was with regard to a herd of cattle that was driven in 1796 from South Carolina to Pennsylvania, where the disease broke out in Lancaster County and other places. Dr. Mease had done some research on this herd and stated that the people of Virginia prohibited the passage of North Carolina cattle through that State; that these cattle infected others while they themselves remained healthy and that cattle from Europe or the interior when taken to the seacoast section of our country south of Virginia, were attacked by the disease and it generally proved fatal. Again in a report to the Society in September, 1825, Dr. Mease stated, "The circumstances of cattle from a certain district in South Carolina affecting others with this disease has long been known." The precise locality or its extent was not given.

¹


Mr. J. Wilkerson, Athens, Georgia, in April, 1867 reported to the Department of Agriculture that cattle seldom contract the disease unless removed from where they were raised; that if they were taken from the mountain country to the low country, they soon contracted the fever and died without transmitting the disease to the native cattle; that cattle taken from the low country up into the mountains continued to improve, while they communicated the infection to animals with which they came in contact, but after remaining in the colder country for a time they lost the power of communicating the infection.

Little was known of Texas fever in the northern states prior to 1866, although as early as 1795 the Legislature of North Carolina passed the following law:

“No person shall hereafter drive any cattle from those parts of this state where the soil is sandy and the natural production or growth of timber is the long-leaf pine, into or through any of the highland parts of the state where the soil or growth of timber is of a different kind, between the first day of April and the first day of November in every year, under the penalty of four dollars for each and every head of cattle so driven, to be recovered and applied as before mentioned.”

In 1814, the State of Virginia refused to allow the passage of cattle through the State from certain sections of South Carolina.

North Carolina, in 1836, passed a law prohibiting the driving of cattle into the State from either South Carolina or Georgia between April 1 and November 1. Despite these laws, the next forty-two years witnessed the spread of this disease to the Blue Ridge Mountains. Mr. Lenoir, in a letter published in 1879 likened the progress of the disease to the spread of ringworm, slowly advancing with an angry external border and apparently dying away in the district over which it had passed.

During these years the settlers moving westward established herds, the livestock industry developed and the method of driving stock overland gradually spread the disease over the entire South and frequently to sections in the North. By 1877 it was the cause of much alarm throughout the country, especially along transportation and trail routes. Invariably, where cattle from Texas or other southern states were driven to northern markets, they left disease and death in their wake.

By far the greatest losses seem to occur by driving Texas cattle through Missouri, Kansas, Arkansas and Indian Territory for distribution as feeders to the various western states.

In 1852, the “Murrain” was reported as highly destructive in Missouri and from 1858 to 1861 it had increased to such an extent along the Texas cattle trails that Missouri in 1861 passed laws to regulate the movement of herds from the South. Other states soon followed the example set by Missouri. The people in these states were aroused to great indignation because some Texas cattlemen persisted in driving their herds north and armed parties confronted and turned back the invading herds. This action proved effective in preventing further losses.

The Texas Almanac, 1949–1950, on page 259 records the fact that Baxter Springs, Missouri lost a great chance as a trail terminal when Missouri farmers in 1866 established a “shotgun quarantine” against the passage of trail herds from Texas. James Daugherty, later of Abilene, Texas was flogged by a mob of Missouri farmers on a drive in 1866 to Baxter Springs, Missouri.

The disease ceased in all of these border states during the Civil War, but imme-
Immediately after the close of the war, when the Texans again sought an outlet through Kansas and Missouri for their accumulated surplus stock, it reappeared.

In order to avoid the hostile opposition met in the adjacent states, Texas cattlemen were forced to resort to shipping their livestock up the Mississippi River by boat. By 1867, Cairo, Illinois, became the chief point of trans-shipment of cattle from steamboat to railroads. During the Spring of 1867, beginning April 23, about 30,000 cattle were landed at Cairo. Although most of the animals were slaughter stock and went direct to abattoirs, the disease spread to many native herds in southern Illinois. The river traffic increased and in 1868, Texas cattle landed at Cairo, were shipped eastward by rail in large numbers spreading infection and consternation into the heart of the country from Illinois to Massachusetts.

The experiences of 1868 aroused the livestock men of the North to a realization of the increasing dangers from fever or "Murrain" disseminated by southern cattle and the necessity of taking strong measures against it. State laws were passed and strengthened from time to time—still the border line of the infected area continued to advance steadily northward and frequent outbreaks occurred in many states. By 1879, cattle owners in many parts of the country were in greatest consternation and alarm.

No one knew of a remedy. No one knew why only southern cattle communicated the plague nor why the disease disappeared in the Winter time. No one could comprehend how perfectly healthy southern cattle could convey such a deadly poison to northern cattle, while the northern cattle sick with the malady, seemed unable to transfer it to others.

In 1868, during the extensive outbreak in Illinois, Dr. John Gamgee, an authority from Europe, visiting in America, was induced by the Pork Packers Association of Chicago to investigate the disease and report. His studies began July 29, 1868 and continued until August 4, at which time the Department of Agriculture requested him to continue his investigations throughout the nation. Since some thought forage played a part, Mr. H. W. Ravenel, a botanist of South Carolina, accompanied Dr. Gamgee in his investigations. At the end of ten months or by June, 1869, he reported his conclusions among which are the following:

That southern cattle, especially from the Gulf Coast, are affected with a latent or an apparent form of the disease; that all breeds of cattle in states north of the Gulf Coast, without regard to age or sex, if they feed on grass contaminated by southern droves, are attacked by the splenic fever; that the disease may be, but is very rarely propagated through the feeding of hay; that the disease occurs mainly during hot weather and never after wild grasses have been killed by frost, until Spring returns; that then the grasses are healthy and continue so until fresh droves of Texas or Florida cattle are driven over the land and that there is not the slightest foundation for the view that the ticks disseminate the disease.

In 1879, Dr. D. E. Salmon, a young veterinary surgeon, was appointed by the Commissioner of Agriculture, LeDuc, to investigate animal diseases in the southern states with particular reference to Texas cattle fever. Efforts were made to learn the boundary of the permanently infected area, the rate of progression into northern country and the losses sustained along the slowly advancing line.
Although the cause was not determined, young Dr. Salmon learned much of practical value.

The cattle tick with which southern cattle were generally infested had for a number of years been suspected by cattleman as being connected with the spread of the disease.

Scientific men generally were inclined to discredit the tick theory. Dr. Salmon noted that northern cattle developed the disease when allowed to graze on the trails of cattle from the South or in pastures occupied by them. He felt in order to protect northern cattle that it would be necessary to establish a quarantine line across the country and regulate the movement north of all cattle originating below the line.

By 1883, he succeeded in establishing about two hundred miles of the line extending from the Atlantic Coast westward through the State of Virginia. During 1884 the line was extended to the Mississippi River, in 1885 to the Rio Grand River and in 1895 on through to the Pacific Coast.

The first Texas fever quarantine was issued on July 3, 1889. On February 26, 1892, the Secretary of Agriculture issued an order placing the following states and the Indian Territory (Oklahoma) within the permanently infected area: South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas and Louisiana. The southern portions of the following states crossed by the quarantine line were also included in the order: Virginia, North Carolina, Tennessee, Oklahoma and Texas. In 1894, outbreaks of Texas fever in Nevada, Kansas, and Missouri, were reported as apparently caused by cattle originating in California. Investigation proved this to be true and accordingly in 1895 California was included in the infected or quarantined area. The United States Bureau of Animal Industry has continued to supervise the movement of southern cattle since that time.

The order required that cattle from the quarantined area enroute to northern markets be yarded away from native cattle, in separate pens and that cars in which they were transported be cleaned and disinfected before they were again used. This order remained in effect until November 1 of 1889 and was renewed each year.

In 1888, Dr. Theobald Smith first noted the destruction of red blood cells in the blood of cattle sick with Texas fever. Previously in 1886 he noted peculiar bodies in the red blood cells of Texas fever sick cattle. Other experiments being conducted in the nation established the fact that the cattle tick was somehow necessary to the transmission of the disease and finally Texas fever was caused experimentally by putting recently hatched ticks on susceptible cattle which had been protected from any other possible source of infection.

In 1889 Dr. Cooper Curtice reported his experiments on the life cycle of the tick. Dr. F. L. Kilbourne also contributed to this work.

The tentative conclusions drawn in 1888 and 1889 were that:

Texas fever is a disease not produced by bacteria.

Texas fever is probably caused by a protozoon living for a time within the red corpuscles of the blood of infected animals.

Southern cattle without ticks cannot infect pastures.

Ticks alone, scattered on a pasture will produce the disease in susceptible cattle.
The final experiments conducted in 1892 confirmed earlier reports of 1889–1890 and 1891. On February 6, 1893, Bureau Bulletin No. 1 was issued, giving the cause and nature of Texas fever and the manner in which it is transmitted from infected to susceptible animals.

Others who figured prominently in research work and immunisation studies include Dr. Mark Francis of the Texas Experiment Station, Dr. J. W. Connaway of Missouri Experiment Station, Dr. J. C. Robert, Mississippi Experiment Station and Dr. W. H. Dalrymple of Louisiana Experiment Station. Doctors C. A. Carey, Alabama, Charles F. Dawson, Florida, Tait Butler, North Carolina and G. E. Nesom, of South Carolina.

EXPERIMENTS IN DIPPING CATTLE TO DESTROY TICKS

In the conclusions drawn following research in 1888 and 1889, one of the factors determined was that "southern cattle without ticks cannot infect pastures". This led to experiments designed to free cattle of ticks. Various substances and combinations were suggested for spraying, dipping and smearing cattle to destroy ticks and were tested between 1892 and 1906.

Under the quarantine issued July 3, 1889, cattle below the quarantine line could be shipped to market for purposes other than slaughter only between November 15 and February 15. This regulation has such a depressing effect upon the cattle industry south of the quarantine line that the discovery of some way to kill the ticks took precedence over practically everything else. Mr. R. J. Kleberg, Manager of Santa Gertrude's Ranch in Nueces County, Texas, designed and built the first vat used by the United States Bureau of Animal Industry in its dip investigations.

The vat was placed at the disposal of the Bureau in 1895, together with the ticky cattle on the ranch. The best results were obtained during the first year from the use of chloronaphtholeum and Lone Star cattle and sheep wash, two coal-tar preparations.

In August, 1897, the Fort Worth Stock Yards Company built a large dipping plant and placed it at the disposal of the Bureau and experiments formerly planned for Santa Gertrude's Ranch were transferred to the Fort Worth Stock Yards.

BIRTH OF THE UNITED STATES LIVESTOCK SANITARY ASSOCIATION

It has been generally believed that the parent organization known as the Inter-state Association of Live Stock Sanitary Boards was formed at Fort Worth, Texas, on September 28, 1897. However, in the Report of the Board of Live Stock Commissioners of Illinois for 1892 and covering the year November 1, 1891 to October 31, 1892, pages D102 and D103 the following is recorded:

"Resolutions adopted by the Inter-state Meeting of Live Stock Boards and State Veterinarians:

RESOLVED: That it is the sense of this convention that tuberculosis in cattle is a dangerously contagious and infectious disease, destructive to human life when the milk or meat of animals so affected are used for human food.

RESOLVED: That towns, villages and cities, should pass an ordinance requiring
all persons who exercise the calling of dairymen and who keep cows for the purpose of selling their milk, or who shall ship milk into such town, village or city, should, before they are allowed to sell or in any way dispose of such milk, procure a certificate from a competent veterinarian to be designated by such corporation stating that the cows in such dairy herd and from which such milk is drawn are free from said disease and that such certificate should be renewed semi-annually, under such penalties as may be fixed by such corporation.

**RESOLVED:** That the legislatures of the different states should pass laws requiring all persons who keep cows and milk same and sell milk to cheese and butter factories should procure certificates from some competent veterinarian designated by the Live Stock Sanitary Commission of that state, or other proper official of such state; that their cows are free from tuberculosis and that such certificate should be renewed semi-annually under penalties for failure.

**RESOLVED:** That where there is no suitable legislation upon the subject in any state, then the legislature of such state should at once pass ample and sufficient laws for the suppression of the same and place the execution of such laws in the hands of the offices empowered with authority to suppress said disease and that suitable appropriations should be made to carry out the provisions of such laws.

**RESOLVED:** That in states where suitable laws for the suppression of said disease have been heretofore enacted, it is the sense of this body that the properly constituted authorities of such state should proceed at once to inaugurate the work of suppressing and extirpating said disease in such states.”

From the foregoing, it is evident that at least as early as 1892 there were group meetings of Inter-state Live Stock Boards and state veterinarians; possibly research into reports of other state livestock sanitary boards or commissions, may disclose reports of joint action by men in official position in the several states at an even earlier date. Other collateral reading strengthens the opinion that individuals concerned with livestock health in a number of states conferred with each other by meeting together and through correspondence.

In 1897, many of the states had regulations against the movement of southern cattle across their area except during the cold months of the year and the federal government also had established a tick quarantine line which was being violated, several of the state officials were making plans to meet for the purpose of presenting a united request for greater aid from the government in policing the line.

Mr. W. E. Skinner of Fort Worth stated when he met the Sanitary Board of the State of Kansas at Topeka, the question of uniform system of inspection and quarantine was discussed and he asked that the proposed meeting of the sanitary boards, looking to such conclusion, be postponed until such time as he could demonstrate to them something of the results of the experiments he expected at the Forth Worth Stock Yards and he assured them that at that time he would endeavor to secure representation of the Bureau of Animal Industry to supervise such experiments. This was acceded to and the meeting of record was held in Fort Worth, Monday and Tuesday, September 27–28, 1897, to observe a demonstration of the efficiency of the new dipping vat. Accordingly, representatives from Missouri, Illinois, Kansas, Oklahoma, Texas, Colorado and Nebraska, along with representa-
tives of the Bureau of Animal Industry convened at Fort Worth to witness the
demonstration.

A resolution was passed providing for the establishment of an Association to be
known as the Inter-state Association of Live Stock Sanitary Boards.

Another resolution provided for a request to the United States Government for
the inclusion of the whole State of Arkansas and Tennessee in the tick quarantine
area. At this time the federal quarantine line was located two tiers of counties south
of the Missouri state line in Arkansas.

This resolution excited the Arkansas officials, who although invited to attend
the meeting at Fort Worth, failed to send a representative and they demanded a
hearing before any change was made in the line.

The senator from Arkansas protested to Honorable James Wilson, Secretary
for Agriculture, seeking deferment of the inclusion of the two northern tiers of coun-
ties in Arkansas within the quarantine area.

Other states, notably Missouri, presented evidence of the existence of Texas
fever in the area of Arkansas under question and established their state quarantine
line at the boundary of Missouri and Arkansas. In the interim, the State of Illinois
reached the conclusion that Missouri was right and quarantined against the entire
State of Arkansas.

The livestock commissioners from Illinois, Indiana, Kentucky and Tennessee
met in Chicago early in November, 1897, to take action against the practice said
to be rife in Chicago, of buying and selling horses infected with glanders and cattle
with Texas ticks, supposed to be the cause of splenic or Texas fever. Resolutions
were unanimously adopted asking that James Wilson, Secretary of Agriculture,
call a general convention to meet at St. Louis or some other central point, not later
than December 15th. One of the most important subjects for consideration will
be the present quarantine law which is objectionable to many of the northern
dealers.

MEETING AT ST. LOUIS, DECEMBER 2, 1897

At a meeting of the group held in St. Louis, December 2, 1897 and composed of
deleates from Illinois, Missouri, Kansas, Nebraska, Colorado, Montana, Texas
and Oklahoma, action was taken asking the United States Department of Agricul-
ture to place its quarantine line for 1898 on the Missouri boundary line. The De-
partment of Agriculture complied with this request. The action was vigorously
protested by the Arkansas authorities, claiming that Texas fever infection did not
exist in Northern Arkansas; that their cattle were healthy and not dangerous to
the cattle interests of other states. Missouri presented evidence to the contrary.

SUBSEQUENT MEETINGS OF THE INTERSTATE ASSOCIATION OF LIVESTOCK
SANITARY BOARDS

The second annual meeting was held in Omaha, Nebraska, on October 11–12,
1898, in conjunction with the Trans-Mississippi Exposition. To date we have not
found a printed report of this meeting.

The third annual meeting was held in Chicago, October 11 and 12, 1899. A copy
of the report of this meeting is on file in the United States Department of Agriculture, Washington, D. C.

The fourth annual meeting was held on October 2–3, 1900, in Louisville, Kentucky. A copy of the report is on file in the United States Department of Agriculture, Washington, D. C.

The fifth annual meeting was held October 8–9, 1901 at Buffalo, New York. A copy of the report of this meeting will be found in the library of the United States Department of Agriculture, Washington, D. C.

The sixth annual meeting was held in Wichita, Kansas, on September 23–24, 1902. The report of the proceedings of this meeting was never printed. Reference is made to the report of this meeting in the Seventh Annual Report.

The seventh annual meeting was held September 22–23, 1903 at the Brown Palace Hotel, Denver, Colorado. The printed report is on file in the library of the United States Department of Agriculture, Washington, D. C.

The eighth annual meeting was held August 23–25, 1904 in St. Louis, Missouri, and a report was printed.

The ninth annual meeting was held in Guthrie, Oklahoma, August 15–16, 1905. No report of the proceedings of this meeting was printed.

The tenth annual meeting was held August 15–16, 1906, in Springfield, Illinois. A printed report of this meeting will be found in the library of the United States Department of Agriculture, Washington, D. C.

Prior to 1897 it appears the officials of the various states met and were known as Interstate Live Stock Boards and State Veterinarians.

From September 28, 1897 to 1909, the name of the meeting of officials was known as The Interstate Association of Livestock Sanitary Boards.

In 1909 the name was changed to The United States Livestock Sanitary Association.

The reports of the 1st, 8th, 11th and all subsequent meetings have been bound several to a volume and are on file in the Office of the Secretary-Treasurer of the United States Livestock Sanitary Association.

BIBLIOGRAPHY

HISTORICAL SKETCH OF THE EARLY MEETINGS OF THE UNITED STATES LIVESTOCK SANITARY ASSOCIATION

J. W. CONNAWAY, Columbia, Missouri; C. A. CARY, Auburn, Alabama, and J. E. BOOG-SCOTT, Fort Worth, Texas

1923

Mr. President and Gentlemen of the Association:—It was not a very happy day for the Chairman of this committee when President Butler discovered that he was a charter member of this Association, and was mistakenly adjudged a historian competent to reconstruct the story of the early activities of the organization after the lapse of a quarter of a century. Realizing the difficulties of the task, the president made amends by the addition of competent and welcome colaborers whose timely aid has made possible the presentation of a portion of the early records. It will serve no good purpose to dwell upon the difficulties that were encountered in tracing up the data of the first meeting and the causes that led to the formation of a permanent interstate organization of livestock sanitary boards and agencies engaged in sanitary work. Some difficulties were to be expected since some of the members who participated in the early meeting are no longer living, and others are no longer active in livestock sanitary work. In this connection it may seem strange to you that the man who took the most active part in the early work of this association and served as its first president, and was re-elected three or more times is now apparently unknown in his own state by the men who are carrying on in a splendid way the work which he began and fostered years ago. At least we have been unable to get any information from the Animal Industry Departments at Springfield or Urbana, as to whether Clarence P. Johnson once Secretary of the Board of Livestock Commissioners of Illinois and first president of this Association is still alive; or, if dead, when and where he died. "Sic transit gloria mundi," or in shorter significant English, "Forgotten" is the epitaph of many worthy workers. Such Mr. President will be your fate and ours in a few years to come. But the work of the pioneers of livestock sanitation will still live, if that work is honest and sound—the work is the important thing for the present and future good of humanity, and not that its transient agents shall be remembered and glorified. Yet it is helpful to progress to go back occasionally and review the labors of the past and to recall as best we can the laborers. We hope therefore that some one present may be able to give us more complete data concerning our first president.

The first meeting of this Association was held at Fort Worth Texas, September 27 and 28, 1897. The main cause that led to the conference between representatives of the livestock sanitary boards of a few states namely, Illinois, Missouri, Kansas, Oklahoma, Nebraska, Colorado and Texas was the feeling that closer cooperation among the states and between them and the federal government was essential for the protection of the cattle industry of the tick free territory against the menace of Texas fever infection through the interstate shipment of carriers of Texas fever infection, since during the summers of 1896 and 1897 a number of outbreaks of
Texas fever had occurred in states above the quarantine line and notably in Illinois, Missouri and Kansas.

The selection of Fort Worth as a place of meeting was due to the fact that at the time mentioned the United States Bureau of Animal Industry was carrying on in cooperation with the Fort Worth Stock Yards Company extensive dipping experiments to determine the practicability of commercial dipping to rid southern cattle of the fever ticks and render these cattle safe for grazing and feeding in northern territory during the summer months or closed season for southern cattle. At the solicitation of Mr. W. E. Skinner, General Manager of the Fort Worth Stock Yards the conference contemplated was delayed until he could make arrangements with the federal department for demonstrations of the dipping process and when those arrangements were completed he sent out invitations to a number of livestock sanitary boards to visit Fort Worth and witness the cattle dipping work. The following States responded and sent representatives: Illinois, C. P. Johnson, J. P. Lott, J. R. Goddard and Dr. C. P. Lovejoy, State Veterinarian; Kansas, W. F. Weinshank, J. W. Johnson and Taylor Riddle; Missouri, J. W. Hill and Dr. J. W. Connaway; Nebraska, W. N. Babcock, W. F. Bort and R. J. Edwards and W. F. Cantelyou; Texas, R. S. Kleberg and W. B. Tullis; Colorado, Dr. Charles Gresswell.

The Bureau of Animal Industry was represented by Dr. Victor A. Norgaard, Col. Albert Dean, Chief of the Western Division of Cattle Inspection and members of his staff Dr. Charles Blemer, Dr. F. T. Shannon and W. D. Jourdan. The meeting was called to order by R. J. Kleberg of the Texas board who nominated Mr. C. P. Johnson of Springfield, Illinois, as chairman of the conference. Mr. D. O. Lively of Fort Worth was chosen secretary of the meeting. Dr. Norgaard was asked to address the meeting on the progress of the dipping work which he did giving a brief history of the preliminary work which had been carried out by him in cooperation with Mr. Kleberg at the Santa Gertrudes Ranch and the cooperative work carried out by the Texas and Missouri experiment stations. Following Dr. Norgaard's talk, Dr. Connaway of the Missouri Experiment Station, gave a brief account of the cooperative work of the Texas and Missouri Stations and pledged cooperation in testing the results of the Fort Worth dipping experiments by exposure of dipped cattle to susceptible natives at the Missouri Experiment Station. Col. Albert Dean, Chief of the Cattle Inspection Division of the Bureau of Animal Industry, gave a talk on the effects of the Winter season on the safety of shipment of southern cattle to the North and that the mildness or severity of a Winter would have a bearing on the date when quarantine should be raised. He also mentioned the inspections which he had made of the cattle which had been dipped at the Texas Experiment Station and shipped to the Missouri Experiment Station in which the effects of double dipping on one lot of cattle was observed even in transit to have been much more effective than a single dipping. Col. Dean also corroborated Dr. Norgaard's statement that the idea of dipping cattle to kill ticks originated with R. J. Kelberg of the King Ranch who had built a dipping vat to treat cattle for mange and had observed the effect also on the ticks.

Col. Dean stated that the late Honorable Mr. Rusk, Secretary of Agriculture of the United States had told him that Mr. Kleberg made the first suggestion looking towards the solution of this question; that he said to him, "Mr. Secretary, if the
tick carries this disease, as your investigation seems to show, I will get rid of the
tick.” Col. Dean discussed in considerable detail the condition along different
parts of the quarantine line and the factors favorable and unfavorable to the life
of the tick and he stated that according to his personal recollection he believed
that the fever area had extended north a hundred miles in the past twenty years.

Following Col. Dean’s talk the questions of the date of raising and closing the
quarantine was discussed by various members. The question also of the location of
the line or rather changes in the existing line was discussed. The fact was brought
out that on account of the existing quarantine line passing through Arkansas two
counties south of the Missouri state line and through Tennessee some distance to
the south of the Kentucky state line had resulted in violation of the federal quaran-
tine regulations and had caused outbreaks of Texas fever in Illinois, Missouri,
Kansas and Nebraska. It was further pointed out that in Arkansas at least, the
organization of a state inspection agency for the protection of the quarantine line
was not adequate; and that, on that account, some of the states had quarantined
against the entire State of Arkansas. Missouri moreover, had established a separate
quarantine line on the Missouri-Arkansas state line. It was therefore the sense of
the conference that the government quarantine line should be moved farther north
and made to coincide with the Missouri-Arkansas line, and on the Kentucky-
Tennessee line. A resolution to that effect was presented and passed.

As all of the delegates could not remain long enough to see the effects of the
dipping demonstrations which had been carried out, a committee was appointed
to remain another day or two for further observation and to make a report. This
committee consisted of Dr. Charles Gresswell, State Veterinarian of Colorado, Mr.
W. B. Tullis, Secretary of the Texas Livestock Board, Mr. J. F. Williams, Cattle
Inspector for the Kansas Board, Dr. J. W. Connaway, Missouri Experiment
Station representing the State Board of Agriculture, W. F. Cantelyou, Inspector
for Oklahoma territory, Dr. C. P. Lovejoy, State Veterinarian of Illinois, and W.
N. Babcock representing Nebraska. The report of the committee was as follows:

To the Secretary of the Interstate Association of Livestock Sanitary Boards:

We, the undersigned, your duly appointed committee to investigate the experi-
ments now being conducted at the Fort Worth Stock Yards with the object of
destroying the Southern cattle tick, the carrier of Southern or Splenetic fever, by
and under the supervision of officers of the Bureau of Animal Industry submit the
following as the results of our observation:

The tick carrying this fever from southern to susceptible northern cattle is
extremely tenacious to life, and its thorough eradication by methods which will be
economical and practical is extremely difficult. The long continued and exhausted
experiments hitherto made show in their results a great advance toward a successful
issue, and the exhibition of the latest experiment leads us to the positive conclusion
that ultimate practical success will be obtained. Without anticipating the report
of the Bureau, we feel justified in stating that the tick can be effectually killed by
the material now being used, provided absolute and sure contact can be obtained,
and we are of the opinion this fact has been demonstrated on animals which have
been subjected to more than one dip; but we deem it advisable that the final test
of exposure of dipped cattle to susceptible northern cattle be made upon northern
pastures under official surveillance. The general disturbance created in cattle by the use of the tick killing agent now in use is of temporary character, and will not, in our opinion last longer than sixty hours and animals submitted to this process will be ready for shipment after such time has elapsed from the time of dipping.

It is highly probable that this disturbance will be lessened in character and duration by future improvements in the composition of the dip agent.

We find the facilities for carrying on this work are unequalled at the point at which they are being conducted and we bear testimony to the thoroughly scientific and able manner in which this difficult work is being prosecuted at the hands of the official now in charge of it.

We recommend our respective sanitary boards await the report of the Bureau of Animal Industry, but at the same time be prepared to make practical tests by admitting under due surveillance such animals as may be recommended to them by the government for such purposes.

Considering that the expert of the national government, having those experiments in charge, has not yet reported to the head of his department the final result of his work, we deem it inexpedient for us to express a more definite opinion of the results already obtained.

In appropriate resolutions Dr. Norgaard was commended for his efficiency in supervising the experimental work and it was recommended that he and his able assistants be retained. Thanks were also extended to Mr. W. E. Skinner for his labor and enterprise in endeavoring to carry to a successful issue the dipping experiments.

At the morning session of the last day, September 28, 1897, a permanent organization was formed in pursuance of the following resolutions:—

WHEREAS, there are many questions of great interest to the officers and boards of the various states charged with the execution of the laws for the eradication and prevention of the spread of contagious and infectious diseases among domestic animals that could be discussed with much benefit to all and probably a greater uniformity of methods should be adopted in dealing therewith; and,

WHEREAS, thorough organization is necessary to the successful accomplishment of any undertaking; and,

WHEREAS, the Bureau of Animal Industry in the United States Department of Agriculture, should have the cooperation of the Livestock Sanitary Board of all the states and our united support in all of its investigations; therefore be it,

Resolved, That this organization is hereby declared permanent under the name of the "Inter-State Association of Livestock Boards," the membership to consist of the different state and territorial sanitary boards, state and territorial veterinarians, and five delegates to be named by the United States Secretary of Agriculture; and in states and territories where no livestock sanitary board exists, of three members by the Board of Health, Board of Agriculture, or other bodies charged with the execution of the livestock sanitary laws, together with the Secretary of Agriculture and the Chief of the Bureau of Animal Industry, who shall be honorary members.

Resolved, That before adjournment this Association shall fix by vote the time
and place for the next meeting of the Association, and that the Chairman and Secretary be instructed to notify the boards and proper officers of states and territories not here represented of the proposed meeting and to invite them to attend and to become members of the Association.

Resolved, That a committee of three be appointed to prepare a programme, consisting of papers to be read and questions to be considered, at the next meeting of the Association.

Resolved, That the officers of this Association shall be a President, Vice-President, and Secretary.

The resolutions were seconded and carried.

The place and time of meeting were next considered. Mr. Lott of Illinois proposed Chicago as the next meeting place. Mr. Riddle invited the convention to meet at Kansas City; Mr. Babcock desired the convention to meet at Omaha, and Mr. Skinner asked it to meet at Fort Worth.

Upon ballot by states, Fort Worth was selected as the next place of meeting.

The time of meeting was fixed as the second Tuesday in March 1898. This was reconsidered in the afternoon session and the time fixed on the second Tuesday of October 1898.

A called meeting was held in St. Louis, December 2, 1897, for discussion of the quarantine line; at this meeting representatives from Arkansas and Tennessee and some other states were present. The action at Fort Worth in regard to the change in the quarantine line was confirmed; and Secretary James Wilson complied with the wishes of the Association in an official order dated December 15th, 1897. A copy of a letter from Secretary Wilson to Senator Berry giving his reasons for the change in the quarantine line, is printed in the 30th Annual Report of the Missouri State Board of Agriculture for the year ending March 1st, 1898—page 378. This is part of an article by the Secretary of the Missouri Board (John R. Rippey) dealing with the question of "Texas fever Infection in Northern Arkansas" and giving the evidence of Missouri inspectors Dr. N. Jewett, located at Monett, Dr. D. F. Luckey, located at Joplin, and Dr. Jesse Robards in Southeast Missouri that the Texas fever infection existed in the northern counties of Arkansas and that "large numbers of Missouri cattle die each season of Texas fever contracted from Arkansas cattle smuggled across the quarantine line." Secretary Wilson's letter referred to gave the evidence of Federal Inspectors Dr. Brougham, East St. Louis, Col. Albert Dean, Chief Inspector in charge of Texas fever Inspection and Dr. Charles Blemer, a member of Col. Dean's force. In addition to this Governor Holcomb of Nebraska had reported an outbreak of Texas fever at Germantown, Nebraska, from infection brought in by cattle from northern Arkansas.

This letter of Secretary Wilson's also mentions the complaint of the State Board of Livestock Commissioners of Illinois, and the action of that Board in quarantining against the entire State of Arkansas, also that the Secretary of the Illinois Board had stated that;—"It became an absolute necessity to take this step, because of the fact, established to our satisfaction, that there was an organized effort to fill this state, with cattle that were being run across the line in Arkansas."

At the meeting held in St. Louis, Mr. Vincinheller the Commissioner of Agri-
HISTORY OF THE ASSOCIATION

culture of Arkansas protested vigorously against the action of the Association, "claiming that Texas fever infection did not exist in Northern Arkansas, that their cattle were healthy and not dangerous to the cattle interests of other states, and that their statutes and their enforcement were ample protection to all concerned." But the representatives of the livestock boards of Illinois, Missouri, Kansas, and Nebraska who had the evidence of unquestioned outbreaks of Texas fever in their respective states following exposure of native cattle to cattle shipped in from northern Arkansas were not impressed by the protestations of the member from Arkansas; nor were the members from other states including those having infected territory such as Texas and Oklahoma in the least impressed. The facts of the case were too plain for dispute. Nor did the protestations have any effect with Secretary Wilson. The quarantine line was put further to the north and a new start was made in cleaning up the tick infested territory, and pushing the "Fever Line" south again. And I am constrained to believe that the newly organized Interstate Association of Livestock Boards which brought men together from different states to confer and discuss and plan to the end that interstate traffic in livestock might be made safer and safer each year has been a far greater factor in the development and conservation of the livestock industry of the country than many of us have realized.

The meeting of the succeeding year 1898 was to have taken place at Fort Worth, but a change to Omaha was made on account of the Trans-Mississippi Exposition which was being held there. A record of the proceedings of that meeting has not been found, but a reference to it occurs in the South Omaha Daily Stockman, October 10, 1898 as follows:

SOUTH OMAHA DAILY STOCKMAN

Oct. 10, 1898

Interstate Association of Livestock Sanitary Boards meeting tomorrow at 10 o'clock.

The second annual meeting of the Interstate Association of the Livestock Sanitary Boards will convene in Exchange Hall tomorrow at 10 o'clock. C. P. Johnson of Illinois is President and Taylor Riddle of Kansas is Secretary of the Association which at present includes fourteen states. President Johnson arrived this morning and says he expects a large attendance and a good meeting.

The importance of the Association to the livestock interests of the west can hardly be overestimated but a good idea of some of the vital questions to be discussed and acted upon can be formed from the programme for the two day session which has been prepared by President Johnson.

Meeting called to order by the President.

Reading of Minutes of Previous Meetings.

Practical Suggestions as to the Practical Suppression of Tuberculosis by Dr. Charles Gresswell, State Veterinarian of Colorado.

Discussion of Paper by Dr. C. P. Lovejoy, State Veterinarian of Illinois.

"Glanders and its Suppression, Including Experience with Mallein Test" by Dr. J. M. Wright, A.S.V., Chicago.
"The Best Treatment for Cattle Afflicted with Southern Fever" by John Bryden, Chairman, Kansas Livestock Sanitary Commission.

Discussion.

"The Best Treatment for the Prevention of Black Leg" by Dr. Paul Fisher, State Veterinarian of Kansas.

Discussion.


"Report of Exposure Tests made in Illinois During the Summer of 1898 under the Supervision of the State Board of Livestock Commissions" by Dr. C. P. Lovejoy, State Veterinarian.

Discussion of Modification and Changes Deemed Safe and Desirable Demonstrated by Dipping and Exposure Tests.

"Results of Experiments in Immunizing Northern Breeding Cattle Against Southern Fever" by Dr. J. W. Connaway of Missouri.

Reports of Committees.

Date of Meeting, October 11, 12, 1898.

COPY FROM SOUTH OMAHA DAILY STOCKMAN

Thursday, October 13, 1898

Sanitary Board Meeting

The National Association decides that dipping southern cattle removes danger from splenic fever.

Notwithstanding the excitement naturally incident to President McKinley's visit to the Trans-Mississippi Exposition, the Interstate Association of Livestock Sanitary Boards got through with considerable important business at their second days session at Exchange Hall yesterday. After a thorough practical and scientific discussion of the efficiency of dipping as a preventive of splenic fever, the following resolution was unanimously adopted:

Whereas, the experiments recently conducted have demonstrated that southern cattle dipped in dyno oil saturated with sulphur will effectually destroy the southern cattle tick, and that cattle so treated may be mixed with northern native cattle without danger of communicating Texas or Southern Fever, thereto, Therefore be it,

Resolved, that the quarantine regulations may be amended with safety so as to admit dipped southern cattle on the certificate of a designated inspector of the state or of the United States Department of Agriculture to northern states during any portion of the year.

The Committee on quarantine lines recommended that in 1899 the entire State of California be placed below the federal quarantine line, and another resolution was adopted recommending that all of the states in adopting regulations governing the importation of cattle from other states and territories shall conform to the
uniform regulations recommended by this Association or adopted by the United States Department of Agriculture.

Dr. Norgaard, Geddis and Dean, representing the Department of Agriculture Bureau of Animal Industry, rendered valuable assistance in the deliberations of the Association and taken all in all, it was probably the most important and successful meeting the Association has had. Next year the Association will meet at Fort Worth, Texas.
ADDRESS OF WELCOME

John B. Gage

Kansas City, Missouri

Gentlemen, I am truly very happy to have the opportunity to extend the welcome of this City and this area to the members of this great organization. Both Governor Smith of Missouri and Governor Arn, of Kansas, as well as Mayor Kemp of Kansas City, by letter as well as by spoken word, have instructed me on their behalf to extend to you their hearty welcome, and to say to you that they deem it an honor that this City and this location between the States of Missouri and Kansas has been chosen as your meeting place for this, the 55th annual meeting of the United States Livestock Sanitary Association.

I believe it will prove to be a very happy and a most appropriate choice for your meeting. Kansas City is a beautiful city, and I hope those of you who come from far away will have the opportunity while here to see some of the lovely residential sections, renowned throughout this country, as well as the terminal market area, the stockyards and the packing houses.

It is an appropriate place for an organization such as yours to meet, because this City is founded on agriculture, and particularly livestock. It is very largely a product of the livestock industry—that industry which you and the members of your organization and those associated with you have served so faithfully and so well for more than fifty years.

It is a city that is still proud, either in song or speech, to be called and to be known as a “cow town”. Friendships among your members perhaps are accountable for the fact that I extend this greeting to you. Those friendships go back over a period of many years. I know that your organization had its birth in the developing campaign of over half a century ago to eradicate Texas fever, the early-day scourge of the cattle of the West and Southwest. You led in that fight, and it was won to the great benefit of the livestock industry of the nation. It had its difficulties, as has had every great campaign that you have backed.

And then came the control and eradication of tuberculosis. As a livestock producer I know of the great work that you did to establish and educate people. That work has been unsurpassed by any country or nation, to the great benefit of the people of the United States and the public health.

You have had problems, and we more than others here in the middle west know the ever-changing character and the difficulty of solution that have surrounded those problems.

It was your steadfast purpose, successfully implemented, to keep foot and mouth disease out of this country, to keep us free from the infection of that dread disease. In that work you lead the way, and despite threats and dangers you have been successful.

As the new diseases arise, such as pullorum and Newcastle in poultry, you have established controls that are successfully operating for those diseases so threatening and damaging to the poultry industry.
In hog cholera you led the way in the practical control of that scourge of our swine population. Now, as these new diseases threaten, we know something of the requirements of technical research, of competent planning, of coordination of effort, that are required to successfully control or eradicate those diseases.

Whether it be anaplasmosis in cattle, or erysipelas or infectious rhinitis in hogs, or Newcastle disease in poultry, or any other of these new infections that sweep through our livestock population, I think all of us—the growers and producers of livestock of all kinds—have confidence in your organization and its leadership.

I know there are criticisms at times. Sometimes there are those who feel that progress is too slow and halting, disregarding the requirements of technical research that are essential before even sound planning can commence. Sometimes the livestock producer thinks you move perhaps too fast before diagnostic analysis of disease is sufficiently definite; and yet the results speak for themselves.

I am somewhat acquainted with the situation in England, and there, in a small, homogeneous livestock country where the greatest livestock breeders of the world have lived, the accomplishments that have taken place in that country, as compared to this country with all its diversified climactic conditions, are far from equal.

Foot and mouth disease still exists. Tuberculosis eradication is not far advanced. They have adopted methods for the control of brucellosis that were developed here by those associated with your own organization.

So it goes throughout the world. Were the problems of those countries met from the standpoint of effort and legislation as here, they would be more easily and quickly solved.

You are to be congratulated that this country takes leadership of all the countries throughout the world in the particular subject and in connection with the particular objective for which this organization exists. Without organization, without cooperation that brings together the technician and the legislator, the official and the layman and the veterinary practitioner, the grower and producer, in contact with each other, these great results that have been achieved in the past would not have been accomplished.

And so I say sincerely that we are glad to welcome to this City and this area the annual meeting of an organization with such a great constructive record, for the good of those whom it directly serves and for the good of the nation as a whole.

I hope your stay here will be happy and pleasant. I want to assure you, on behalf of the City and its citizens, that if there is anything we can do to add to your pleasure in order to make this meeting more convenient and more pleasant, we hope you will let us know. Your meetings are very valuable to you and also to those whom you serve. I speak for our official City when I say we would be only too happy to be called upon to serve you.

I thank you for this opportunity of meeting with you.
RESPONSE TO WELCOME

RALPH L. WEST

St. Paul, Minnesota

Mr. Chairman, Mr. Gage, members of the United States Livestock Sanitary Association, and guests: It gives me great pleasure to be able to respond on behalf of the United States Livestock Sanitary Association to this very cordial and warm welcome to Kansas City. It is a great personal pleasure because, like many of the other veterinarians in this room, I spent some of the most pleasant years of my life as a student in this City.

Riding around the City for a little while yesterday afternoon, I could note great changes; but there is one thing that has not changed, as I am sure all of us who have spent the last few days here can testify to, and which the newcomers will recognize, and that is the warm friendliness of the people. That is something I have remembered since the years when I was here going to school. That friendliness still exists and is an outstanding characteristic of Kansas City—that the people, as you meet them in every walk of life, have a friendly welcome and cordial approach. It is heartwarming to return to this City.

In responding to Mr. Gage's welcome, I don't think it is necessary to explain to him the nature of our organization. I know he is familiar with the work it has done and has tried to do, and what is planned for the future. However, he is one of the few people outside of this organization and outside the organized disease control bodies who does realize what has been done.

It is surprising to us, who are engaged daily in the control of disease and in daily contact with the livestock industry, to see how many people there are whose very existence depends upon the livestock industry, and how few have any realization of the ramifications and implications of what might happen if this industry should suddenly be destroyed. It is inconceivable that this country could continue to exist if we did not have a profitable and thriving livestock industry.

The general public today could hardly conceive of how they could exist if they did not have access to livestock and livestock products.

It is not only the livestock that gives us this source of general welfare, but it must be qualified with healthy livestock. If we didn't have healthy livestock the industry could not thrive, could not produce. Livestock affected with disease, as we all know, would be a losing proposition. No one could afford to invest money—no banker could afford to invest his money—no individual could afford to spend his lifetime building up herds and developing an industry such as we have in this country if that livestock were not protected from disease.

Therefore, we believe that this organization, in the results it has attained, has been a major factor in producing the strength and the power that this country now maintains as one of the greatest nations in the world.

This organization is the one place now in this country in which there can be officially a meeting of minds of the various organizations interested in the control of disease, and therefore the betterment of the livestock industry. Membership
in this organization is open to the scientist, the research man, the technician, the practicing veterinarian, the livestock grower, the livestock marketer, the processor, and the official disease control agencies of the United States. I know of no other organization in which there can be this meeting of minds and determination of policies.

I believe that is the reason why we feel that we can take credit for much of the progress that we have made in this country in the development of a wonderful livestock industry, and at the present time can fairly claim that the United States of America is the safest country in the world in which to invest and in which to raise the various types of livestock, including poultry.

There is one further factor which in my opinion is extremely important and which has a very definite bearing on the accomplishments that we have made. While all of the various agencies interested in the control of disease have this organization as a meeting place, the final determination as to these policies under the Constitution and By-laws has been made by trained disease control officials who, by the very nature of their office, are definitely imposed with the duty of determining the policies and the effect of any measure which goes out of this organization as a recommendation to the various states, the United States Bureau of Animal Industry and the livestock industry as a whole.

Not only do they consider the benefits as they would affect any one branch of the livestock industry, but any measure that is proposed must be finally determined as to its effect not only on an organization of livestock men, not only an organization of processors, not only an organization of purebred livestock breeders, but they must consider the individual back in the brush with a little farm and eight or ten head of cattle. They must consider the small hog raiser. They must consider the poultryman. Above all, they must consider the man who is to consume the products—who, after all, is the man for whom we are all working—the livestock producer, the disease control official, and this organization.

Mr. Gage, on behalf of the Livestock Sanitary Association I wish to thank you most heartily for your very cordial welcome.
PRESIDENTS ADDRESS

FERD E. MOLLIN

Denver, Colorado

It is quite fitting that this 55th Annual Meeting of the United States Livestock Sanitary Association should meet here in Kansas City. It is near the geographical center of the United States. It is right in the heart of the great producing area, where livestock production is the major industry. I believe we can truly say that Kansas City is a part of the bread basket of the nation. It is one of our great livestock markets, and I am sure it was a wise selection when we decided to meet here.

I appreciate the honor bestowed upon me in making me President of this organization. It was wholly unexpected. When I was Third Vice President I left the meeting before the nominations were reported, and I didn't even know that my name was up for consideration. I consider it an honor to the Association with which I have been connected for the past twenty-two years, the American National Cattlemen's Association, and it is a rather peculiar coincidence that the American National in January will hold its 55th annual convention. Therefore, the work of the United States Livestock Sanitary Association and our Association started at practically the same time.

I am particularly pleased that we have in attendance at this meeting which I believe, is the largest gathering of stockmen at any meeting I have ever attended. Dr. Hendershott might know of a meeting at which we had greater attendance of stockmen. Perhaps in the earlier days of the Association more stockmen attended meetings, but I am sure there have not been so many at any recent meeting.

There have been no great emergencies during the past year with regard to disease control matters. The work of the Association has been largely what one might call routine. Therefore, I have devoted my energies to trying to get greater participation in the work of the Association on the part of the livestock producers. The fact that they are here in greater numbers than normally shows that I have achieved some measure of success, although not as much as I had hoped for. Nevertheless, we are building up interest in the United States Livestock Sanitary Association, and I hope that build-up will continue to increase.

To my mind, this is a three-pronged organization—state officials, federal officials, and the livestock industry. I think we can do no better job at this meeting than what we can do to improve the relationship between these groups. I will return to that subject a little later and will comment on it further.

The livestock industry is the backbone of the entire agricultural economy of this country. The remarks made by Dr. West were not overdrawn one bit as to the importance of this great industry. Recent developments show the tremendous importance of the industry to the whole economy of the United States, not just to the agricultural economy but to the entire economy.

In the last few weeks we have witnessed a time when our Army had difficulty buying its meat supplies. It seems almost incredible, with the greatest number of cattle and the near-record number of hogs, that this should be the case; but the
Army has had difficulty buying adequate supplies, beef in particular, and I think there might be one result of that situation which may be helpful to us as an industry:

For many years the Army rather had the feeling that they were being penalized because of the "Buy American" clause in the appropriation bill which made it necessary for them to buy their supplies in this country except under emergency conditions. When they came to the present emergency, and when they would have had complete justification in going abroad to buy meat supplies, those supplies could not be brought into this country on account of regulations for the control of disease, although they could be sent overseas to our occupation forces.

The Army suddenly found that there was no place in the world where they could buy adequate beef supplies. Perhaps we now have a little better understanding with the Army, as they realize that the United States is the principal source of meat supply in the world today.

The Argentine government has been talking about a surplus for years. They have a contract to supply 200,000 tons of beef to England this year. I was told recently that Argentina was supplying only about 125,000 tons on that 200,000 ton contract. There is no surplus in Argentina available to take up the slack.

The tremendous demand we have for meat in this country today imposes a greater responsibility on the members of this Association, upon both the livestock producers to produce the needed meat, and upon the sanitary officials to protect the health of the herds and flocks. We must realize that our responsibility has been substantially increased in that regard.

To call attention to that increased responsibility, I have in mind going back to the time when I started my work with livestock in 1906. I went to work for a large feeding and ranching concern in Nebraska. We didn't think too much of it in those days when we lost a steer or two in the feed lots, or two or three on the range. But today, when a 400 lb. calf will bring from $150 to $200 a head, and when an animal of some maturity in the feed lot is worth from $300 to $400, it makes one think twice about taking care of that animal. I am sure we can and must reduce the losses to the very lowest minimum.

As a layman you do not expect me to attempt to make any technical remarks about disease control. I am not competent to do so, and I shall not try. However, I would like to comment on some of the diseases that are of particular interest to the livestock producer, and which constitute a major problem in his operations.

I shall start by referring to the brucellosis program. One thought I have in mind in discussing these matters is to show that I believe there is an absolute necessity for cooperation between the livestock producer, the owner of the livestock, and the sanitary officials who have responsibility for doing all in their power to control and eradicate disease.

In the case of brucellosis we have had this problem before us for many, many years. Finally, I believe, we are beginning to get somewhere. The calfhood vaccination program, which the American National long advocated, is going to prove to be the solution to the problem. Once you get pretty well along with a calfhood vaccination program it may be possible to switch to a more restrictive program in
the final cleaning-up program; but you have to go the route first with calfhood vaccination.

The Sanitary Association started, following the completion of the tuberculosis program, on a test and slaughter program. They had to abandon it. I mention that only because I want to show you the importance of cooperation between the sanitary official and the producer. We happened to be right in that case when we proposed that we follow the calfhood vaccination route. I am glad it is now being followed generally throughout the country.

I believe I am correct in saying that we finally are making satisfactory progress. In fact, I believe the brucellosis program is in a more satisfactory stage today than it has been since it became a major national problem.

We have been interested in programs developed recently in Colorado and South Dakota. In both of those States the programs involved the use of laymen in carrying out the vaccination program. We are not interested in that merely because they are laymen, but in many areas of the West there is a serious shortage of veterinarians to do the job. If these programs are to be carried out they must be done with the aid of laymen.

In South Dakota particularly, the program was instituted by the stockmen. They are just getting started on it. Colorado has gone a little further with it, but a good deal of it is the same procedure. There are probably other states that are following similar programs, of which I do not have special knowledge. They are voluntary programs. The stockmen are helping to arrange and carry out the program, and I believe that is the way the job is going to be done in the final analysis.

I want to refer now to the National Brucellosis Committee. It has contributed a great deal in educating the livestock industry as to what must be done finally to control brucellosis, if not to completely eradicate it. We have several men on that Committee. There are scientists and men from other branches of the industry. They have a fine working committee that will contribute more in the years to come toward helping to get this job done.

Mr. Gage mentioned the tuberculosis program. It is true the livestock industry held back on the tuberculosis program until we were able to persuade Dr. Mohler to put in what we called the modified accredited plan in the range and semi-range areas. Under the plan the job of accreditation was completed in fairly short order out in the West, where we have been laggard, it is true, in relation to other states. The eastern states and part of the midwest had much heavier losses because of the density of population, and the problem there bore heavier on the industry than it did in the western states, some of which had practically no trouble with tuberculosis.

There is one feature of the tuberculosis program I would like to refer to, and I hope we don’t have similar trouble with other programs. I remember very well when the sanitary officials were strongly advocating that pressure be applied, at least in publicity, concerning the great benefits that would come to the livestock industry if only we got our areas accredited. I remember we were assured we could ship our livestock anywhere as soon as that was done, as far as tuberculosis was concerned.
Today there are some states that have even more rigid restrictions against the importation of livestock as far as tuberculosis is concerned, than they had before the western areas were accredited.

I believe it is a mistake for any state to impose regulations that can be waived merely by a telegram or by a written permit. What is the sense of imposing a regulation and then letting that regulation be waived by applying for a permit to enter the state? We want to do everything we can to cooperate in disease control, but we think there are some limits, and we must be practical and efficient as well as doing everything possible to eradicate disease.

The accreditation of the entire United States was a great achievement. It is an achievement that stands to the credit of this Association and the credit of the stockmen who participated in making it possible to get the job done.

I understand there are some difficulties being experienced now in connection with the re-accreditation work. Some states have not appropriated money for it or do not have the veterinarians available to carry on the work necessary to re-accredit, as must be done every six years. That subject is under consideration by the Tuberculosis Committee at this convention, and I hope they will find a solution for it.

It seems to me there is a need for uniformity in the way these programs are carried out, and that the federal men ought to do all they can to bring about uniform activity in the various states.

Concerning uniform activity, that is one of the things the livestock industry has been seeking for a long time, namely, uniform regulations. Well, we don't want them quite badly enough to take the uniform regulation report that was made a couple of years ago by this Association, which would take the maximum restriction that any state had on any movement and would compile it into a set of maximum regulations. They may be all right as a goal, but they are not practical in the operation of the livestock industry in many respects.

If you could comply with all of those restrictions you could ship your cattle to China or to the moon. There are not very many people, however, who could comply. We want the maximum uniformity that we can get, and still retain the maximum of practicability and efficiency.

I said earlier that I wanted to make further reference to the cooperation between the federal men, the state men and the livestock industry. In preparing for this convention I had occasion to review some of the addresses that Presidents have made in recent years to this Association, and I took particular note of Dr. Brandenburg's remarks at the Columbus convention. He devoted a great deal of time to the importance of working out the problem between the federal regulatory officials and the state regulatory officials. I think he made some recommendations that have not been particularly followed.

It is a subject of great importance, and this convention could well devote some time to it. I would like to suggest that Dr. West, my successor, consider the appointment of a joint committee of federal men, state men and livestock producers, to serve in that capacity. Perhaps such a committee could be kept in being for several years, to see what could be done to further the coordination of regulatory work.

I believe it was in Dr. Brandenburg's address that the statement was made that
no program could be carried out successfully under two heads, one the federal government and the other the state official. It is a difficult matter to adjust to 100 per cent satisfaction of everybody concerned.

One of his suggestions was that the federal government should contribute the money, or a certain amount of it, and the state regulatory officials have charge of the work. I don’t know how practical that might be, but I do think it is a subject that merits consideration and study. If a committee could be appointed that had this responsibility, and could meet with the federal officials and the state officials and the livestock industry, I am sure it would work to the common good.

Now I would like to refer briefly to the subject of foot and mouth disease, partly because it is a subject in which I personally have been interested for a great many years.

When President Roosevelt was elected for his first term there was immediately great pressure on the part of the Argentine government to bring their surplus beef into this country—and they had surplus beef at that time. We in the American National took a very active part in combatting that effort. I personally published four separate booklets on the subject—not technical booklets, but booklets that contained information which I had gathered from all available sources. We were successful, together with the efforts of other groups, in preventing the admission of Argentine beef.

I read an article in one of our Denver papers the other day, written by a Washington columnist, in which he referred to the efforts of our Association—the American National—and the livestock industry generally in keeping out Mexican beef or cattle and also in keeping out Argentine beef, and taking the old line we have heard so much, that there was no justification for the embargoes against imports from Mexico and Argentina.

Anyone who has made any study of this subject knows that those statements are untrue. It is hardly worthwhile attempting to argue with these columnists who are so self-centered and who think they know all about everything.

I became convinced years ago that some of those columnists were subsidized and were deliberately putting out that kind of propaganda for purely selfish reasons.

At any rate, we are particularly happy that the program which has been carried on in Mexico has almost achieved full success. We understand that there is grave suspicion of sabotage in connection with the last two outbreaks, one in December of last year and the other this past summer; if it hadn’t been for those two outbreaks very likely the border would be open today.

We are not particularly interested in the matter of opening the border. I don’t think the Bureau of Animal Industry will open the border until they are sure that foot and mouth disease is stamped out in Mexico. We are happy that Dr. Noyes will be at this meeting and will participate in the discussion of this subject. He is due a lot of credit. He has not had very much credit given him as yet. He has done a fine job as a scientist and also as a coordinator of activity, and we owe him and the other officials of the Bureau of Animal Industry a great deal for the fine job they have done.

You might be surprised to know that a man who is particularly interested in cattle would want to say anything about hog cholera, but my interest in hog cholera
goes back a long way. When I was a boy on the farm we lost 105 out of 113 hogs one year, and my job in the morning, before walking a mile to school, was to go into the hog house and pull out the dead hogs so they could be loaded on a sled and taken to the field for burial. That was in the 1890's.

In 1906, I went to work for a firm in Nebraska, and we were the first in Nebraska to vaccinate hogs for hog cholera. If my memory is correct, hog cholera serum was perfected at Ames in about 1907 to 1909, and we started vaccinating very shortly thereafter. I personally have vaccinated thousands of hogs.

In those days we all thought that if you just had something to protect against hog cholera, the problems of the hog raiser would be solved. But they aren't solved. You have hog cholera serum; it is an efficient serum if properly administered with the live virus. But people become careless. Our own outfit used to get careless and failed to vaccinate when there was no trouble, and then the disease would flare up again.

In the early days there was a tendency to call everything hog cholera. The point I am trying to make is this: This fight against disease is a moving fight. It never ends. You conquer one disease, and there is another to take its place. It will always be the way. Just as a human being is always subject to ills, and although doctors and scientists perform almost miracles in their treatment of various diseases, there is always something else coming along to merit their attention. It is worthy of note that this Association need never fear it is going to run out of work, because we are always going to have these new diseases to deal with.

I am pleased to learn there will be presented at this convention papers and discussions on this new attenuated vaccine which it is hoped will enable us to go further not only in controlling hog cholera but possibly will lead to the eradication of that disease.

You are familiar with the fact that Canada, which does not permit the use of the live virus in connection with the present serum, has suffered far less losses in proportion to the volume of their operation than we have suffered in this country, where we do permit the use of the live virus. If this new vaccine will give sufficiently long immunity without the use of the fully virulent agent, then there will be a possibility of eventually wiping out the disease in this country. That certainly is to be greatly desired.

I want to say just a word about our livestock markets. That is one of the problems in connection with livestock sanitation. We have not only the great central markets which have been established for many years, but we have the development of auction markets, and it appears that they, too, are here to stay.

I believe it is fair to say that in the early days of the auction markets they presented an increased problem in the matter of controlling livestock diseases. They were new, and they were not too well organized, and there was difficulty in getting proper inspection and proper control methods. That problem is being met.

Some of the markets are not going to last, especially the smaller ones, but those that become established will take proper precautions so that they will not be a menace to the livestock industry.

You will hear shortly our next speaker, Mr. Pepton, President of the Denver Stockyards, who has been a leader in the movement to keep the Denver yards
clean. I think they have one of the best systems of cleaning and disinfecting of any other market in the country.

I want to say just a word about the fact that we must also pay attention to the Public Health Service. About three years ago Dr. Simms called a meeting in his office in Washington. I was rather amazed that the man who represented the American Medical Association at that meeting was convinced that all undulant fever came from drinking milk. He had never heard that there was any other possibility of contacting undulant fever.

We must not only cooperate with the Public Health authorities, but we must publicize the facts not only in regard to undulant fever but to other diseases, particularly those communicable to man. Drinking milk from infected animals is only one of several sources of undulant fever or brucellosis in man. It is largely an occupational disease and the public should not be misled as to its cause.

We also must have continued research. I have mentioned a few of the diseases that we are particularly interested in. There are others that are very serious. Personally, I know nothing about atrophic rhinitis, but I understand it is spreading considerably; it will be discussed at this meeting. Certainly it needs research. The same is true of what is commonly referred to as X disease of cattle. Not too much is known about that. Research may show us how to control it. Anaplasmosis, which has been with us for a good many years, is causing greater losses all the time. The answer to that has not as yet been found.

This Association and its committees should take the lead in contacting the authorities of the research administration in the Department of Agriculture to be sure that we get a just share of the money appropriated for research.

I want to say something about the committee that was appointed at Phoenix last year for the purpose of studying and bringing to this convention a report on the revision of our Constitution and By-laws. That is rather a “hot” subject at this convention. We considered it at Phoenix last year, and there is pending before the Executive Committee a report that was submitted at that meeting concerning possible revision of the Constitution and By-laws.

I am very hopeful that this convention will accept a reasonable compromise and will revise the Constitution and By-laws sufficiently so that the livestock industry will feel encouraged to remain and to become a greater factor in the deliberations of this Association.

As livestock people, however, we cannot permit this Association to say that it represents the livestock industry before committees of the Congress or before the federal Bureau of Animal Industry, when we have absolutely no voice in the final decisions of this Association as far as policy-making is concerned. No matter what this convention might do in the next three days, at the end of that time the Executive Committee could go into session and could veto every single action that might be taken by this convention. I know of no other organization in which such veto power exists. It certainly does not exist in any of the livestock organizations which are organized along democratic lines.

It we will approach this matter fairly—all of us—and try to work out a reasonable compromise, I think it will be but a very, very short time until we will all forget all about the Constitution and By-laws. I think we can all cooperate with each
other, and if we wipe out the conditions that exist now, namely, why you don’t want to revise the By-laws and why we do, it will be fine. Let’s forget about the By-laws. Let’s make it possible for all of us to have a voice in the policy of this Association.

We don’t want to control this Association. We have no such thought at all. However, there are some important national policies that the livestock industry cannot surrender to the regulatory officials. I am making as earnest and sincere a pleas as I can for you to consider this seriously.

In this connection I would like to refer to the remarks Dr. Hendershott made in his report earlier this morning. He referred to the action of S-1629, on which we did work together. We have too much in common to go our separate ways. I think this Association is the proper agency to function, wherein we can thresh out our differences. We have made a lot of progress in the past two or three years. There were only three or four producers at Columbus, Ohio, and we have gone a long way since then. We can really make this Association bigger and better than it has ever been before if we will truly approach this subject in a fair manner.

In conclusion may I say I am extremely pleased that we have a full audience. It is very difficult to talk to empty chairs, and it is fine to have such a large turnout at this first session. I believe there will be more people here this afternoon and tomorrow than there are here now.

I realize I haven’t been able to contribute a great deal to the work of this Association, but I have done what I could. If we can work out the problem I have just referred to on a satisfactory basis, I shall feel I have accomplished something during my term.
REPORT OF THE SECRETARY

RALPH A. HENDERSHOTT

Trenton, New Jersey

Mr. President, ladies and gentlemen of the United States Livestock Sanitary Association. Again this year it has been a decided pleasure for me to endeavor to serve you as secretary-treasurer.

In every way possible, through telegraph, telephone, correspondence and personal appearance I have earnestly tried to carry out your commands and desires as set forth in committee reports and resolutions adopted at the Fifty-Fourth Annual Meeting.

Immediately following the Phoenix Meeting the Poultry Branch, Production and Marketing Administration of the United States Department of Agriculture called a two day meeting of representatives of industry, health, and livestock sanitary representatives in Washington, D. C. to discuss the controversial subject of the grade labeling of uninspected poultry meat. After two days of discussion an agreement on the major points of difference was reached and all participants left the conference confident that we finally were on the way to complete agreement. Unfortunately, points made and agreed upon at this meeting seemed to fall upon deaf ears. We were soon to learn that no real progress toward the solution of differences between the thinking and expressed opinion of our Association and those in charge of poultry meat inspection was to be attained so easily. Subsequent meetings in Chicago in May of 1951, attended by Dr. D. M. Campbell and in Philadelphia attended by both Dr. A. L. Brueckner and myself, failed to bring about the desired result. On June 25, it was my privilege, along with Dr. Brueckner, to present the views of our Association at a hearing before Assistant Secretary of Agriculture Mr. Knox Hutchinson. Other groups represented were: New York Conference of Health Officers and Food and Drug Officials, New York State Public Health Veterinarians, Westchester County Health Department, Nassau County Health Department, Conference of Public Health Veterinarians, New Jersey Health Officers Association, New Jersey State Department of Health, New York City Department of Health, Ohio State Department of Health, State and Territorial Health Officers Conference, Colorado State Health Department, Denver City Health Department, Conference of State Sanitary Engineers, American Public Health Association, Food and Drug Officials of the United States, Department of Navy, United States Livestock Sanitary Association, Jersey City Department of Health, State and Territorial Health Officers Association, State Department of Health of Kentucky, Illinois State Department of Health.

Mr. Hutchinson heard the views of all present and promised to study the complaints and proposals and render a report of the Department of Agriculture's decision. To date, we are still awaiting this report. Subsequent to the June 25th conference another meeting was called by the Poultry Branch, Production and Marketing Administration to which Dr. D. M. Campbell was invited and which we requested him to ignore until such time as Mr. Hutchinson rendered a report of
the position and decision arrived at as a result of presentments made at the hearing in June.

The position of our Association as directed at the Phoenix Meeting, namely that grading and inspection of poultry meat be divorced and poultry meat inspection be turned over to the meat Inspection Division of the Bureau of Animal Industry, was presented at the June 25th meeting. This subject will no doubt be dealt with more completely in the Report of our Committee on Meat and Milk Hygiene.

CONFERENCE ON S-2188

As directed at the Fifty-Fourth Annual Meeting a conference of interested parties was called by Dr. B. T. Simms, at the request of President Mollin, in Washington, D. C. on April 3rd to discuss an amendment of Senate Bill 2188 which because of disagreement among interested people, failed to pass the 81st Congress.

At the conference representatives of the beef breeders, dairy breeders and regulatory officials met and agreed upon the insertion of a sentence in wording of the Bill. They agreed upon Bill S-1629 that was introduced in the Senate by Senator Ellender and passed the Senate on October 1st. An identically worded Bill H.R. 5063 was introduced in the House of Representatives by Mr. Marshall of Minnesota.

A hearing on H.R. 5063 was scheduled by the House Committee on Agriculture under the Chairmanship of Representative Cooley of North Carolina for October 16, 1951. It was my pleasure to serve you at this hearing and to speak in favor of this legislation. I am happy to report that S-1629 passed Congress, was signed by President Truman and is now law. The Committee on Legislation no doubt will render a more complete report of this matter on Friday.

On October 3rd, it was my pleasure to call together the chief state regulatory officials of the northeastern group of states as directed by our Committee on Policy report of last year.

These officials met in the Hotel Statler and formed the Northeastern States Group Meeting of Livestock Sanitary Officials and spent the day organizing and discussing livestock diseases control problems related to the area represented. They plan to meet annually sometimes following the American Veterinary Medical Association Meeting and our Annual Meeting. It is expected that other regional groups will meet, organize and report their activity at our annual meetings.

I am still devoting some spare time to writing up the history of the Association and do not have a copy of the report of the meetings held in 1898 to 1906. As you know the 54th Annual Report carries a reprint of the report of the first meeting of which there is a printed report. The original report of the meeting in 1897 along with that of 1904 generously donated to the Association by Dr. J. C. Norton of Phoenix, Arizona and all reports from 1907 to 1950 have been bound and shall be surrendered to my successor. Meanwhile if any of you know of the existence of reports for 1898-1899-1900-1901-1903 the Association will be pleased to purchase them.
MEMORIAL ADDRESS

J. L. AXBY

Indianapolis, Indiana

Mr. President, Members of the Association, Visitors, Ladies and Gentlemen:
To the best of my information, the following members had died since the last meet-
ing.

B. J. KILLHAM

Dr. B. J. Killham died October 12, 1950. He was a member of the United States Livestock Sanitary Association for the past fifteen years. He was prominently identi-
fied with brucellosis control work in Michigan.

EDGAR ARNOLD CROSSMAN

Edgar Arnold Crossman, of Cambridge, Massachusetts, died on November 21, 1950. He was a graduate of Harvard University, Class of 1891, and was in the service of the United States Bureau of Animal Industry for many years. He served as Dean of the School of Veterinary Medicine of Middlesex University from 1940 until it closed in 1947.

He was former Inspector of the Bureau of Animal Industry for New England and during 1941 served the United States Livestock Sanitary Association as president.

FRANK D. MCMAHON

Frank D. McMahon, aged 56, died at his home in Phoenix, Arizona, on November 22, 1950. He had been in poor health for several years. He was a graduate of the Chicago Veterinary College, class of 1920, and practiced in Jerseyville, Illinois, until 1927. He then went to Arizona and practiced until 1947, when he was appointed State Veterinarian. He was elected a vice-president of the United States Livestock Sanitary Association at the meeting held in Phoenix shortly before his death.

Dr. McMahon was the host for the 54th annual meeting of the United States Livestock Sanitary Association in Phoenix last November 1–3 and was ill at the time. Following the meeting, the Doctor took to his bed till the time of his death. He was elected 3rd Vice-President of the Association at Phoenix.

JERRY RAYMOND BEACH

Jerry Raymond Beach, aged 62, of Davis, California, died on January 4, 1951. He was a graduate of the New York State Veterinary College at Cornell University, class of 1913, and joined the veterinary staff of the University of California the following year, to engage in the study of poultry diseases, a field in which he became a leader. He made outstanding contributions to our knowledge of roup, coccidiosis, fowl pox and pneumoencephalitis. Dr. Beach’s co-workers at the University of California plan a memorial to him in the form of a library encompassing poultry diseases and related subjects.

He was a member of the Committee on Infectious Diseases of Poultry of the United States Livestock Sanitary Association and has delivered a number of papers before the Association.
MEMORIAL ADDRESS

JAMES H. MURPHY

James H. Murphy, aged 64, of Paris, Illinois, died on June 13, 1951. He was a graduate of the Terre Haute Veterinary College, class of 1915, and had been in the employ of the United States Bureau of Animal Industry, assigned to hog cholera control.

FLOYD PERRIN

Floyd Perrin, aged 65, of Grand Island, Nebraska, died on June 18, 1951, following a heart attack five days previously. He was a graduate of the Kansas City Veterinary College, class of 1914, and practiced in Spencer, Platte Center and Lincoln, Nebraska, for about 25 years. In 1939, he joined the staff of Norden Laboratories as manager of the Grand Island serum plant. For the past six years, he had been a member of the Board of Directors. He was a past president of the Nebraska State Veterinary Medical Association.

DR. CLAUDE S. BRYAN

Dr. Claude S. Bryan, Dean of the School of Veterinary Medicine at Michigan State College, died on July 30, 1951, after a brief illness. The cause of death was aplastic anemia.

Born in Bedminster, Pennsylvania, on June 5, 1908, Dr. Bryan attended Pennsylvania State College and received his B.S. from that institution in 1930. That year he joined the staff of the Michigan State College as a graduate assistant in bacteriology. He received his M.S. in 1932, and his Ph.D. in 1937. He then continued his studies in veterinary medicine and received his D.V.M. in 1942.

Upon the retirement of Dr. Ward Giltner as Dean of the School of Veterinary Medicine in 1947, Dr. Bryan was selected to fill the position.

Dr. Bryan is widely known for his work on bovine mastitis and dairy hygiene. He is the author of more than 100 scientific articles in these fields, in addition to numerous bulletins.

With the growth of the School of Veterinary Medicine at East Lansing, and the pressing need for better and larger facilities for teaching, Dr. Bryan spent much time and energy in obtaining support for the project and planning the new Veterinary Medical Center, after the necessary appropriations had been made. This project is now nearing completion and the new veterinary building will be named Giltner Hall.

Dr. Bryan held membership in numerous professional organizations and, at the time of his death, was secretary of the Association of Deans of American Colleges of Veterinary Medicine. He was a past secretary of the Division of Veterinary Medicine of the American Association of Land Grant Colleges and Universities.

For a number of years, he was chairman of the Committee on Meat and Milk Hygiene of the United States Livestock Sanitary Association and was currently a member of the Committee.

Believing in the fatherhood of God and the brotherhood of man, may I humbly request all present to arise and remain standing for a moment of silent prayer for the peaceful repose of their souls.

(Silent prayer)

Thank you.

They are dead. Shorn of all dramatics, that naked sentence in all its brevity, states a sad fact which will long be felt by many, many people in their respective communities, and throughout the nation.
Woven in the philosophy of their lives were the golden threads of human kindness, sympathetic understanding, benevolence of heart, a humanitarian spirit, and a burning desire to bring joy, happiness, peace, contentment, and security to all. They strove ever for the fulfillment of the purpose of this Association in respect to their membership.

Their contributions to livestock and poultry sanitation and health were of great benefit to countless thousands of people and their passing leaves vacancies very difficult of adequate fulfillment.

To their friends and associates, they were ever sincere, loyal, and true. To know them was to love, admire, and respect them.

The Association and the country have lost great friends and benefactors, but their contributions to home, community, state and nation shall ever remain a living monument to them that posterity may be convinced great careers can be carved out of the granite of hard knocks and varied circumstances by vigor and courage that overcomes all odds.

Thus, we humbly memorialize these departed members, resolving to emulate the goodness and grandeur their lives display, holding high the torch they tossed to us until we meet again on that beautiful isle of somewhere.
LIVESTOCK CONDITIONS—PAST, PRESENT AND FUTURE

L. M. Pexton

President and General Manager, The Denver Union Stock Yard Company

Mr. President, Members of the United States Livestock Sanitary Association:

It is a great pleasure to appear before you today, if for no other reason than to congratulate you upon the good you have done the livestock industry down through the years. My experience in this industry is now about 50 years, 35 of which have been spent upon the Denver market, either with railroads or with the Stock Yard Company. When I first started, cattle and sheep scab, hog cholera and other livestock diseases were a rather common thing. They were quite expensive to the industry, yet the industry itself was usually the one which objected the most when efforts were made to clean up. I well remember a shipment of about 60 cars of range cattle which arrived at Denver with one car of bulls scabby. The Bureau of Animal Industry inspector ordered them all dipped. Inasmuch as all of the shipment had been exposed to scab, this was a protection to the owner. The owner, however, because he happened to be a good friend of several senators, some cabinet officers, and perhaps the President himself, refused to dip anything but the carload of bulls. The Bureau of Animal Industry inspector insisted and refused to release any of the shipment. The owner held the cattle at Denver about a week, endeavoring to have the inspector over-ruled; however, he was unsuccessful. It was this sort of a position, taken by men working for rather small salaries but with plenty of fortitude, that finally got the job done. They are entitled to a great deal of credit.

I spent about two months in South America this Spring and, while there, had a chance to observe foot-and-mouth disease in that area. There, this disease is more or less accepted as a matter of course, with no particular effort being made to eliminate it. It is handled about the same as colds in human beings in this nation, with the attitude, if we can do something about it, fine, but if not, we will just have to get along with it. Some owners vaccinate every six months, as seems to be required; others do not. Part of this may be due to the low prices of livestock; however, they do admit that the death loss is about one per cent and the weight loss during the period the animal is getting over the disease about 135 pounds. The marketing date is set back several months, with increased carrying costs and treatment expense. Apparently the animals of that area have built up a certain immunity, at least so far as death is concerned, an immunity that would not exist in the United States for many generations. At Sao Paulo I watched a sort-off from a large herd, about 200 animals with badly deformed feet, being slaughtered. They were certainly a pitiful sight. I doubt very much if they would have been permitted to graze under such conditions in this nation, let alone be used for food. Certainly they destroyed my appetite for meat while in Brazil and to a certain extent while in South America. I do hope this Association and the Bureau of Animal Industry will never weaken in their attitude towards lifting embargoes against nations having foot-and-mouth disease. While Mexico is making an effort to clean up, certainly South American is

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not. With their form of government and general inefficiency, I doubt if they ever will.

Speaking of their form of government, I believe you would be interested in some of the conditions in Argentina. As you perhaps know, that nation, prior to Peron, had a constitution patterned after our own. The revolution of 1943 put Peron in power—the election of 1946 put him in as President for a six-year term which expires in 1952. He will undoubtedly be re-elected for another six years. Since 1943, the constitution has been amended to provide that the government, which is Peron and his associates, may confiscate or condemn any property which, in their opinion, should be devoted to public use. They have used that power in any way they saw fit for either public or personal use. All of the railroads, formerly owned by the British, were purchased with sterling impounded in Britain as a result of meat purchases during the war. The British operation was quite efficient—the Argentine government operation grows worse daily. All of the stockyards are federally owned and charge 10 per cent for use compared to our one and one-half per cent for both yardage and commission. Much land has been taken over and is being used by government officials. For example, the government built a very large airport about 30 miles from the center of Buenos Aires, the land being appropriated from the former owners, largely cattlemen who had built quite large landscaped estates in that section. One very fine home, not on land required by the airport, was condemned for an art gallery. Four paintings were hung for about a week, and since then it has been occupied by the Secretary of Agriculture.

Local or city transportation is also under government operation. In Buenos Aires during the evening period when workers are going home, it requires about an hour and a half to catch a bus or street car. Yet we saw a string of about 80 large American busses sitting along the curb for want of repairs. Such things as this are common.

In order to break up large land holdings, a regular property tax will exist upon a certain acreage of land under one ownership—a larger tax for additional acreage—another rate for some more—and so on. This is being done to encourage smaller farmer ownership, and perhaps might be a good thing so far as distribution of wealth is concerned if the people were ready for it. However, 65 per cent of the people are illiterate, and they are not ready for such development. When placed on land, they act somewhat like some of our Indians—they just live there and exist and do not add anything to the food supply or the common good. The national result is less food, less development, and less prosperity.

The Jockey Club, as you perhaps know, more or less ran the government prior to Peron. Practically all the national policies were fixed by members of that club and all of the laws were written within its walls. The members were always opposed to higher wages, better living conditions and other such things which have contributed to the development of this nation. After all, we cannot manufacture several million automobiles per year unless we have someone to whom to sell them. We cannot receive a good price for meat unless customers have the money to purchase. The cattlemen of Argentina were free spenders as far as they themselves were concerned. They had wonderful estates on their home ranches—fine winter homes in Buenos Aires—many had homes or apartments in Paris or London. They con-
stituted only about 2500 or the total population of many millions so the final result was almost automatic. I asked several of them if they had taken a different attitude—if they had been willing to assist in raising the national living standard—if they had been less selfish unto themselves—if it would have happened. Practically unanimously they agreed that if they had been more considerate, it undoubtedly would not have happened and they probably would have been more prosperous. While we were in Argentina, choice beef was selling for about four cents a pound American money, certainly not a price to write home about. It seems to me that what has happened there may be an object lesson to us.

The real subject of my talk is livestock conditions—past, present and future. All of us are interested in a prosperous livestock condition and in discussing this particular subject I should like to make the observation that the industry has always been prosperous on good average prices, not necessarily on extremely high prices. The extremely high prices of 1918 and 1919 and 1928 and 1929 got us into trouble. I feel that incident to the war effort every industry or portion of the American people should do their part. For that reason I happen to be one of those in the livestock industry who feels that properly regulated and efficiently managed controls are a good thing for us and may keep us out of trouble.

While certain segments of labor, such as construction workers, have received increases in wages proportionate to the increase in cattle values since 1939, the average laboring man has not. Neither have the prices of the various commodities and equipment livestock producers purchase, gone up in the same ratio as the increase in cattle prices. This is shown by the fact that the parity figure on cattle is around 150 per cent. It is well recognized that each increase of $1.00 per cwt. in the price of live cattle tends to eliminate certain customers and reduce consumption by driving these people to other kinds of food. During the past three or four years this elimination of customers has been offset by numerous people, mostly marginal operators, getting into the cattle business. For example, during a recent month the female cattle slaughter was only 37 per cent of the total kill compared to normal average of about 47 per cent. Calf slaughter is at an 18-year low. The cattle population as of January 1, 1952 it is estimated will be around 91 million, the highest in history. Cattle on feed may equal or excel the record high of last Winter. While admittedly human population is going up and this number of cattle is not out of line with normal prices, it could easily be with abnormal prices. With the large packers and others who do stay in compliance, slaughtering only 50 to 60 per cent of normal, it is obvious that if there were no controls those packers would maintain their position, and fat cattle today might be selling for $4.00 or $5.00 per cwt. higher than they are.

It is a lot further from 42 or 43 cents per pound for fat cattle down to what many have insisted is a fair price, or around 24 or 25 cents per pound, than a drop from the current market of 37 or 38 cents per pound to that level. The Chicago average price of choice steers for the first nine months of 1951 was $36.06—the 1942-1951 average $22.93. All of us get into the habit of adjusting our economy and expenditures to our income. It is easy to go up but it is often rather difficult to come down. Based on experience, therefore, if there should be a very substantial break
in the fat cattle market, it is bound to result in great losses to both feeders and producers. In the '20s and '30s those drops lasted for several years, eliminated many from the industry, closed numerous banks and created much more poverty than the high prices created good. Fat cattle did break from the high of around 40 cents following O.P.A. to about 25 cents in February 1949. That can happen again and is much more apt to happen on 42 cent cattle than on 37 cent cattle.

All of us have a partner through Uncle Sam's income tax on the profit side. Except as some carry-backs might be available this does not exist on the loss side. Where a producer or feeder might have a 50 per cent partnership with Uncle Sam on the profits, it could work out that he would have none on the losses. It could take several years of fair profits to offset and pay for one year of substantial loss.

Unfortunately, perhaps, the entire control program has been tied to meat. The industry has been very vigorous in opposition to any controls with considerable success. Currently there is some discussion of controls being abandoned. All of us agree that inflation is bad for the nation and could lead to a Socialist-Communistic condition which could destroy prosperity in the cattle industry much as Socialism has in Argentina. The industry, along with some of the packers, has outlined various methods of controlling inflation which include limitation of credit. The limitation of credit on automobiles, for example, reduced the volume of both new and used car dealers about 50 per cent and their profits more than that. I happened to be in Washington about the time that quotas were taken off and roll-backs eliminated by Congress. A lobby of automobile dealers then showed up and asked like treatment. Actually, there is no reason for the control of automobile credit which creates inflation if others are not going to be controlled. Congress amended the credit bill, something that probably would not have happened had it not first amended meat controls. We are, therefore, thrown into the position of recommending controls for others but vigorously opposing them for ourselves, which seems to be the common American practice.

When the bank I am connected with, which makes rather large livestock loans, suggests to a feeder that he either pay less or put up some equity, which is contrary to past practices of lending 100 per cent on feeding cattle, the feeder usually objects and seems to feel his credit is being questioned. If we continue our present practices, personally I cannot see where we will wind up without either more major inflation, which will help to destroy our economy, or a rather severe depression, at least in the cattle business. Cattle prices pay little attention to the national debt or other things which tend to create inflation when they start down. None of us likes government regulations and certainly after 30 years' experience with the Packers and Stockyards Administration, I can say we would much prefer to be without it. That regulation, however, was proposed and put through Congress largely by the livestock industry. This same industry has been quite vigorous in proposing railroad regulations and in appearing before the Interstate Commerce Commission for reduced rates. This is, undoubtedly, one of the reasons that, all things considered, railroad livestock rates are lower than almost any other freight rates in America. It is not entirely consistent for this industry to be for regulation of all others and none for itself during a war period. This is over and above the adverse effect ex-
tremely high prices may have on the industry. As many of you know, some mem-
bers of the industry have opposed efficient regulations for health improvement.
The healthy condition of livestock in this country today—in elimination of many
diseases—has shown they were wrong in taking that position.

I do appreciate this opportunity to appear before you and hope I have given you
both some information and food for thought.
Coccidiosis in cattle of the southeastern states is caused by ten species of small protozoa (Christensen, 1941; Boughton, 1945) belonging to the genus Eimeria. Nine of these were found by the present authors in the following report of the natural occurrence of coccidia in twenty calves. These parasites, as shown by photographs with a phase microscope in Plate I, are: *Eimeria subspherica*, *E. zurnii*, *E. alabamensis*, *E. ellipsoidalis*, *E. cylindrica*, *E. bovis*, *E. canadensis*, *E. bukidnonensis*, and *E. auburnensis*. A tenth species, *E. brasiliensis*, is found occasionally in Alabama, but as it was not observed in this study, it is not illustrated.

The coccidia spend their reproductive lives in the small and large intestines where they cause varying amounts of damage, depending on the species involved, the numbers of organisms and the area being attacked. Some begin their damage in the first few inches of the small intestine, while in later stages others are to be found as far down the digestive tract as the rectum. The usual visible damage is in the lower small intestine, the cecum, and the large intestine (fig. 1).

After the parasites have completed their cycles in the intestines, they produce a small “resting” stage or oocyst (Plate I) which is carried out in the feces. The oocyst, if it reaches a suitable environment, undergoes a process known as sporulation, in which the protoplasmic mass inside the shell divides into four sporocysts, each of which soon splits longitudinally to form two sporozoites. In this manner every normal sporulated oocyst contains eight sporozoites, each of which when swallowed can emerge in a calf and start the cycle again. The process of sporulation requires about two to seven days or longer, depending on various environmental factors, and the oocyst is not infective until sporulation is completed. Cold weather prolongs sporulation time and drying may destroy the oocysts. Apparently viable normal appearing oocysts of *Eimeria bovis* and *E. alabamensis* were found by the authors eight and one-half months after an infected calf was left in a 5 x 10 foot pen for one week. The plot was fenced in to prevent further contamination and was in partial shade throughout the entire summer.

**Importance of Coccidiosis**

Coccidiosis causes far more damage than many people realize. A veterinary committee on parasitology (Swales et al., 1948), in a report to the American Veterinary Medical Association, listed coccidiosis as the third most important parasitic disease in cattle. Simms, Boughton, and Porter (1942) found coccidiosis to be one of the important factors in persistent diarrhea of dairy calves from one to three months of age. Foster (1949) estimated that this disease is responsible for an annual loss of ten million dollars in the cattle industry and he believed that the economic loss
is at least as great as that caused by coccidiosis in poultry. It is interesting to note, however, that many articles on diseases of calves fail to list coccidiosis as one of the causes of scours.

Dairy calves usually show more clinical coccidiosis than beef calves because of

![Fig. 1. Internal surface of calf's intestine showing hemorrhage of cecum and colon due to coccidiosis.](image)

![Fig. 2. Dairy calf showing typical symptoms of coccidiosis. Note soiled hind-quarters, rough coat, drooping ear and listlessness.](image)
The photographs of oocysts of bovine coccidia were made from oocysts which were floated on saturated sugar solution, and were photographed to the same scale. The scale shows dimensions in microns. Final magnification is 1000X.

Photomicrographs were made with phase microscope, using Dark Contrast-Medium, 43X objective, with "B" and "G" Wratten filters (green and orange-yellow). Photographed by L. R. D.

1. Eimeria subsphérica
2. E. zurnii, spherical type
3. E. zurnii, elliptical type
4. E. alabamensis
5. E. ellipsoidalis
6. E. cylindrica
7. E. bovis
8. E. canadensis
9. E. bukidnonensis
10. E. auburnensis
the differences in management. Most dairymen keep calves in small lots or barns which have been contaminated by calves for many years. Accumulation of oocysts in these places is such that a calf can swallow a sufficient number in one day to cause clinical coccidiosis one to four weeks later. Boughton (1945) has shown the effects of this type of concentration.

A beef type calf usually stays with its dam on pasture and wanders away from its own droppings. However, when calves are crowded into feed lots for winter feeding, they are exposed to heavy contamination from themselves and from the previous occupants.

SYMPTOMS

One can usually tell whether a calf is suffering from chronic coccidiosis by observing whether the base of the tail, the hind quarters, and the legs are soiled with manure (fig. 2). The calf may not be able to raise its tail fast enough to prevent this type of soiling, especially if the diarrhea is accompanied by coughing. The combination of straining and coughing may cause the manure to be ejected forcibly in a stream for six to eight feet behind the calf. These characteristic streaks of feces on the ground, combined with slight traces of mucus or blood, are typical signs to observe.

Not all diarrhea caused by coccidia appears in this manner, however. In some species the oocysts are given off in large numbers without the consistency of the manure being changed. Only a microscopic examination would reveal the disease. Death may occur without visible blood being passed.

The calves usually appear undernourished. They have rough coats, drooping ears, sunken eyes, (sometimes with lachrymation) and are so listless that defecation may take place while the calf is lying down. When made to get up, the calf staggers as it walks away. Prolonged diarrhea may cause extreme dehydration and loss of weight. In artificial inoculations, the symptoms of coccidiosis may be accompanied by a temperature elevation for a few days before death (Hammond, Davis and Bowman, 1944). In naturally contaminated calves an examination too early in the cycle, or just before death, may reveal no fever at all. The temperature may even be subnormal in a dying animal, so the presence or absence of fever should not be the main criterion for deciding whether the calf has coccidiosis.

Infections with *Eimeria zumii*, *E. bovis*, and *E. auburnensis* are usually accompanied by straining and passing of visible blood and mucus, especially in artificial inoculations with large number of oocysts, or natural outbreaks where contamination is heavy. The last-mentioned species does not occur as often as the other two. *E. alabamensis*, *E. bukidnonensis*, *E. canadensis*, *E. cylindrica*, *E. ellipsoidalis*, and *E. subspherica* do not cause as much as damage as the other three, but some of these are potentially capable of destruction when large numbers of oocysts are swallowed. *E. brasiliensis* is rarely found in Alabama, where most of these studies have been made.

The diarrhea caused by coccidiosis normally appears in calves older than three weeks but younger than six months. Coccidiosis in older calves and mature cattle is mostly associated with grossly contaminated surroundings, especially in cattle with no previous history of infection.
Positive diagnoses of coccidiosis may be made from observations of oocysts (Plate I) or intermediate stages in feces. The oocysts may be concentrated by Christensen’s sugar flotation technique (1941).

LESIONS

In a post mortem examination one may find semi-fluid bloody material in the lower small intestine, cecum, and colon, with evidence of erosion and sloughing of areas of mucosa. Some regions may show thickening of the intestinal walls and pin-point hemorrhages (fig. 1). A croupous membrane may be found on surface areas of the cecum and colon (Hammond, Davis, and Bowman, 1944).

In a few cases, depending on the species and numbers involved, there will be no macroscopic evidence of clinical coccidiosis in the digestive tract, but microscopic examinations of mucosal scrapings often show myriads of small spindle-shaped motile merozoites or oocysts in various stages of development.

Close observation may reveal tiny white dots in the distal end of some villi in the lower small intestine. The dots, which are macroscopic, were first described by Smith (1893), who thought they were Sarcosporidia. Marotel (1907) suggested that they were the schizont stage of coccidia in cattle. Boughton (1942) showed that these bodies were schizonts of E. bovis, and pointed out that they were of diagnostic value. Hammond et al. (1946) estimated that the schizonts contained 55,000 to 170,000 merozoites, with an average of 120,000, each of which could penetrate the intestinal mucosa and cause cellular damage.

NATURAL OCCURRENCE

In a field survey of dairy cattle in the southeastern states, Eimeria ellipsoidalis, E. bovis, and E. zurnii were found to be responsible for the greatest losses. These species were present in animals of all ages, to the extent of 44.7, 40.7, and 42.2 per cent, respectively, in 2,492 fecal samples (Boughton, 1945).

A study was made by the authors of this article of the natural appearance of coccidia in 20 grade Jersey calves, born at this laboratory or purchased locally and placed in outdoor portable pens (fig. 3) at 24 hours of age. They were born between December 20, 1945 and March 14, 1951. Daily microscopic examinations were made during the first 90 days of life by means of Boughton’s sugar flotation method (1943). Nine species of coccidia (Plate I) were seen. The sequence of the earliest appearance, peaks of infections, and repeated infections with each species, are listed in Tables No. 1 and 2.

The initial peaks and reappearances of the different species (Table No. 2) were recorded as peaks of “+” (0–100 oocysts per loopful), “++” (100–500), “+++” (500–1,000), and “+++++” (over 1,000), based on Boughton’s method (1943) of estimating the amounts of infections. Counts of over 1,000 oocysts of most species were comparable to 5,000 to 10,000 oocysts per gram, and were sometimes accompanied by observable symptoms of coccidiosis.

Calves born in the Winter and those born in the Summer showed no appreciable differences in the numbers of oocysts and the time of appearance of the species.

Calves on this experiment had fewer oocysts and were negative many more times.
than calves of comparable ages examined in the average calf lot or barns at this laboratory or on nearby farms.

INCUBATION PERIODS

Two species, *E. zurnii* and *E. bovis*, appear to be the most destructive in cattle. The life cycle of *E. bovis* has been described in great detail (Hammond et al. 1944, 1946). It was shown that *E. bovis* produces oocysts beginning 16 to 21 days after inoculations, with peaks of discharge between 20 and 23 days in 12 out of 13 calves.

The authors gave inoculations of oocysts of *E. zurnii* 117 times to calves between the ages of one day and five months. In this series, 75 out of 94 peaks of oocyst discharge occurred between 16 and 30 days after the inoculation. More calves showed peaks on the 19th and 20th days, 10 calves being represented on each of these days. Of 30 calves which showed peaks of "+++++" (over 1,000 oocysts), the greatest number of peaks (15) appeared on the 20th, 21st, and 22nd days, with 6, 4, and 5 calves, respectively, represented. Peaks of over 1,000 oocysts were produced in 13 of 36 calves when inoculated before two weeks of age; 12 out of 31, between two weeks and one month; 4 out of 29, between one and two months; one out of 13, between two and three months; and none in eight calves between three and five months. There were 23 negative responses out of the 117 tests, the most negatives occurring in the calves over two months of age.

TRANSMISSION

Infective oocysts are picked up by the calf from soiled food and water and by licking or sucking at its own body or that of other animals. Examinations at this
COCCIDIOSIS IN CATTLE

TABLE 1
Initial appearance of the nine species of coccidia in 20 calves, the time of the first highest peak, and the numbers of calves which did not show the nine species

<table>
<thead>
<tr>
<th>SPECIES OF COCCIDIA</th>
<th>APPEARED</th>
<th>HIGHEST PEAK</th>
<th>STOPPED</th>
<th>NEGATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First</td>
<td>Average Days</td>
<td>First</td>
<td>Average Days</td>
</tr>
<tr>
<td>E. ellipsoidalis</td>
<td>14</td>
<td>26</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>E. zurnii, elliptical</td>
<td>14</td>
<td>33</td>
<td>22</td>
<td>37</td>
</tr>
<tr>
<td>E. cylindrica</td>
<td>18</td>
<td>32</td>
<td>21</td>
<td>38</td>
</tr>
<tr>
<td>E. alabamensis</td>
<td>18</td>
<td>48</td>
<td>20</td>
<td>49</td>
</tr>
<tr>
<td>E. zurnii, spherical</td>
<td>20</td>
<td>36</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td>E. bovis</td>
<td>22</td>
<td>35</td>
<td>24</td>
<td>37</td>
</tr>
<tr>
<td>E. subspherica</td>
<td>22</td>
<td>44</td>
<td>25</td>
<td>46</td>
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<tr>
<td>E. auburnensis</td>
<td>24</td>
<td>41</td>
<td>27</td>
<td>42</td>
</tr>
<tr>
<td>E. bukidnonensis</td>
<td>33</td>
<td>60</td>
<td>37</td>
<td>61</td>
</tr>
<tr>
<td>E. canadensis</td>
<td>38</td>
<td>58</td>
<td>38</td>
<td>58</td>
</tr>
<tr>
<td>Averages</td>
<td>22.3</td>
<td>41.7</td>
<td>25.8</td>
<td>44.8</td>
</tr>
</tbody>
</table>

TABLE 2
Numbers of calves, out of a total of 20, which produced peaks of 9 species of coccidia, the numbers of times each species reappeared after the initial peak, and the numbers of calves which did not show a reappearance of the species

<table>
<thead>
<tr>
<th>SPECIES OF COCCIDIA</th>
<th>INITIAL PEAK OF OOCYSTS</th>
<th>REPETITION OF PEAKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0-100)</td>
<td>(100-500)</td>
</tr>
<tr>
<td>E. ellipsoidalis</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>E. zurnii, elliptical</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>E. cylindrica</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>E. alabamensis</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>E. zurnii, spherical</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>E. bovis</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>E. subspherica</td>
<td>13</td>
<td>3</td>
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<tr>
<td>E. auburnensis</td>
<td>16</td>
<td>3</td>
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<tr>
<td>E. bukidnonensis</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>E. canadensis</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>

Laboratory by the authors of this paper have revealed infective oocysts on calves' ears, legs, bodies, and tails. Small soil samples were obtained at random in a calf barn and three areas in a calf pen where the owner was losing about one-third of his
calves from *E. zurnii* infections. Eighteen out of 20 samples showed *E. zurnii* oocysts, many being sporulated. Oocysts are usually extremely resistant to common disinfectants. Horton-Smith and Taylor (1939) estimated that using a "blowlamp" (blowtorch) would require two to 16 hours to sterilize a 12 x 20 foot concrete poultry house. Scrubbing with water will remove gross contamination, but the remaining moisture furnishes optimum conditions for sporulation of oocysts.

It is very common to hear some farmers say that their cattle must have caught coccidiosis from chickens, birds, rabbits, dogs, etc., in the calf lot. These animals have their own species of coccidia which do not infect cattle. However, any animal or man can walk through a contaminated calf stall or lot and carry the oocysts mechanically to other sites.

**TREATMENT**

The initial work of Horton-Smith and Taylor (1942) showed the value of sulfamethazine in the treatment of coccidiosis of poultry. Many others have reported that some sulfa preparations are more efficacious than others. Delaplane et al. (1947) were the first to report that sulfaquinoxaline was effective in preventing *E. tenella* infections.

Other writers have reported that both sulfamethazine and sulfaquinoxaline have proved satisfactory in treating cases of coccidiosis in dairy and beef calves but unfortunately, no calves were left as untreated controls.

The authors of the present paper found that sulfamethazine showed promise of preventing infections with *Eimeria zurnii* in 27 grade Jersey calves. These treated animals showed less infection, and during an observation period of six weeks gained 50 per cent more weight than did the 24 untreated controls. These researches were reported by Simms (1948). In later work done by these authors and reported by Simms (1949), 11 dairy calves treated with sulfaquinoxaline showed reduction in severity of coccidiosis and made better weight gains than did 11 untreated calves subjected to artificial infections with large numbers of coccidia of bovine origin. As a result of further work by these authors, Simms, in 1950, pointed out that after administering coccidia of different species to three groups of calves, sulfamethazine gave more protection than did sulfaquinoxaline, identical amounts of the two drugs being given to two groups of animals. The details of the experiment comparing sulfamethazine and sulfaquinoxaline are as follows:

The calves used in the experiment which follows were grade Jersey males born at the Regional Laboratory or obtained from local dairies before the calves were 48 hours old. They were placed in outdoor individual pens (Davis, 1949) and were moved to a fresh site once each week (fig. 3). Daily counts were made of numbers of oocysts in the feces, using Boughton's technique (1943).

In the first test, eight calves were divided into three groups, based on previous natural infections, ages, and weights. Two groups of three calves each received either sulfamethazine or sulfaquinoxaline, while two calves were left as untreated controls. The drugs were given at the rate of one grain per pound of body weight on the first day of each course, and one-half grain on the ensuing three days. A course of treatment was given during the first, second, and fourth weeks.

Each of the calves was given large numbers of sporulated oocysts in suspension,
Coccidiosis in Cattle

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via a nipped flask. Each calf was given approximately one-half million oocysts on two consecutive days of each week during the first four weeks of the experiment. The inoculum was composed of the following species: E. ellipsoidalis, 56 per cent; E. zurnii, 26 per cent; E. alabamensis, 9 per cent; and E. bovis, 9 per cent. Figure 4 shows the average oocyst peaks per week in the three groups of calves.

The average daily numbers of oocysts during the seven weeks were 108 for the three calves receiving sulfaquinoxaline, 20 for the three getting sulfamethazine, and 171 for the two controls. None of the eight calves passed blood, and there was no appreciable difference in the amount of diarrhea of the three groups. The average weight gains during the seven weeks were 35.6 pounds for the calves receiving sulfaquinoxaline, 52.7 pounds for those getting sulfamethazine, and 43.0 pounds for the controls.

In the second test, the number of sporulated oocysts was increased to five million to each of eight calves. The oocysts were divided into five equal daily amounts and were given during the second week. The following species were given: E. ellipsoidalis, 44 per cent; E. zurnii, 23 per cent; E. alabamensis, 22 per cent; E. auburnensis, 6 per cent; E. subspherica, 3 per cent; and E. bovis, 2 per cent.

Drugs were given in the same amounts as in the first test, the courses of treatment being administered during the first, third, and fifth weeks. Two calves were given sulfaquinoxaline, two received sulfamethazine, and four were left as controls.

More definite results (fig. 5) were obtained than in the first test. Many more oocysts were produced and two of the four controls died from coccidiosis in the fifth week during the peak of E. bovis output, despite the fact that this species constituted only two per cent of the inoculum.

The daily averages of oocysts per loopful were 476 in the calves receiving sulfa-

![Figure 4. Average oocyst peaks per week in three groups of calves which were treated in the first test with sulfaquinoxaline, or with sulfamethazine, or were left as untreated controls.](image-url)
quinoxaline, 80 in those getting sulfamethazine, and 2,440 in the controls. The calves getting sulfamethazine were diarrheic about one-half as many days as the other two groups, which were nearly similar. Neither of the calves which received sulfamethazine passed blood in the feces, while one getting sulfaquinoxaline passed blood for two days. One control calf passed blood for five days and recovered. Surprisingly, the two controls which died had not passed blood. The average weight gains during the experiment were 14.5 pounds for the group receiving sulfaquinoxaline, 42.5 pounds for the group receiving sulfamethazine, and 15.3 pounds for the four controls.

![Graph showing average oocyst peaks per week in three groups of calves treated with sulfaquinoxaline, sulfamethazine, or left as untreated controls.]

In these two preliminary controlled tests when the same amounts of both drugs were given sulfamethazine proved to be superior to sulfaquinoxaline in preventing coccidiosis in dairy calves.

**PREVENTION**

It is easier to prevent clinical coccidiosis than to cure it. Some farmers keep young calves on raised mesh or slat-bottom pens; others use isolation stalls. These methods work fairly well, but the extra chore of cleaning the pens is time consuming. The authors of this paper recommend an outdoor portable pen system for dairy calves (Davis, 1949). This 5 x 10 x 3 foot pen (fig. 3) is moved to a fresh site once each week to eliminate cleaning and to remove the calf from its own feces before many oocysts become infective. The ground is left unused for at least six months before the pen is returned to it.
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This method does not eliminate all coccidia, but if the calves are placed in the pens within 24 hours after birth, clinical coccidiosis is usually prevented and there is a reduction in the amount of white scours, pneumonia, lice and worm parasites.

County agents have reported that 1,009 of the portable pens were in use on 251 dairy farms in 33 counties of Alabama in 1950-1951. The pens are now being introduced into Georgia, Tennessee, Mississippi, Louisiana, South Carolina, California, and other states. No losses for 18 months is the report from some dairymen who have changed to portable pens after suffering annual losses as high as 50 to 75 per cent with the old style calf lots.

To prevent coccidiosis as well as other parasites, beef calves should be dropped and allowed to graze on clean, well drained pastures. Feed and water containers should be designed and elevated to prevent soiling. Overstocking pastures and crowding feed lots should always be avoided.

When beef calves are brought into feed lots, the lots should be cleaned as often as possible. If they are heavily contaminated, the upper surface of soil should be removed and replaced with small gravel. Calves showing diarrhea should be isolated to prevent the contamination of others. Extremely valuable calves could be handled in the portable pens described above.

SUMMARY AND CONCLUSIONS

Coccidiosis causes more damage in cattle than is usually believed. The symptoms of coccidiosis include straining, diarrhea, loss of weight, weakness and passing of blood and mucus. Sometimes deaths from coccidiosis may occur without bloody diarrhea.

A study of natural appearances of oocysts in 20 calves, until they reached the age of 90 days, revealed nine species of coccidia. The earliest appearance of oocysts was when the calves were 14 days old.

The incubation period of Eimeria urnii, responsible for heavy losses in cattle, was found to be 16 to 30 days, the greatest numbers of peaks of discharge being at 19 and 20 days.

In two experiments comparing sulfamethazine and sulfaquinoxaline, using control calves, sulfamethazine gave more protection than sulfaquinoxaline. Calves receiving sulfamethazine produced fewer oocysts, showed less diarrhea and blood, and gained more weight than comparable calves getting sulfaquinoxaline.

Portable isolation pens which are moved to a fresh site once each week are recommended for reducing death losses from coccidiosis and other diseases of calves.

REFERENCES CITED

NATIONAL WOOL GROWERS' ASSOCIATION, AND ITS INFLUENCE IN PROMOTING CONTROL AND ERADICATION OF SCABIES AMONG SHEEP

RAY WILLOUGHBY
San Angelo, Texas

In presenting these remarks, it is first appropriate to state that the National Wool Growers' Association is the oldest national livestock organization; having been organized in 1865.

The moulding of this organization was primarily conceived for the levying an equitable adjustment of tariff rates as related to the sheep and wool industry.

Later, and after the turn of the century, scabies among sheep came under the observation of your organization, as a matter of importance to the producers of this branch of livestock industry. This matter was brought to the attention of the United States Bureau of Animal Industry to the extent that as early as 1907 a dip had been recognized for the control and eradication of this parasitic disease.

Among the older government employees, now holding various positions with the state or government, with records of long and enviable service,—Dr. S. O. Fladness, with the Bureau of Animal Industry, Dr. H. E. Curry, State Veterinarian of Missouri and Dr. Rosenberger with the State of California, took active part in the eradication of scabies in the mountainous states—Utah, New Mexico, Arizona and Colorado, and possibly others.

The dip used in 1907 was the lime-sulphur solution, without the benefit of a vatside test.

In apprehending and controlling this disease, these field employees traveled on horseback, using pack animals to carry equipment. Their inspections were made by this mode of travel to various sheep camps and largely at the season of the year when shearing of the bands was in operation. This process in the control and eradication of scabies was followed until 1915, when recognition was gained of the vatside test in the use of lime-sulphur dip.

You will note that for a period of eight years progress was made in the control of sheep scabies by the use of the lime-sulphur dip, the strength of which was maintained through computation and not through vatside test.

It is generally understood that during these eight years considerable progress was made in the control of scabies; however, it has been stated by Dr. Fladness that much more accuracy was injected into the accomplishment following the discovery of the vatside test.

Following recommendations of both state and federal field representatives, indulging in the control and eradication of scabies, this campaign was given national recognition to the extent that those states involved were placed under quarantine regulations in 1917, in order that ample protection might result through the enforcement of preventive measures in the protection of accomplished work in the other states, as well as to protect local progress within the state individually.

Following this protective measure, machinery was set up in the form of organized
field personnel under the supervision and cooperative planning of the respective states and the Bureau of Animal Industry, looking forward to statewide eradication, wherever field inspection proved justification of such operations.

Progress continued, with the use of lime-sulphur as the eradicating insecticide, until about 1924. At this time nicotine-sulphate also gained recognition as an effective insecticide in the control and eradication of scabies. The vatside test was available, and while somewhat complicated, proved accurate.

With the continuance of this program, and through the experience of the field personnel, and those in charge, by 1930 a most satisfactory control of the disease had been accomplished.

The disease had been eradicated in many sections, and those areas remaining exposed or infected were placed under restrictive measures to the extent shee$ scabies eradication was considered an absolute accomplishment. The number of infected bands was rapidly diminishing.

As this program continued to progress, the sheep-producing states had accomplished the control of the disease and felt, individually, security in the results obtained. However, in those states lying east of the Missouri River, the sheep industry was not considered of importance at that time in the ranks of livestock industry.

The native sheep in those states were of common grade, producing fleeces of inferior quality. These sheep were not in demand in the area west of the Missouri River, due to their inferior grade and lack of weight. For this reason, it appears, interest was lost in the campaign of scabies eradication in that area. Quarantines were levied by the federal government in some of the states east of the Missouri River, however, no force was placed behind the campaign to complete the eradication.

Methods of transportation and the distance dividing these quarantined areas east of the Missouri River from those large sheep growing areas west of the Missouri River, left this an item of apparently little importance. Movements of sheep were then made only by rail or by trail.

In support of this statement, I will cite the State of Louisiana where quarantines were placed on four or more parishes as early as 1918.

The sheep population of the areas under quarantine was known to be heavily infected, however, the lack of commerce in sheep between that area and the area mentioned as sheep-producing states, acted as a restraint upon the scattering of the disease to areas west of the Missouri River.

Some 25 years passed before this condition became a menace and during these 25 years scabies eradication had been accomplished in practically every state west of the Missouri River, or diminished to the extent it was no longer a menace within the state, or to other states within the Union.

Records show, in 1940—or thereabout, the federal government concurred in planning the eradication of scabies with the State of Louisiana. This was carried on through one Summer season, but through interference, by the depletion of manpower and finances through World War II this campaign bogged down, without effecting scabies eradication.

After peace was declared, and normal commerce in livestock again established,
following World War II, methods of transportation had undergone considerable changes. Trucks became available, receiving shipments from points of origin and delivering them to destination with much dispatch.

Commission merchants conceived the idea of establishing livestock auction sales barns over the livestock producing areas of most of our states. Prices of livestock, and especially sheep, climbed to inflationary levels. These conditions brought all sheep into demand, regardless of grade or location. It was then that the neglect by the states and federal government, permitting the reinfestation to spread to practically the entire sheep grazing area west of the Missouri River, became evident.

Texas, in its geographical location, is adjacent to one of these long neglected, quarantined areas, where sheep scabies is known to exist. During normal times, prior to the inflationary period, sheep ranchers in Texas, and other states, were not attracted to the common grade of sheep available in Louisiana and other southern states, and for that reason had not been penalized, to any considerable extent, through exposure resulting from the importation of sheep from Louisiana, and other southern states.

It was not uncommon to find outbreaks of scabies among Texas sheep immediately adjacent to the Texas-Louisiana line, but as prices advanced, the sheep population over the United States decreased and a strong general demand developed for sheep of any class. As a result of this demand, the availability of rapid transportation by truck and the accessibility of traders to these sheep through sales barns, a general importation and intermingling of sheep from southern states, still infected with scabies, to those states west of the Missouri River was promoted.

Instances were traced through reliable records showing that speculators dealing in common sheep were employing rather doubtful procedures in procuring required health certificates for the clearance of shipments of sheep, originating in exposed and infected areas, where quarantines were known to exist for the control of the disease. Neglect and evasion were definitely proven in certification of sheep to interstate destinations.

These records reveal that as much as 100 per cent profit could be made in those sheep, provided the dealers could evade prescribed quarantine regulations.

It was further proved that from one shipment of sheep originating in the State of Louisiana, exposure and reinfection resulted in five separate states. This condition was placed before state and federal livestock sanitary officials in January 1950.

The uncontrolled movements from sales barns, transported by uncontrolled truck lines, made the most favorable conditions for reinfecting various states of the United States with sheep scabies.

This condition continued to develop unfavorably to the extent that some 19 states were barred from shipments unless and until drastic quarantine measures had been complied with that were considered to definitely preclude the scattering of further exposure from those states than known to be showing different degrees of infection.

The hardships resulting from various forms of quarantine invoked by different states in self protection, brought about the assembly of representatives from some 19 states at Salt Lake City, Utah, during the Month of June 1951. The purpose of this assembly was the discussion, by producers and livestock sanitary officials, of
the prevailing conditions with the hope of bringing forth some concurrent, uniform requirements that would be acceptable to the states concerned. One of the main points of controversy was the various treatments required by the different states involved, before shipments would be acceptable for entry into their respective states.

Since this was the chief barrier to be overcome before uniform requirements could be agreed upon, it was proposed that the Bureau of Zoology, which is a branch of the Bureau of Animal Industry, present such statistical information as was available in substantiation of the effectiveness of some insecticide and ovicide, that would accomplish in one treatment the control and eradication of the disease, thereby providing full protection to importing states, or premises of destination, and gaining the recognition by the states concerned.

This report was delivered by Dr. H. E. Kemper, then stationed at Albuquerque, New Mexico. The report revealed that immediately following cessation of World War II, the hydrocarbon chlorinated dips had undergone wide field experimentation. The continued experiments had developed that one of these dips, identified as BHC, and a derivative of lindane, had proven to be highly successful; could be used in normal temperature of water, without heating, and would accomplish control and eradication of the psoroptes Ovis variety of scabies among sheep by an initial dipping. It further proved that the residual period, following the application of this insecticide was such that it afforded protection from re-exposure for a period of not less than 60 days, thereby placing this insecticide in the foreground to the extent that few producers or sanitary officials cared to continue to adhere to the use of the old government recognized solutions of lime-sulphur or nicotine-sulphate. The only innovation since has been the introduction of hydrocarbon chlorinated dip which this Department has considered and adopted in the form of BHC.

The representatives of the industry and livestock sanitary officials of the 19 states mentioned in the foregoing were so impressed by the report delivered by Dr. Kemper that by unanimous agreement they decided this insecticide should be adopted, and it was adopted for use in interstate shipment by the representatives of the states attending, and with the accord of Bureau officials present.

It developed, through discussions from the floor, during this conference, that the Bureau had been accused of negligence in permitting the pool of scabies infection to exist in the State of Louisiana. However, it was also developed that through lack of interest on the part of the producers and lack of demand for this program, there had been no favorable appropriation made to provide finances and personnel to meet the demands of such a program.

With this before the Convention, a motion was made and adopted, for the producers to make known to their representatives in Congress that a shortage of personnel and finances existed to the extent that disease had been scattered over the United States that had been considered under control for more than 20 years, and, therefore, an urgent request be placed before the representatives in Congress whereby funds would be made available to the Bureau of Animal Industry to the extent that full control could again be had of this condition, looking forward to the complete eradication of scabies again within a minimum length of time.

As a result of this request, even though coming late in the session of Congress,
an additional allotment of $50,000.00 was made. This allotment will have considerable influence toward reviving and carrying out better protective measures.

This sum is vastly inadequate, as it was developed through competent sources that at least $350,000.00 additional funds for the eradication of scabies should be made available to the Bureau of Animal Industry.

Since this conference at Salt Lake City was instigated by the National Wool Growers' Association, and resulted in the adoption of uniform agreements between the states attending, it is most fitting that due credit be given your organization for the long line of constructive service you have rendered to the sheep growing industry and an expression of appreciation be made for your diligent and consistent efforts for the betterment of those concerned in the industry. Please feel assured of the support of this organization, and the industry of those states concerned in furthering your efforts towards continuing your long and enviable record of beneficial achievements, which are favorably felt throughout the entire industry.
EFFECT OF INDIVIDUAL SPECIES ON GROWTH

Strongyloides

The intestinal threadworm, *Strongyloides ransomi*, which occurs in its adult stage in the small intestine, has attracted but little attention, in spite of its demonstrated potentiality for serious damage to the health of pigs. This species is one of the smallest of the worm parasites of swine. The adults, all of which are females, are only about one-sixth of an inch long and occur embedded more or less deeply in the intestinal mucosa. For this reason, threadworms are easily and usually overlooked in routine post mortem examinations. The microscopic, partially developed eggs are in the feces. After a short period of development the eggs give rise to larvae which either develop to the infective stage, or develop into free-living males and females. These, in turn, produce eggs from which infective larvae ultimately develop. One or more generations of free-living males and females may occur on soil.

Infection of pigs occurs by penetration of the infective larvae through the skin or by swallowing the larvae. In either case, once within the body of the pig, the young threadworms migrate extensively and may invade all tissues, including the myocardium, the brain and spinal cord, the skeletal muscles, the liver, the lungs and the reproductive organs. Eventually the larvae reach the lungs, migrate through the air passages to the esophagus and are swallowed. In the intestine they grow to egg-producing maturity in about a week. There is reason to believe that infection of unborn pigs can occur as a result of migration of the larvae through the placenta.

In certain foreign countries, threadworms have come to be recognized as a cause of epizootics among pigs. In this country, more or less recent investigations have shown that this worm can exert a profound injurious effect on the health of pigs. In sublethal experimental infections the rate of growth of infected pigs has been observed to be retarded to the extent that the weight gains were as little as one-third those of uninfected littermate controls. In addition, numerous cases of sudden
death of adult swine and young pigs in the herd maintained by the Zoological Division of the Bureau of Animal Industry at Beltsville, Maryland, and a number of deaths of farm-raised pigs in Maryland, have been found associated with extensive invasion of the entire body, particularly the heart muscles, by the migrating larvae. Experimentally infected pigs that survived injuries inflicted by the migrating larvae, underwent a long period of debilitating diarrhea, coupled with loss of appetite, which resulted in failure to grow.

Little information is available as to the frequency with which threadworms occur in swine the country over, and no information is available relative to the proportion of pig mortality on farms that can be ascribed to this parasite. The limited information that is available indicates that about 30 per cent of the adult swine may be expected to harbor these worms. However, since in older animals the infections are often too light to be diagnosed by means other than careful post mortem examinations, the actual incidence of threadworms may be higher than indicated by the available data.

**Whipworms**

Whipworms, *Trichuris suis*, are parasites of the cecum and colon and have generally been considered of little importance. The parasite eggs, which are passed in the feces, are undeveloped. On soil they develop slowly, and within several months a larva forms within the egg. The eggs do not hatch, and infection occurs as a result of pigs swallowing the infective or larvated eggs. In the intestine the worms develop to maturity in about seven weeks.

In investigations carried out at the Agricultural Research Center at Beltsville, the growth of pigs harboring heavy experimental infections was compared with that of uninfected littermates. Weight gains of the infected pigs were about 70 per cent as great as those of the uninfected controls, the reduction in weight gains becoming apparent before the worms had reached egg-producing maturity. In other experiments, weight gains of pigs harboring light experimental infections were compared with those of pigs severely parasitized with this worm. The heavily infected pigs gained only 57 per cent as much weight as did the lightly infected group.

In addition to the depression in weight gains there is some indication, not fully substantiated as yet, that the breeding capacity of female pigs that recover from severe trichuriasis may be impaired.

**Stomach Worms**

The red stomach worm, *Hyostrongylus rubidus*, is, so far as is known, rather widely distributed among swine the country over, although precise information is lacking. This parasite, so small that it may easily be overlooked in routine post mortem examinations, has a direct life cycle. Eggs passed in the feces develop and, within a period of about a week, give rise to infective larvae. Infection can occur as a result of swallowing the larvae, but it is not known whether it is possible for the larvae to penetrate the skin. Soon after reaching the stomach, the larvae burrow into the mucosa, the injuries produced causing loss of blood in quantities great enough to be detected in the feces as early as seven days after infection.
In experimental infections, blood continued to be passed as long as three months, which was as long as the observations were continued. Under conditions of the tests, the infections were associated with reduction in weight gains, the gains varying from about 40 to 90 per cent of those made by uninfected littermate pigs. The animals that made the least gains were those that harbored the greatest number of worms. The most severely infected pigs, namely, those that harbored more than about 500 worms, died.

**Nodular Worms**

Nodular worms, *Oesophagostomum* species, are among the commonest of the worm parasites of pigs. In the South, probably none of the pigs escape infection. Four species of nodular worms occur in swine, but only three are of common occurrence. Adult nodular worms occur in the lumen of the cecum and colon; the pre-adult forms occur in the wall of the cecum and colon where they give rise to small nodules, from which the common name of the parasite is derived.

Nodular worms have a direct life cycle. Eggs passed in the feces hatch after a short period of development and the larvae develop to the infective stage in about a week. In so far as is known, the usual route of infection is by mouth, but there is some reason to believe that skin penetration also may occur. After gaining entrance to the large intestine, the larvae penetrate its wall, where they undergo a period of development lasting one to three weeks, after which they emerge into the lumen of the intestine and attain sexual maturity in about seven weeks.

Tests to evaluate the effect of nodular worms on the host showed that extensive damage to the wall of the cecum and colon through invasion by the larvae may become apparent as early as three days after infection. In severe infections the wall of the intestine is greatly thickened, with the formation of a diphtheritic membrane over the mucosa, hemorrhages in the intestinal wall and fibrosis of the regional lymph nodes. In experimentally infected animals, blood appeared in the feces as early as three days after infection and continued to be passed as long as 16 weeks, which was the longest time pigs were kept under observation.

On the basis of work carried out in the Zoological Division, it was found that weight gains of infected pigs were inversely proportionate to the number of infective larvae fed, infections of 140,000 larvae generally being sufficient to destroy the health of the pig to the extent that a continual loss of weight and in some cases death occurred. Weight gains of pigs harboring sublethal infections were from 10 to 60 per cent as great as those of uninfected littermates.

**Kidney Worms**

The kidney worm, *Stephanurus dentatus*, is a common parasite of swine in the South and has recently been found to have moved into the Corn Belt. The parasite lives in the kidneys and in cysts along the ureters. Eggs deposited by the adult female worms in the kidneys and ureters pass to the outside with the urine. After a short period of development they hatch and the larvae become infective in about a week. Infection occurs either by mouth or through the skin. It has long been recognized that once within the body of the hog, the young worms make their way to the liver where they live for a time. During their migrations through the liver
they destroy the hepatic tissue, the injuries giving rise to large areas of cirrhosis, thus spoiling this organ for food. After a period of development in the liver, the young worms migrate through the body cavity to the kidneys and ureters. Egg production is begun by the females about six months after infection. Recent investigations have shown that in addition to liver damage the migrating larvae can cause profound pathologic changes in the intestines and mesenteries of susceptible pigs. The changes consist of extensive fibrosis of lymph nodes and mesenteric tissues, hemorrhages from the intestinal wall and destruction of its tonus. Pigs subjected to heavy infections failed to grow and died within a period of three to five weeks after infection. In sublethal infections the rate of growth of pigs was markedly retarded, the extent of the retardations being directly proportionate to the severity of the infections. In addition, migrating larvae have been recovered from the lungs, the brain and spinal cord, the loin muscles and from the pancreas within a few days after infection.

As stated previously, it was formerly thought that kidney worms were confined to hogs raised in the South. In recent surveys conducted in abattoirs slaughtering hogs raised in several states of the Corn Belt, as many as 40 to 50 per cent of the livers of the animals examined contained damage due to kidney worms. The damage observed was so great as to necessitate either extensive trimming or condemnation of the entire organ.

Ascarids

In the past, some confusion has existed relative to the deleterious effects of ascarids, *Ascaris lumbricoides*, on growing pigs. Some investigators have considered that only the migrating larvae in their passage through the liver and lungs produce injury and that the adult worms do little, if any, damage. Recent investigations have shown, however, that a marked reduction in growth may occur in pigs harboring mature ascarids in the intestine. In experimentally infected pigs which, at necropsy, harbored numbers of ascarids ranging from 12 to 109, the retardation in growth was directly proportionate to the number of worms harbored. In the case of the heaviest infection, the affected pig weighed less at the end of the experiment than at the beginning. In the case of pigs harboring lighter infections the weight gained was, in some cases, as little as 50 per cent that of the uninfected littermate controls.

In addition to their potentialities for injuring the health of pigs and adversely affecting weight gains, ascarids frequently are a cause of condemnation of swine carcasses at slaughter, the condemnations being necessitated by a condition of generalized icterus resulting from occlusion of the bile ducts by these worms. According to federal meat inspection records, about eight per cent of the total number of swine carcasses condemned in the United States are condemned for icterus. Investigations have disclosed that in the vast majority of cases the icterus was associated with occlusion of the bile ducts by ascarids.

Lungworms

Three species of lungworms occur in the respiratory tract of pigs, one species of the genus *Metastrongylus* and one of the genus *Choerorostrongylus* apparently
being widely distributed throughout the United States; the other, which belongs to the genus *Metastrongylus*, having been reported only from pigs in the South. Only a limited number of hogs have been examined specifically for lungworms in this country, the available data having been derived chiefly from examinations of hogs raised in the South. The findings indicate that about 70 per cent of hogs in that region may be expected to harbor these parasites.

Lungworms have a complex life cycle which involved earthworms as an intermediate host, the red-striped manure worm, *Helodrilus* being the one most commonly involved. Pigs become infected with lungworms by swallowing the infected earthworms. The larval lungworms migrate by way of the lymph channels to the lungs where they become established in the bronchi and bronchioles. Adult lungworms feed on the inflammatory exudate which contains red blood cells and leucocytes. Petechial hemorrhages in the lungs and bronchopneumonia are the most common postmortem manifestations of lungworm infections. Clinically, coughing and shortness of breath are generally considered as indicative of the presence of lungworms.

Complete evaluation of the potentialities of lungworms in producing unthriftness in pigs has not been made. However, limited observations indicate that in heavy infections the worms can interfere with weight gains. In experimental infections in which more than 1400 lungworm larvae were fed to test pigs, the weight gains were only about 80 per cent as great as gains made by uninfected littermate controls. It is interesting that the retardation in growth persisted as long as two months after it was possible to recover lungworm eggs from the feces.

**EFFECT OF PARASITES ON THE GROWTH OF AND FEED CONSUMPTION BY PIGS**

Further evidence of the costliness of swine parasites is afforded by findings in studies carried out by Bureau of Animal Industry parasitologists in the coastal plain section of Georgia. In these studies, the rate of growth and feed consumption of pigs harboring moderate to heavy infections of parasites were compared with those of lightly infected pigs. In these investigations, litters were farrowed each Fall and Spring under conditions conducive to the acquisition of parasites. Equal numbers of litters were farrowed under conditions designed to limit to a large extent the acquisition of parasites. The growth of litters that acquired moderate to heavy infections of parasites was retarded to the extent that they required from four to five weeks longer to attain a market weight of 225 pounds than did the lightly infected pigs. In addition, the heavily infected pigs consumed nearly one pound of feed more per pound of gain than did the lightly infected ones.

Still further evidence of the effect on the growth of pigs of naturally acquired parasite infections is afforded by experiments in which weanling littermate pigs, worm-free at the beginning, were maintained on filthy hog lots. One group of the pigs, the controls, was fed a balanced grain ration and was in no way protected against parasites. The other two groups were kept relatively free of parasites by feeding skim milk in lieu of grain and water, either once daily or for three consecutive days at intervals of two weeks. Observations were continued for about three months. During that time, the pigs fed only grain were unprotected against parasites and acquired heavy infections. As a consequence of the heavy parasitism, these
pigs gained only 0.32 pound per day, on the average. In contrast, the pigs fed milk either remained free of parasites or acquired only light infections. They gained over one pound per day, on the average.

**UNSOLVED PROBLEMS RELATING TO SWINE PARASITES**

The general sum of knowledge with regard to swine parasites is very limited in relation to what is not known. A few examples are as follows:

Little is known of the effect of various nutritive elements—vitamins, amino acids, minerals, carbohydrates, proteins, etc.—on the resistance of pigs to parasites or their ability to withstand the effects of parasites.

The complex of the immunological relationships between parasites and their definitive host, the pig, has received little attention.

Little information is available regarding the possible relationship between parasites and the transmission of bacterial and/or virus diseases, or in predisposing swine to the onset of these diseases. In this connection, lungworms have been implicated in the transmission of swine influenza, and investigations have revealed that larval trichinae can carry in their bodies the causative agent of lymphocytic choreomeningitis. Due to the tissue invasive powers of the larvae of certain parasites, it seems reasonable to suppose that they may be able to carry with them into the body of the pig, viruses, bacteria, or even fungi.

The prevalence or incidence of the various species of swine parasites the country over is largely a matter of conjecture, as is the extent of losses due to retarded growth and death of pigs on farms.

The potentialities of many of the species, either singly or in combination, for causing losses through retarded growth and by other means has not been adequately explored.

The effect of parasites on the breeding capabilities of swine is a matter for conjecture. As stated previously, there is reason to believe that females that have recovered from near-fatal infections of threadworms and whipworms may be deficient in breeding capabilities; this, however, must await critical experimentation.

The development of satisfactory treatments for the removal of some species is a great need. A number of the parasites of swine occur in locations in the body where they are beyond the reach of known anthelmintics. For example, no treatment is available for the removal of kidney worms and satisfactory treatments for the removal of threadworms and lungworms are lacking. In fact, entirely adequate chemotherapeutic measures are available only for ascarids.

Control measures that have been devised sometimes fall short of the ideal. Some of them are cumbersome, have other disadvantages and do not meet with the approval of the swine raiser.

Relatively fragmentary information is available regarding the longevity of eggs and larvae of swine parasites under various conditions as regards soil types, moisture, herbage, etc.

Many gaps exist in our knowledge of the mode of transmission of swine parasites. There is some indication that birds and mammals, such as rats, may serve to disseminate the eggs of swine ascarids and eggs of thornheaded worms, and that these eggs are viable after passage through the intestine of the animal or bird.
Little information is available relative to the potentialities of the various protozoan parasites—balantidia, coccidia, endameba—in causing disorders in pigs. There is some indication that pigs on a high carbohydrate diet—corn, for example—may suffer from severe balantidiasis.

Lice and mange are widespread among swine. A small bit of information available, not yet substantiated, indicates that lousy pigs do not make satisfactory weight gains. No quantitative information regarding the effect of mange on the growth of pigs is available.

A need exists for the selection and development of strains of swine that are either resistant to infections of parasites or that possess a tolerance for parasites. If strains of pigs could be found which inherit either a genetic resistance to infection or a tolerance to the adverse effects of parasites, a big step would have been taken in solving the problems attendant upon the widespread infections of swine with these pests.
A REVIEW OF FOOT AND MOUTH DISEASE ERADICATION IN MEXICO

L. R. NOYES, D.V.M. CO-DIRECTOR

Mexico-United States Commission on Foot and Mouth Disease

In order to give you an account of what has been happening in the foot-and-mouth disease campaign in Mexico during the past 12 months, I had better sketch in a little of the background.

The field of operation is a little larger than the combined area of the States of Colorado and Washington and it covers all kinds of country, from sea-level jungle to snow-capped mountains more than 17,000 feet high. Some of this territory was considered unexplored until members of the Commission went into it to inspect animals. In addition to the extremes of altitude, there are extremes between the dry and wet seasons. We must be prepared to operate in country without water and in country that is flooded. Thousands of square miles of semiarid and mountain country can be reached only on horse or muleback, for passable roads form only a thin network in many parts of the area. This means that quarantine of suspicious herds must often be held for days until samples are brought in by painfully slow means of transportation. We exercise control over this terrain and these distances by organizing the region into nine districts, 30 areas, and 355 sectors, connected by a network of radio communications.

You will recall that, after the initial outbreak in Mexico in December of 1946, it took four months to set up the international machinery for this operation. In that four months, in spite of the efforts of the Mexican government, the disease had spread like a prairie fire through 17 states and the Federal District.

The governments of Mexico and the United States were agreed upon time-tried methods of eradication.

Nearly a million animals were involved in the first efforts to stamp out the disease. The virus had great spreading powers, even though the death rate for the large animals was quite low. In the dairy herds, however, the death rate of newborn calves and the after-effects of the disease on animals were very severe. Most of the dairy herds attacked by the disease have been replaced since, in proportions running from 50 to 100 per cent. But, because the death rate was low in native herds, the campesino and the small farmer could not understand why such drastic measures were taken to eradicate the disease when most of the animals, if left alone, eventually would recover.

These difficulties led to the vaccination phase which, however, included the eradication of actively infected and contact animals. In the course of four waves of vaccination, more than 60 million doses were administered. That phase of the program ended in July 1950. While vaccination is rather widely considered to have been a factor in the eradication program, many important questions concerning its real effectiveness must yet be answered. Several European and South American countries which rely on vaccines have had many outbreaks since we have been working in Mexico.
The present and closing phase of the campaign in Mexico is based on inspection, coupled with education of the people and soliciting their cooperation in reporting sick animals. When active cases are found, of course, they are eradicated.

The maximum manpower reached by the Commission, during the eradication and vaccination phase, was 8,204. The largest number of motorized vehicles operated was 1,790; the largest number of saddle and pack animals was 3,800. The policy for some time has been to taper off gradually on personnel and material, looking toward completion of the campaign.

A year ago, in November 1950, our manpower stood at 2,912, or 35.5 per cent of maximum. We then had 951 vehicles, or 53 per cent of the number at the peak of operations, and 2,300 horses and mules, 60 per cent of the peak number.

We now have about 1,900 people, 650 vehicles, and 1,200 horses and pack animals, or 23 per cent of the people, 36 per cent of the vehicles, and 31 per cent of the work animals that we had at the height of the campaign.

Expenses have also shown a gradual decline, as indicated by these figures: In August 1950, United States and Joint Commission expenditures were $987,000 in round numbers. In August of this year we spent $624,000, or 36 per cent less than in the August before. This month's figure would have been more than $100,000 lower had it not been for the Nautla outbreak. These figures, by the way, do not include separate expenses incurred by the Mexican government.

Because of the outbreak at Nautla, Veracruz, in August of this year, it is our intention for the immediate future to maintain about our present strength of men and materials, diminishing our forces by natural processes of attrition and making replacements only when absolutely necessary.

Inspection is our main activity. Out of a total force of Americans numbering about 525, there are 55 veterinarians and 375 livestock inspectors in the field, making a total of 430. Each veterinarian and each livestock inspector works with his Mexican counterpart, so we keep in the field 110 veterinarians and 750 livestock inspectors of the two nationalities—a total of 860 men. We also keep in the field ten Mexican and ten United States quarantine and disinfection supervisors, who are in charge of 400 men on the quarantine lines and detailed to disinfection work. The veterinarians and inspectors have been able in the past 12 months to inspect an average of about nine million animals a month. The number naturally varies with season and place: in the dry season, when the animals are congregated around waterholes, more can be inspected than in the rainy season, when they are scattered all over the country. The accumulated total of all inspections made by the Commission is more than 342 million—a number lacking only 12 million of equaling all the cattle in North and South America, Europe, and Oceania. But, in spite of these impressive figures, we clearly recognize that inspection, at such intervals as we can accomplish it, cannot cover every possibility of finding every sick animal.

We know that we must depend on reports of sick animals from the people to give us the maximum protection. Regardless of the number of livestock inspectors we maintain in the field, it is absolutely essential to keep men who can sell this program to the campesinos so they report sick animals, whether theirs or their
FOOT AND MOUTH DISEASE ERADICATION

neighbors. These people see every animal in the infected zone every day, which we cannot possibly do. This kind of cooperation was demonstrated in the last two outbreaks, both of which were reported by livestock owners.

The participation of the Mexican government, the cooperation of the Mexican people, and the generally good working relations of Mexicans and Americans in the Commission, have been indispensable to this cooperative enterprise. Licenciado Oscar Flores, Director of the Commission, is an outstanding official, and one who never spares himself when effective and constructive work is at stake. I have been privileged to work with him.

I can give you some outstanding examples of reporting by the people. There are sectors where the men of the community are organized into vigilance committees, which report animal diseases to the presidente of the municipio, a political subdivision somewhat like a county in the United States. The presidente passes on the report to the nearest Commission personnel. There are cases where local priests have been alerted to the danger and from time to time they speak of it to their parishioners. Their influence with the women of the community has been very helpful in this campaign. There are schools in Mexico where children report each morning, when the roll is called, any sick animal they know about. If this cooperation, touching each member of the family, could be made uniform throughout the affected area, foot-and-mouth disease could not get a foothold without our knowledge. But, in this as in other human affairs, the performance is spotty. Here you have cooperation, there you have none, and in between are areas where most people are inactive or indifferent.

We are placing a great deal of stress on reporting sick animals, and the effort is bearing fruit. For instance, there were reports last August on sick animals in 7,103 herds, an increase of 78 per cent over the number reported for July, and of these 7,103 reports, 4,024 were made by livestock owners or other people in the community. That is about 57 per cent. In September the percentage dropped to 53. I wish the percentage were in the 90's rather than in the 50's.

Reports on lame and salivating animals are particularly important in Mexico, where vesicular stomatitis is a frequently recurring disease covering the entire infected zone. As most of you know, this disease is indistinguishable from foot-and-mouth disease by visual inspection, even to the best-trained veterinarian. Stomatitis is negligible in its effects upon livestock; foot-and-mouth can be devastating. Biological and serological tests are necessary to differentiate rapidly between them. Foot-and-mouth disease can develop alarmingly from one inspection to another, so the people must be enlisted as resident watchmen, so to speak, who are on the job every day.

Our laboratories in Mexico City, from November 1, 1950, to September 30, 1951, received 406 samples from different animals in the field. Fourteen of these samples were insufficient for testing. Of the remaining 392 samples, 229 were diagnosed as vesicular stomatitis—148 of the Indiana type and 81 of the New Jersey type. In these cases, of course, the quarantine of animals was removed when a definite diagnosis was made. Seventeen samples from two outbreaks showed positive foot-and-mouth disease. Samples to the number of 146 were negative or inactive to both
laboratory and biological tests, but, as an additional safeguard, herds from which the samples came were kept under quarantine for 15 days and the animals were inspected every day.

Regarding the last two outbreaks, both of which occurred within the past twelve months:

On Friday evening, December 29, 1950 at about 4:30 p.m., information was radioed from district headquarters at Texiutlán, Puebla, that veterinarians were leaving to investigate a herd suspected of having a vesicular disease. They arrived at the village of Comalteco, Veracruz, that night and made a preliminary inspection of the herd, which contained 56 animals. Twenty-five of these animals showed lesions. Samples from three animals reached our laboratory in Mexico City the next morning at 11:00 o'clock, December 30. Tests were run and the results showed foot-and-mouth disease, type-A.

The next evening, December 31, we eradicated the 56 animals.

Three days later, on January 3, daily inspection of animals in the vicinity found two infected hogs in the village. It then became necessary to eradicate in 328 hogs, 11 sheep, and 6 cattle the town that were in contact with the two infected hogs. This was done the day after the hogs were found—on January 4. There followed the customary cleaning and disinfection of premises, including the whole village. The area was kept under quarantine for 30 days, and no one was permitted to leave it without undergoing disinfection and wearing freshly laundered clothes. No animals were permitted to leave or move from their respective pastures within the quarantine area. Test animals were then placed on the infected premises for 90 days, with daily inspection for the first 30 days and twice-a-week inspection thereafter to the end of the period.

The Nautla outbreak of last August, in a municipio bordering on the Gulf of Mexico, was bigger and in many respects more vexatious than the one at Comalteco.

One of the cattle owners reported he had sick animals in his herd, which with its contact herds was quickly placed under military quarantine. All available manpower was rushed in from other parts of the district to carry out daily inspection of adjoining herds. Samples taken from animals with lesions were apparently too old, or for some other reason did not give a positive test. Additional sick animals were found on an adjoining ranch by our veterinary inspectors. Samples of epithelium and fluid were taken from these animals, which had been vaccinated four times. Serological and biological tests run on these samples showed positive foot-and-mouth disease, type-A.

In the course of this break, nine separate samples were subjected to both serological and biological analysis; and in each case one test confirmed the diagnosis of the other. Material from each of the nine samples was also injected into horses, with negative results. Portions of four of these samples were sent to the Research Institute at Pirbright, England, for further confirmation, which was later received.

It was not really necessary to send the material to England for diagnosis, but we have done it every time we had a new outbreak of foot-and-mouth disease in Mexico. A few people in the United States and Mexico occasionally make the statement that foot-and-mouth disease has never existed in Mexico. In order to protect this program and the people working on it, we have followed the custom of sending
samples for confirmation of diagnosis. In every instance, our findings have been confirmed.

As soon as the disease at Nautla was definitely diagnosed, which was at 5:00 p.m., Sunday, August 12, men and equipment were ordered from the other eight districts to assist in the eradication operations. These men started arriving at their new assignments at daylight on Monday morning; some of them were ordered in from as far as 600 miles away. Laborers were not available locally, so it was necessary to recruit them from as far as 75 miles away.

We used 450 men, 160 vehicles, and 160 horses on the break. The operations were in a rugged locality four hours from the nearest highway, and it was necessary to transport all the material over rivers and almost impassable roads. The vehicles had to winch themselves up steep hills to reach their destination. These conditions made it difficult to provide supplies, including food for men and horses. The break was in malaria-infested tropics and in spite of the antimalarial drugs taken by the employees, several cases of the disease were contracted during this operation. Also, as a result of the rough terrain, it was necessary to establish two mobile shops in order to keep the vehicles in operation.

The majority of the 80 inspection teams brought their own portable radios, but standby units and generators were also provided. The central radio units kept in touch with all the inspection teams covering the surrounding area.

A temporary headquarters office was set up within the ten-kilometer radius to handle all administrative matters. There were disinfection stations and soldiers to enforce disinfection and to hold the quarantine lines. Large quantities of lime and soda ash were trucked in for the disinfection of persons and premises. All personnel working at the break were required to wear protective outer garments, such as rubber boots, gloves, coveralls, raincoats, and rain hats.

Eradication of infected and contact animals was finished within two days after completion of the trenches. It was early October before the cleaning and disinfection was done and personnel from other districts could go back to their own jobs and to well earned week-ends of rest.

Even then, some of the men and their vehicles were marooned by high water caused by rains in the mountains and there was a question for several days how they would get out and how test animals could be brought in to graze over the formerly infected territory. Susceptible animals from northern Mexico were turned into the area early in October. At this moment, in mid-November, they are being herded to all parts of the infected and contact area and inspected twice a week. It will be the first of the year before the books are closed on the Nautla break.

There are many ways of estimating the cost of such a break, which covered an area of about 4,000 acres and involved more than 1,800 animals. In terms of human cost, there was the usual run of minor injuries and, in addition, two men lost their lives in the area, although neither death was work-connected. There were plenty of inconveniences to everybody, but very few complaints. Several of the men said afterward, "it was pretty rough," but very few of them itemized the rough spots.

The outlay of cash over and above the regular running expenses of the Commission—and not including the pay of many men transferred to the area of the break—was in the neighborhood of $150,000. But that is only the immediate cost.
The operational costs of the Foot-and-Mouth Commission had been projected to drop gradually over a period of about a year following the outbreak at Comalteco in December 1950. The Nautla break caused us to revise our future plans. The projections on manpower, matériel and expenditure had to be raised. The difference between the higher projection and the lower, on which we had our sights set before this break, is going to run nearly two million dollars. That is the real cost of this outbreak.

Foot-and-mouth is not only a terrible disease—it is a very expensive one.

But look at it this way: This work is keeping foot-and-mouth disease away from a million cattle in Guatemala. It is protecting nearly 32 million susceptible animals in Mexico, valued at 10½ billion pesos. It is protecting the 13-billion dollar livestock industry of the United States.

In those terms, it is very low-premium insurance.
CHAIRMAN CARR: There are so many questions asked of the regulatory officials about foot and mouth disease, not only in Mexico but all over the world, that it seemed advisable to your Committee on Foot and Mouth Disease to arrange for a panel of men who are well acquainted with this disease and its implications and have them answer questions directed from the floor.

I hope you will keep your questions confined to the disease itself and not to political implications that might be involved in international disease control.

Your Committee on Foot and Mouth Disease has been very fortunate to have Dr. Noyes as part of the panel. He needs no introduction, I am sure.

Our President, Mr. Ferd Mollin, graciously said he would handle questions for the industry.

We also have Dr. M. R. Clarkson, Assistant to the Administrator of the Agricultural Research Administration, whom I am sure you all know. He has been very active in the campaign in Mexico and other countries, and he is well qualified for this panel.

We have Dr. Maurice Shahan, who was in on the beginning of foot and mouth disease outbreak in Mexico. I am sure you all know him and are acquainted with the great work he carried on in Mexico while he was there. Dr. Shahan is now in charge of the foot and mouth research laboratories for the Bureau of Animal Industry in Washington.

We have with us Mr. R. E. Boyle, a member of the Foot and Mouth Disease Advisory Committee to the United States Commission. He is a livestock producer, and I am sure many of the livestock men here know him.

Each member of the panel has agreed to give us a five- or ten-minute dissertation on a subject of his own choosing. In that way you will know perhaps to whom to direct your questions.

We will call first on Dr. Clarkson.

DR. M. R. CLARKSON: I think I probably should be last on this panel, because what I have to say is a little off the beaten path.

We are accustomed to consider foot and mouth disease from the standpoint of accidental introduction of the disease over a long period of years. The few words I have to say have to do with the possibility of intentional introduction of foot and mouth disease or other foreign diseases that would be devastating to our livestock; in other words, the biological warfare that we hear about in the press and other places and have heard about for some years.

With respect to the livestock industry, it is pretty well agreed that we are vulnerable to attack by biological warfare weapons, and particularly with foot and mouth disease, rinderpest, European fowl pest or fowl plague, and Asiatic Newcastle disease of poultry.

In mentioning those diseases I mean not to leave out others, because of course we must consider any and all diseases that would be dangerous to our livestock. We have to center our attention also on the probabilities, and put less attention...
on those that are fringe possibilities. That attention might have to be shifted from
time to time as new knowledge comes to our attention.

We in the Department of Agriculture have been given quite a large share of the
problem with respect to working out defensive measures against the possibility of
biological warfare because of the usual activities in the field of animal disease con-
trol and eradication. The state livestock sanitary officials have been given a like
responsibility for exactly the same reason. It is hoped that that team, working
as it has done in the past, can give us a rather effective defense against any possible
attack.

We know that it seems unlikely that we would be able to prevent an attack if
resourceful enemies were to press one indeterminately. We do have inspection con-
trol at the ports of entry, and so on; but again that is gauged to keep out accidental
introduction. We can go only so far toward making it more difficult for planned
introduction.

It does seem likely that an enemy could get in, and that his most likely means of
attack would be by sabotage, maybe before or after any overt act of war. We are
accustomed to thinking of biological warfare in terms of planes flying over and drop-
ning infected material, or submarines coming up next to a coastal city and spraying
it with infected material.

Certainly those things have to be considered, and particularly with respect to
biological warfare against human beings. But in the animal field it is pretty well
agreed that the sabotage factor is the one that we really have to be prepared for.

In trying to prepare ourselves for it we have endeavored to avoid dramatic
action, to avoid building up a lot of hysteria. We have tried to hit a mid-point
between hysteria and complacency so that the people who need to be informed
will be informed of the possibility and of what to do about it if it should occur.

Probably the first word of any attack will come from some farmer or rancher or
feeder or yard with animals ill of some unusual disease. The next point of contact
may be the practicing veterinarian. It may be that others in the area, the county
agent or someone else who is working with farmers, may learn of it first. Whoever
learns of it, the thing we want them to remember is to report immediately that
occurrence of an unusual disease to the state livestock sanitary official or to the
Bureau inspector in charge of field activities.

It is their problem to go into action with the first step, that is, to investigate and
determine the nature of the outbreak. They, being familiar with disease conditions
in the state, are able, as we have found out in many trial runs that we have held
on this procedure, to determine that it is or is not foot and mouth disease or rinder-
pest or whatever other disease might have been suspected.

In the event it is, however, they are the people who have the experience and the
know-how, and they have the legislative authority to deal with it. The state live-
stock sanitary official on a state basis and the federal official on an interstate basis,
the two of them working as a team, are required to do this job.

We feel pretty good about the progress that has been made. Almost all of the
states have alerted their people, and I believe the word has pretty well spread
around. Of course, we have 150 million people or more in this country, and that is
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a lot of people to be informed. I don’t know just how many farmers and ranchers there are. I suppose I should have known that number before I mentioned any figures, but they should all know this line of contact.

This is a case where we all have to work together. If we do work at it, and report it if it does occur, and diagnose it promptly, and work at it immediately following its diagnosis, we can feel at least some confidence about the threat of biological warfare; at least it need not be the devastating thing it would be if we did not have these tools in our hands.

Thank you.

CHAIRMAN CARR: Thank you, Dr. Clarkson.

As I said earlier, we are going to have each panel member give us a briefing before we start the questions and answers. It would be appropriate now for our President, Ferd Mollin, who has had a world of experience in this industry’s economics in relation to this disease in the United States, and who has visited foreign countries for the livestock industry, review foot and mouth disease for us from the industry point of view.

PRESIDENT MOLLIN: Mr. Chairman, before I say what little I have to say about foot and mouth disease, I want to tell you a story about Dick Boyle. He is a member of the Foot and Mouth Advisory Committee, as your Chairman has indicated.

About three of four years ago he was in Washington at a hearing before the House Committee on Agriculture in regard to foot and mouth disease programs in Mexico. A witness from the corn belt, who shall remain unnamed, was on the stand, and complained of the fact that the Advisory Committee was overweighted with western cattlemen, and that there wasn’t a hog man on the Committee.

It happened that at that time Mr. Boyle, in addition to being a member of the Advisory Committee, was also running the hog ranch that had the contract for the disposal of Los Angeles garbage on farms. We slipped up word to Congressman Bramlett of California that we would like to have Mr. Boyle called upon.

In a few minutes Congressman Hope, of Kansas, who was presiding, said he understood there was another gentleman who wanted to make a few remarks, and he called on Mr. Boyle. Mr. Boyle took the stand and, in referring to the statement of the previous witness that there was no hog man on the Committee, he said, “I have 55,000 hogs today. I don’t know whether that makes me a hog man, or not.”

We have a hog man on the Committee, believe me!

I would like to make just a few remarks about the importance of the livestock industry maintaining its contacts with senators and representatives and to be constantly on the alert against any attempt to break down our present safeguards against the introduction of foot and mouth disease.

Our present safeguard is Section 306-A of the Tariff Act of 1930, which makes it mandatory for the Secretary of Agriculture to notify the Secretary of the Treasury whenever foot and mouth disease exists in any foreign country. Until the Secretary of Agriculture again notifies the Secretary of the Treasury that the disease no longer exists, the Secretary of the Treasury cannot permit entry through customs of any of the products, the live animal or the dressed products, from that country which could bring in foot and mouth disease.
There have been many threats regarding trying to do away with that provision. There has even been an attempt to get around that provision, and I would like to mention that, too.

I have in my office in Denver a mimeographed statement put out by Secretary of State Hull, in which he stated officially that there never had been any foot and mouth disease in Patagonia, which is the southern part of Argentina. I went to work investigating around Washington, and I found in the library of the Department of Agriculture official bulletins issued by the government of Argentina which listed foot and mouth disease outbreaks as having recently occurred in two of the four major provinces of Argentina.

Shortly after that another statement was issued, saying that there had never been foot and mouth disease in the two southern provinces of Chubut and Santa Cruz, or in the island province, Tierra Del Fuego, across the straits from the mainland of Argentina. At that time, some of you will remember, the Secretary of Agriculture, Wallace, got the counsel for the Department of Agriculture to make the remarkable decision that the island of Tierra Del Fuego was not a part of the country of Argentina under the language of Section 306-A, which referred to any country that had foot and mouth disease.

Dr. S. O. Fladness, who is at this convention, went there to investigate; while his report was never made public, in the meantime there was so much pressure applied to the Department of Agriculture that they got cold feet about going ahead with this subterfuge to evade Section 306-A, and after they had actually promised to accept meat under those conditions, and a boatload was made ready for that purpose, they backed out of their first decision, kept the meat out, and eventually had a lawsuit on their hands.

In the records of that lawsuit, which I read just the other day, for the first time I found the official language quoted of what Dr. Fladness said as to the conditions he found down there.

We have to keep our own officials, our congressmen and the officials in the Department of Agriculture and in the Department of State, convinced that we must keep foot and mouth disease out of this country. I don’t know whether any officials of the Department of Agriculture would agree with me, but I have a firm conviction that if the semi-annual agricultural conference, which was held in Los Angeles on July 25, 1946, two months or so before the outbreak of foot and mouth disease in Mexico, had stood pat, there never would have been any foot and mouth disease in Mexico.

The animals that brought it there were at that time on the island, in the harbor of Vera Cruz, and the owners of those animals were about whipped and about ready to take them back to Brazil when our representative, the head man of our delegation at that conference, insisted upon sending men down to Mexico to see if they could find foot and mouth disease and to inspect those cattle.

I don’t think I am betraying any secrets when I say that Dr. B. T. Simms and other officials of the Bureau of Animal Industry had repeatedly told us that they would not inspect the cattle in Mexico for the purpose of such determination, but under orders they sent two men down there, one of them who is at this meeting. They could find no trace of foot and mouth disease.
The bulls were allotted for unloading on the mainland. The inspection was made on September 28, 1946, and the bulls were unloaded on the mainland about October 8—and the disease was found and brought to light on October 18.

Let's give our Bureau officials the support they need to keep from having instructions from higher up nullify their efforts to control these dangerous diseases. Thank you.

CHAIRMAN CARR: We will ask Dr. Maurice Shahan now to speak to us.

DR. MAURICE SHAHAN: Thank you, Dr. Carr. I am sure you did not mean to imply, when you announced me a while ago, that the Bureau now has a foot and mouth disease laboratory in the United States. We do not have and have not been able to obtain appropriated funds for such construction.

On a subject such as this I believe it is well worth while to indulge in a little retrospection, introspection and foresight. In other words, it is well to look briefly at the past, the present, and the prospective future in connection with this disease.

We may recall that in the United States prior to 1900 we had repeated outbreaks of foot and mouth disease, largely attributed to the importation of live animals from infected countries. Such importations have long since been eliminated, of course. The outbreaks prior to 1900 were in fact eliminated by quarantine and restriction of movement of animals, people, and possibly infected or infective materials.

The situation then was considerably different from that of today. The movement of animals and people and agricultural products was rarely restricted, and not at all as widespread and as rapid as it is today.

Since 1900 we have also had several outbreaks of the disease attributable to other sources than importation of live animals. These have all been eradicated by the time-tried and proved (although admittedly radical) method of stamping out the disease through eradication, disinfection and quarantine.

In some of these earlier outbreaks eradication was relatively easy. In 1914–1915, it is well to recall—and all of us as livestock sanitarians well remember—there was a delay of several weeks in the recognition of foot and mouth disease, in consequence of which the disease eventually spread to twenty-two states and the District of Columbia. With more alertness at that time the disease undoubtedly would have caused less damage.

As was the case in 1929 when, largely through the alertness of the personnel of the Los Angeles Livestock County Inspector's office, the disease was determined early, prompt action was taken and the disease was eradicated in very short order.

Beginning with the early discovery that foot and mouth disease was indeed a vicious infection—in fact, it was the first animal disease so attributed—in the late '20s it was discovered through cooperative work in France, in Germany, and on the part of the Bureau's Commission for Research assigned to Europe at that time, that there were multiple types of foot and mouth disease virus, in effect making not simply a one-disease problem but three disease problems, neither type immunizing against the other.

A further complication arose shortly toward the end of the 1914–1915 campaign, when we began to have what is probably considered now to have been vesicular stomatitis. Very soon thereafter it was determined that this disease also had two immunological types. In 1932 in the State of California another disease, clinically
indistinguishable from foot and mouth disease, was discovered. Eventually this was determined to be due to an entirely distinct virus from that of vesicular stomatitis or that of foot and mouth disease. It was called vesicular exanthema. Eventually four types of this virus were described.

In 1938, through the efforts of Schmidt in Denmark and Vollman in Germany, came the development of the presently known Schmidt-Vollman vaccine, chemically inactivated, aluminum-adsorbed virus. This has been widely used in Europe and in South America, with very evident benefit in many cases.

The vesicular stomatitis and the vesicular exanthema that we have just mentioned have been tremendously complicating factors in diagnosis in the United States. At least vesicular stomatitis has been a major problem in Mexico. They are still troublesome factors in differential diagnosis. From an eradication or control standpoint we cannot look at any animal and say it has mycotic stomatitis, vesicular stomatitis or vesicular exanthema. That diagnosis demands a confirmatory examination.

There are several factors other than vaccine to be considered in the apparent success we are looking forward to in Mexico. We had the good fortune to have the good will of the government. We had strong support of the United States livestock industry and of the Congress. We had the northern Mexican cattlemen who were vitally interested in eradication and not any compromise with the disease.

In addition to these advantages we had the interest and cooperation of experienced European research workers. We also had experienced American personnel to throw into the breach when it became necessary to produce and test vaccine and examine specimens in the laboratory. We were fortunate in that through the original work done at the Research Institute at Ferbright, England, we were able to select a strain of virus for the production of vaccine which was comprehensive and which covered some of the other viruses which later developed. We had a source of 100 per cent susceptible cattle with which to work in the production testing of the product.

The promise of the present situation in Mexico has been misleading to many people, who have concluded that vaccine is the only hope of success in case the disease should occur in the United States. Some people have concluded that the vaccine is the modern solution to the problem.

The facts do not support that statement. Our best counselors throughout the world have supported the Bureau and the state livestock sanitarians' position in this country, that we should do everything possible to keep the disease out, and that if it should become widespread we should make every effort to eradicate it at the earliest possible moment.

The vaccine itself must be type and variant specific, at least type specific and variant specific in many instances. In addition to the three previously known types of virus, an additional three have recently been identified by workers at Ferbright, England. Because of the necessity for periodic checking in the field, preparation of vaccine with those currently prevalent strains of virus, the stockpiling of vaccine is an impractical and uneconomical proposition. It has been found so repeatedly in South America and also in Europe.
I don't believe I will extend my remarks further. Some of you may have questions to ask.

CHAIRMAN CARR: Thank you, Dr. Shahan. You are going to come in for a hot time in just a minute. I have some questions to ask you, myself.

Now we will call on Mr. Boyle for a few remarks, and then we will open the discussion to questions from the floor.

MR. R. E. BOYLE: I don't think the people of the United States appreciate the danger to the economy of the country if foot and mouth disease should occur here. I do not think we sell the industrial people and the women in the communities and the labor unions on how a break in any state would affect the economy.

In 1924 in our part of the state nothing was shipped out for months. I think it is our duty as individuals to spread this information concerning the danger of this disease to the United States.

They have done a wonderful job in Mexico, and we will do it again in the United States, provided we don't get a two-legged animal running around with it.

Thank you.

CHAIRMAN CARR: Thank you, Mr. Boyle.

We reviewed the industry concerning one question that seems to be popping up, and we thought that in order to save time we would ask it ourselves. I don't care which one of the panel wants to try to answer this, or whether anyone wants to answer it from the floor. Anyway you answer it is okay with us.

The first question is this: When will the Mexican border be opened?

DR. NOYES: Gentlemen, the border will be opened with the Secretary of Agriculture of the United States says it will be opened. He is the only man who can say so.

CHAIRMAN CARR: I am sure that clears it up. It is going to depend upon when you clean it up in Mexico, Jack.

I have a question I would like to ask before we get too far along. We find now that Colombia, South America, is infected, and that makes the whole southern part of South America unanimous.

I wonder if someone on the panel would bring us up-to-date on the situation in Venezuela and Colombia. We are quite interested in that problem because it gives us something to worry about concerning the matter of port inspection and the matter of the control of commodities in export trade that are moving up and down the coast. That is getting awfully close to the Panama Canal zone.

Does anyone here want to answer that?

DR. SHAHAN: I believe we can say in a very few words just what the situation is in Colombia and Venezuela.

The originally discovered O type virus has spread virtually throughout both countries. In addition, an A type virus has been identified in Venezuela and may reasonably be expected to invade Colombia.

Virtually nothing has been accomplished in the way of control or eradication, according to our information.

CHAIRMAN CARR: Here is another question: "We understand there is a large amount of meat being imported from Mexico, while the foot and mouth embargo is in effect."
Do you want to try to answer that, Dr. Clarkson?

DR. CLARKSON: I ought to pass this question along to Dr. Fladness, but I will try to answer it.

There is a substantial amount of meat coming in from Mexico. It complies with regulations of long standing. It is cured meat, and comes in under strict surveillance. In fact, during the past year additional safeguards have been placed on the entrance of that meat, to the effect that it must go to a federally inspected meat processing establishment, there to be processed under official supervision.

Regulations for many years have permitted cured meat to come in from countries where the disease exists, under certain precautions. The meat must have been held in a fresh, unfrozen state for a number of days. It must then be thoroughly cured. The bone must then have been removed in the country of origin. That has always been given the most careful supervision, and, as I mentioned a moment ago, during the past year additional safeguard has been applied, in that it must be processed under supervision. It is held under supervision from the port of entry until that processing is completed.

PRESIDENT MOLLIN: There has been a big increase also in that type of meat from Argentina. It is the same kind of meat.

CHAIRMAN CARR: Now, gentlemen, we are ready for questions from the floor. I hope you will direct them to a specific member of the panel.

VOICE: I might ask the first question. I would like to know whether or not there is a continued effort to secure funds for the construction of the foot and mouth disease laboratory; if so, is it still mandatory that it be constructed on an isolated island?

Probably Dr. Shahan could answer that.

DR. SHAHAN: As I understand the question, is the Department continuing its efforts to obtain funds for the construction of a laboratory? Secondly, is it still mandatory that such a laboratory be constructed on an island?

Answering the second part of the question first, it still would be mandatory for such a laboratory to be established on an island separated from the mainland by deep navigable water and not connected to the mainland by a tunnel, according to the terms of Public Law 496 approved in April of 1948.

The Congress has in effect three times decided not to appropriate money in accordance with the plans and specifications prepared by the Bureau of Animal Industry. As far as I know, there is no intention at this time of attempting to revive the issue.

VOICE: I would like to ask Dr. Shahan if, in the experience in Mexico to date, they have ever identified foot and mouth disease in the deer or wild pigs. Has there been any report on that?

DR. SHAHAN: I believe Dr. Noyes should answer that question, Mr. Chairman.

DR. NOYES: In 1946-1947 we had some men from the Wildlife Service of the United States trapping, shooting, examining and watching in their natural habitats all the wild life in Mexico, and we were not able to find any disease in them at that time.

Since the new outbreak of August 6 we sent back some of the same men for the
same purpose, and although we shot some deer and even trapped a lot of rodents that were around the break, and took them to the laboratory for examination, still we were not able to find any virus in any of those animals.

VOICE: This is more or less a practical question which would come up during any foot and mouth disease outbreak. It has been asked me by stockmen on many occasions, and it is a question they would like to have answered:

What steps would be taken if foot and mouth disease were to appear right in the middle of Iowa today, to prevent its further spread, with particular reference to the movement of cattle to markets or about the State?

DR. CLARKSON: First, we have to remember that this is a federal-state or state-federal activity. It depends upon the coordinated activity of both the state and federal officers.

In the event of such an outbreak, from the federal side the Secretary of Agriculture would announce the outbreak of foot and mouth disease in Iowa, and would place in effect interstate quarantines to isolate the state in which the outbreak occurs, or that portion of the state that is affected.

The State of Iowa would need to place into effect necessary quarantines to isolate the area within the State of Iowa. The State of Iowa also would need to invoke the necessary authority to deal with the outbreak and to eradicate it.

On the federal side, the Secretary's proclamation would permit the Chief of the Bureau of Animal Industry to cooperate with the state officials in the eradication effort, to put in men and materials, and it would release funds available to the Secretary from any source whatever for that endeavor, the thought being that there would be a cooperative effort for the immediate and total eradication of the disease.

I believe it certainly is the thought of those in Washington—and I think it is shared by the livestock sanitary officials of the states and by the livestock people—that the method that should be used would be the slaughter method to eradicate it quickly, promptly, economically, and as soon as possible to turn that area of the country back into normal commerce.

Certainly there would be an effort made to restrict the area to as small a one as possible, so as to interfere as little as possible with the commerce of unaffected areas.

CHAIRMAN CARR: Dr. Clarkson, would that same procedure apply if we were unfortunate enough to be infected through the medium of bacteriological warfare?

DR. CLARKSON: I think we certainly would be faced with this situation if we had an outbreak and no one knew whether it had come in accidentally or by planned introduction. There might be certain factors that would lead to an opinion one way or another, but while we are standing around debating as to whether it came in one way or another way, I would hope that the two agencies would proceed immediately to eradicate the outbreak and find out afterwards how it got there.

CHAIRMAN CARR: Concerning this same question about bacteriological warfare, Dr. Clarkson, what diseases other than foot and mouth disease should the regulatory official and the livestock owner and everyone else be alerted to?

DR. CLARKSON: We place foot and mouth disease and rinderpest at the top of the list. They are both highly destructive diseases; they are both virus-caused dis-
eases; they spread very rapidly, and they lend themselves to starting by an enemy agent in a small area, and then they spread of their own volition and power from that small beginning.

However, we have the two poultry diseases that I mentioned a while ago, Asiatic strains of Newcastle disease and European fowl plague. Both of these also are highly destructive and highly invasive virus diseases.

We think also that we must look to the regular protection of the herds and flocks, protecting them from the diseases that are common to the United States.

Hog cholera, anthrax—the long list of them we know about. Those diseases that are most highly destructive and that will spread of their own volition, we think, are the most likely ones that we may have to deal with. We don't want to close our minds to any of them, because we may be caught with the one that we haven't planned for.

CHAIRMAN CARR: Let's have some more questions from the floor, please.

VOICE: I would like to ask Dr. Clarkson if he feels that the livestock industry is adequately protected without the aid of the food and mouth laboratories.

DR. CLARKSON: Of course, we would feel a great deal better if we had a laboratory where these dangerous foreign diseases could be studied. Also, such a laboratory might be of help in identifying the type of disease, if it were foot and mouth disease, for example, or six different types; and it might be useful in identifying those types. Certainly it would be useful.

In diagnosis of other diseases that we might be faced with, such a laboratory would be useful. We also have to consider, in terms of biological warfare, the extreme possibility that we may not be able to handle an outbreak by drastic eradication measures. Certainly, if that time should ever come (and we hope it will not), a laboratory in being would be most useful.

JUDGE MONTAGUE: I would like to ask Dr. Noyes a question: In the event of an outbreak of foot and mouth disease in this country, with no further scientific development of vaccine than we have today, would you under any circumstances then recommend the use of vaccine to combat the outbreak at that time?

DR. NOYES: From our experience in Mexico I would most assuredly not use any vaccine in the United States. The slaughter method is the cheapest, the fastest and the safest method. When you complete it you know you have eradicated the disease.

We found out in Mexico that when the disease and the virulency of the virus stepped up, it broke our vaccinated animals as fast as it did our unvaccinated animals.

VOICE: In the event of an outbreak of foot and mouth disease, is there any provision made by the federal government to pay the owner for the cattle slaughtered?

DR. CLARKSON: Yes, there are provisions for the payment of a fair indemnity for animals or materials that are destroyed in the eradication effort. Money is provided, as was mentioned a while ago, from funds available to the Secretary of Agriculture upon the issuance of his emergency proclamation. Those funds are to be matched by state funds. In most states there is provision for the immediate availability of at least a beginning amount of money to give operating time until the state legislature can meet and deal further with that problem.
Always in the past those indemnities have been paid upon fair appraisal, and it is the intention to do exactly the same in any future outbreak.

Voice: As a pathologist, how would you differentiate foot and mouth disease from vesicular stomatitis and vesicular exanthema?

Dr. Shahan: I believe your question concerns screening and separation of vesicular stomatitis, exanthema, and foot and mouth disease.

The system is established whereby especially trained field diagnosticians are called by the state official or the Bureau inspector in charge, to the affected premises, where animal inoculations are to be conducted. The inoculation of different species by different routes is done. Through such means a very substantial preliminary examination can be made by differentiation.

I should stress that any such occurrence should be reported immediately to either the state livestock sanitary official or the bureau inspector in charge, and at that time these special field diagnosticians are available and will report immediately upon call. That is the first and only step that we, as practitioners or as state workers or as Bureau workers, are obliged to take.

There are, of course, confirmatory laboratory procedures, such as serum neutralization tests, complement fixation tests, serum protection tests, and so on. Without a laboratory for confinement of dangerous or particularly suspicious material is is pretty hard to visualize the practical application of such tests except in the event of a widespread outbreak.

Voice: The point is that when we have a large number of vesicular stomatitis cases, if we can possibly report those to an official who would make an actual diagnosis, it would keep one man pretty busy.

Dr. Shahan: It certainly would, and that is what we intend should be done.

Chairman Carr: If it isn't done you might as well forget about foot and mouth disease eradication, and expect to get the disease almost any day. The only way to protect the livestock industry is by reporting these vesicular diseases made by differential diagnosis.

Just as a point of information: California, of course, is unusual, and it has everything. We admit that. Nevertheless, we do have vesicular exanthema in hogs. It cannot be distinguished from foot and mouth disease by visual observation. It is necessary for us to maintain calves on every garbage feeding hog ranch in the State of California in order to make differential diagnoses on the premises, and that disease is with us continuously.

In addition to that we have to employ a great force of men to control the shipment of hogs off these ranches, not permitting them to be moved without inspection.

Beside that, it has forced us to pass some very stringent garbage laws covering the handling of garbage by ships up and down the coast.

If on top of this mess you get an outbreak of vesicular stomatitis, gentlemen, and if we have to make a differential diagnosis even on vesicular exanthema, and then if by accident we should have infection, intentionally or otherwise, of foot and mouth disease, the disease would be all over the State of California before you could get your hat off, because those hogs would be in commerce and through the packing-house and would be shipped all over the country—and they would be “hot” with the virus, too.
Voice: Mr. Chairman, this is in connection with a very good idea concerning public relations: Approximately how much does it cost the United States in this fight in Old Mexico against foot and mouth disease? That information should be made public in order to sell a bill of goods on public relations and the need for keeping foot and mouth disease out of this country.

Dr. Noyes: We have spent about 120 million dollars in Mexico. Of that amount we have spent about 70 million dollars south of our quarantine line in Mexico. The rest of it was spent in northern Mexico.

Gentlemen: I would like to make this statement: If you will give a report of vesicular disease to some livestock official it will cause a tremendous amount of work. In the next thirty to sixty days we will receive from ten to twenty samples a day of vesicular conditions, and we consider every herd reported as foot and mouth until we have made a thorough investigation, and that means the samples will be run serologically and biologically both; otherwise we might just as well leave Mexico at the present time because stomatitis is so widespread there. If we didn’t take those precautions it could gain a foothold and would be all over Mexico before we woke up the next morning.

If you would keep it out of the United States, and if something that resembles a vesicular disease is noticed, report it to your nearest livestock official immediately so that it can be controlled and eradicated without delay, before it becomes widespread (if it does turn out to be foot and mouth disease), because you could not eradicate it. It would be economically unsound to try to do so.

Voice: Mr. Chairman, this is directed to Dr. Shahan:

About two years ago you sent a number of your field men to Beltsville, I understand, for special training in differential diagnosis. In the northwest we have only one man covering quite a number of states. Would it be possible to have one or two state men from some of the states take the same training, or more federal men?

Dr. Shahan: There have been conducted thus far two such courses, in 1948 and in 1950. It is contemplated that an additional course of instruction will be put on some time early next year.

We recognize and believe, of course, that we should have as many diagnosticians as possible. The facilities have not been too ample. The expense of such a course of training is considerable; but we do plan to have another course of training for another class of trainees in the coming Spring.

Chairman Carr: We regulatory officials keep talking about the livestock industry reporting these vesicular diseases which we can’t differentiate ourselves. I would like to ask if there could be some way found so that the government or the states or the industry could see that some very fine colored pictures could be made, for distribution, in order that the livestock men and a lot of us veterinarians could see what these diseases look like, and recognize them if we see them.

Dr. Shahan: We do have in the Bureau a film entitled “Outbreak”, a chronological film on foot and mouth disease. We have some such material in that film. There is a special film, “Vesicular Diseases of Animals”, which was prepared some years ago by the Bureau of Animal Industry particularly for distribution to professional groups. It shows the lesions of these three diseases, vesicular stomatitis
FOOT AND MOUTH DISEASE

vesicular exanthema, and foot and mouth. It also covers in a brief way the differential techniques through animal inoculation.

In addition, the California Department of Agriculture has an excellent film on vesicular exanthema, and their differential diagnostic procedures.

At the present time we are getting together some film material for preparation of a film strip that also will be of value in that connection.

As far as the farmer is concerned in recognizing the disease, of course, in any of these things he is immediately concerned because of loss in production of milk, if it occurs in dairy cattle. There is a very definite and evident lameness and a very evident salivation and stomatitis. If the farmer can be educated, and if we as veterinarians, in our contacts with farm and ranch people, can indoctrinate them with the principle of immediately calling their veterinarian for that first contact, certainly if they contact the state office every time they have a sick animal it will make an unholy mess; but if their first contact is with their practicing veterinarian, and if the livestock owner and the practicing veterinarian are up to their own responsibilities, this thing can and should function.

CHAIRMAN CARR: There is one other question that has been asked, and I shall address it to Dr. Noyes:

As I understand it, there was an outbreak of O type virus in Mexico, the only outbreak of its kind encountered in Mexico. I would like to have him tell us about it.

Dr. NOYES: I wish I could tell you about it, gentlemen. The only thing I know about it is that we had an outbreak of O. We sent samples to England, and they confirmed it. They said it was one of the most virulent types of O that they had dealt with in Europe. It was one of the hottest outbreaks we had in all Mexico. It occurred at Hacienda, about fifteen miles on the Pueblo highway outside of Mexico City. We never permitted it to get away from that spot. We probably had 160 inspection teams around it within six hours after we found it. Somebody had to bring it in, but where it came from we don't know. We carried on an investigation for approximately six months trying to find out how it got there, but we never were able to find out.

CHAIRMAN CARR: Our time is running short, and we are just getting warmed up to this subject, but now it is time to stop. It is very important that the Chairman of the Foot and Mouth Disease Committee read his report.

I want to thank the panel for being with us today and for giving us all of this information. I am sure all of us appreciated it. It is too bad we could not have had another hour for discussion, because it takes time to warm up to one of these deals. Thank you, gentlemen.

Now may I read the report of the Committee on Foot and Mouth Disease.

[Dr. Carr read the report.]

[President Mollin resumed the Chair.]

PRESIDENT MOLLIN: This report will be referred to the Executive Committee. Thank you very much, Dr. Carr.

I would like to make just one comment in connection with the discussion we had a moment ago. I was surprised that the first question didn't go a little bit further. It inferred the problem of whether or not the laboratory, if erected, would be located on an island or somewhere else.
Various congressmen have proposed locating such a plant in some abandoned fort in the United States. While I believe most of you scientists probably would argue that it could be located at any point with safety, just as is the Ferbright plant in England, at the same time it is my feeling, from spending a good deal of time working in Washington with members of Congress, that we have pretty well sold the Congress of the United States on the fact that foot and mouth disease is very dangerous, and I think it would be a mistake now to try to persuade them that it would be safe to locate such a plant within the confines of the United States. Whether it would be safe or not, I don't think we should make such an effort.

The discussion was very helpful. There is nothing more interesting at our conventions than a discussion panel that really works, and there is nothing more deadly than one that doesn't.
REPORT OF THE COMMITTEE ON FOOT AND MOUTH DISEASE

A. K. Carr, Sacramento, California, Chairman; R. E. Boyle, Fontana, California; Emler Brock, Kayce, Wyoming; M. R. Clarkson, Washington, D. C.; D. A. Davidson, Fort Worth, Texas; R. J. Hight, Phoenix, Arizona; Albert K. Mitchell, Albert, New Mexico; F. L. Schneider, Albuquerque, New Mexico; H. F. Wilkins, Helena, Montana

The areas throughout the world infected with foot and mouth disease have not changed materially from those reported by your committee last year. The infection reported in Venezuela last year has now invaded Colombia and foot and mouth disease is widespread in both countries. Also, within recent weeks the disease has attained epizootic proportions in several of the western European countries. The principal regions which continue to report freedom from foot and mouth disease are the United States and Territories, Canada, Australia, New Zealand, Greenland, Iceland, Norway, Ireland, North Ireland, Channel Islands, Central America, Islands of the Caribbean and the West Indies.

The Mexican foot and mouth disease situation is not featured in this report since it is covered by Dr. L. R. Noyes, Co-Director United States-Mexico Foot-and-Mouth Disease Commission, in his paper presented at this meeting.

Three new immunologic types of the virus have been established by Galloway, Brooksby and Henderson, of the Research Institute, Pirbright, Surrey, England, as reported in May, 1950, to the joint meeting of the International Office of Epizootics and the Food and Agricultural Organization of the United Nations in Paris. These exhaustive studies, yet to be reported in detail, further complicate the already complex problem of foot and mouth disease and its control. These are types in addition to those previously recognized, namely, O, A, and C. Among the formerly accepted types, variants of great immunologic significance have been found. The necessity of taking all these types and variants into consideration in vaccine production and the use of the proper product in the field have caused major difficulties and consequent relative ineffectiveness of vaccination in both western Europe and South America. The newly recognized complicating aspects of the problem have increased the question of the practicability of vaccination except under certain circumstances. With present knowledge it is difficult to conceive of circumstances favorable for successful use of vaccine in this country.

Biological warfare is a matter of national concern and presents the possibility of intentional introduction of foot and mouth disease, as well as other dangerous diseases, in addition to the threat of foot and mouth disease from accidental introduction. Those concerned with Civil Defense planning have sought to harness the well organized team work of state and federal disease control officials in a way that would make introduction of a foreign disease difficult, and ensure that a disease would be promptly and effectively dealt with if it should escape the watchfulness at the ports.

The plans of state and federal officials have, as always, laid the greatest emphasis on the necessity of prompt discovery of any outbreak of disease, stressing the im-
importance of transmitting information about the occurrence immediately to the state livestock sanitary official or the federal Bureau inspector in charge of field activities. When a suspected condition is reported, established procedures are used to send trained diagnosticians to the ranch or farm to identify the disease. In event the condition is found to be foot and mouth disease or one of the other dangerous foreign animal plagues, the plans call for immediate slaughter and burial of infected and exposed animals followed by thorough clean-up and disinfection of premises and the use of test animals—all, of course, under conditions of strict quarantine. This method is the only effective way of eradicating the outbreak without the long delays under quarantine and the great uncertainties accompanying attempt to fight the disease with other methods. Only in event of the most widespread outbreak of the disease—such as occurred in Mexico, making outright slaughter impossible—preventive vaccine would be used as an aid to the control and eradication effort. The existence of at least six immunologically distinct types of foot and mouth disease virus, the variability and uncertainty of results obtained from vaccination, and the readily demonstrated fact that the vaccine will not assure protection against heavy exposure to the disease make it unwise to rely upon vaccination as a part of the eradication program except when the disease has gotten so far out of hand that prompt and economical eradication measures are impossible.

The border patrol has developed into a most efficient and effective policing organization. Close coordination has been attained between the border patrol and other state and federal border agencies and livestock interests. This patrol is intercepting animals and materials prohibited entry from Mexico. The fact remains that considerable expanses on the border are inadequately fenced or without fencing and it is in these areas that estrays from Mexico are most frequently apprehended and destroyed. It is expected that an adequate patrol will be maintained as long as the disease exists in Mexico.

We must all realize that the welfare of our agricultural economy is dependent to a very large extent upon safeguarding the health of our livestock. The Committee, therefore, feels impelled to urge that the foot and mouth disease program in Mexico be continued without abatement for whatever length of time may be necessary to give definite assurance that the disease has been eradicated. We must also recognize the continuing dire need for proper facilities in the United States for scientific investigation of foot and mouth disease and other virus diseases. This country should never be dependent upon diagnostic and research facilities located in foreign countries, especially in view of the present world situation. In addition, it is also necessary that we give proper consideration to construction of additional border fencing, alertness to the possible introduction of exotic diseases of livestock and poultry, and the maintenance of adequate enforcement of import laws and regulations at ports of entry.
REPORT OF COMMITTEE ON LAWS AND REGULATIONS

E. P. ANDERSON, Lincoln, Nebraska, Chairman; J. F. CAVANAUGH, Columbus, Ohio; LEE DAVISSON, Lansing, Michigan; H. U. GARRETT, Des Moines, Iowa; T. C. GREEN, Charleston, West Virginia; HORACE HENING, Albuquerque, New Mexico; G. A. KAY, Fort Worth, Texas; J. V. KNAPP, Tallahassee, Florida; F. E. MESSERSMITH, Alliance, Nebraska; ROY THOMPSON, Springfield, Illinois; H. F. WILKINS, Helena, Montana; R. R. YOUNCE, Salem, Oregon

It is recommended by the Committee on Laws and Regulations that Circular 1 (revised) be published at as early a date as possible and republished every two years thereafter.

That the compilation of maximum requirements as adopted by this Association in Phoenix, Arizona in 1950, subject to such revisions as are essential to meet current state requirements be published in the forepart of the Circular and be followed by the downward deviations as presented to the Secretary of the Association. Such downward deviations to be printed alphabetically under roster of states.

It is further recommended that future committees on Laws and Regulations prepare and present annually for the consideration of this Association a uniform interstate regulation covering one or more species of animals, including poultry.
THE IMPORTANCE TO THE PUBLIC OF INSPECTION OF POULTRY AND POULTRY PRODUCTS

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It is occasionally claimed that there is relatively little danger in consuming food products originating from diseased poultry. One could, as a matter of fact, argue that there is relatively little danger in eating any food of animal origin, if properly prepared; but who wants food coming from diseased animals or birds? The thought of eating diseased animal products is repugnant to most people, though they may know that there is little or no immediate danger in so doing. Esthetic aspects of foods and the serving of foods receive much attention in civilized society.

By wholesome foods, we mean those which are free from disease-producing organisms, toxins of food poisoning organisms, by-products of pathological processes or decomposition and unnecessary chemical and other harmful agents. Obviously a wholesome food must also possess adequate nutritive value. A food may be safe in that it contains nothing that is immediately dangerous, but may still be lacking in wholesomeness and may be harmful when consumed more or less regularly over a prolonged period. We have, as yet, no adequate means of determining what may be cryptic effects of by-products of processes brought about by pathological conditions or decomposition. Therefore, to be on the safe side, it seems wise to insist that poultry food products must be as free as possible from any harmful or potentially harmful agent. This means, of course, that such products must come from healthy birds.

Some diseases of poultry, such as swine erysipelas, Newcastle disease, ornithosis, pullorum disease and many other Salmonella infections are definitely communicable to man. Others, among them tuberculosis, leucosis, blackhead and staphylococcic infections and several others, which, while not proved to be communicable to man, justify condemnation of carcasses afflicted by them, if the lesions are at all extensive, at least on the assumption that the by-products of the pathological process concerned render the meat unwholesome.

INSPECTION, A MUST

Proper inspection of poultry and poultry products is valuable not only as a means of health protection, but, if the data concerning diseases, available, in packing plants and dressing stations, were collected, correlated, interpreted and evaluated, and passed on to poultry improvement associations, livestock officials, veterinary colleges and practicing veterinarians, they could be of material aid to the promotion of disease prevention on the poultry farm, a matter of great economic importance.

Those of you who are in my age class, and perhaps some of you younger people, may remember the days when we ordered eggs in restaurants with a silent prayer that the odor and taste of the said article of food might be endurable, that no blood spot might be present, and that, if the eggs had been kept under temperatures
sufficiently high for embryonation, the embryo might not have reached recognizable size. To hope for eggs with clean shells was a sign of simple-mindedness, so we nearly always asked for fried or scrambled eggs. When boiled eggs were ordered, it was very wise to ask that they be broken into a dish before we could get a look at them. Sometimes we ate the eggs, often we did not. A sniff or a taste was too frequently enough to ruin our appetite for eggs until our memory of the occasion grew somewhat dim. Is there any wonder that the per capita consumption of eggs was very low in those days?

Thanks to the educational efforts of extension men, federal, state and commercial, those days are over. I think you will agree with me that we can now order eggs in any respectable food establishment and be sure of at least a reasonably good product. This is due to a realization of the value of inspection and proper handling of eggs. The result is that the per capita consumption of eggs has gone up tremendously with mutual benefit to producers, merchants and consumers.

The value of inspection and proper handling and processing of carcasses and meat products has not been so fully realized. Only 22 per cent of poultry dressed in 1950 was subjected to any kind of inspection with the result that we still have some sad experiences when ordering chicken or turkey dinners. In a hotel, famous for its spring chicken dinners, I once got a half of one with a large, foul smelling abscess under the thigh. Suffice to say that I ate no spring chicken that night nor for some time thereafter. Recently I was served a luscious looking broiler at a banquet. After a few bites I got a mouthful of some vile tasting stuff that would have turned the stomach of a less seasoned individual. What it was, I do not know. For the sake of others at the table, I refrained from making an on-the-spot investigation. By proper inspection, such dark spots on otherwise very pleasant occasions could easily be avoided, to say nothing of the elimination of potential health hazards. Needless to say, such experiences do not increase consumer demand as far as poultry is concerned.

The food inspection service of the Bureau of Animal Industry enjoys an excellent nation-wide, indeed, world-wide reputation. Its seal of approval has earned the respect and confidence of consumers everywhere because of the uniform wholesomeness and general high quality of the foods produced under its impartial, watchful supervision.

An amusing example of the respect which may be developed for the stamp of approval of an organization with a good reputation was encountered in Chungking. I was invited to visit the slaughter house of the United States Army. On observing the numerous carcasses bearing the stamp Inspected and Condemned, U. S. Army, or a similar legend, I asked, “What is done with them?” My guide answered, “The local merchants take them and sell them at a premium because they bear the stamp of the United States Army.”

WHY THIS REHASH?

Most of this is old stuff and I am sure that you know it. I should apologize for taking your time in reading this paper had it not been for the fact that an agency of the United States Department of Agriculture, the Production and Marketing Administration, continued to grade-label individual birds that have not been in-
spected. The reasoning behind such a practice is as difficult to understand as the mental operations of Communist propagandists.

Grading of food products is intended, first of all, to serve the best interest of the consumer and, in turn, to benefit the producer and the distributor by the creation of confidence in the quality of standardized products and consequent greater consumer demand.

Under the present system of grading, the birds are separated solely on the basis of flesh, fat and finish. Thus, without inspection, ante-mortem or at the time of evisceration, there is no way of determining the state of health of the poultry involved. Therefore, Grade A poultry products can come from diseased birds. This is indeed, to put it mildly, a misleading practice and very confusing to consumers. Such a system is harmful to producers and distributors, because consumers will, most certainly, react unfavorably toward the use of poultry food products when they realize that such articles, no matter which grade, may have come from diseased birds. Nothing, it seems to me, could do more to decrease the demand for poultry and poultry products on the part of consumers and thus, in one stroke, undo the excellent work of extension specialists, federal, state and industrial, which has been carried on for years and has resulted in the building up of our poultry industry until it now ranks among the first of all our agricultural industries in economic importance. Furthermore, the faith of the consumer in the stamp of approval of a government agency will be badly shaken. The present United States Department of Agriculture Grade shield, as used on other food products, bears the legend: "U. S. Grade A packed under continuous inspection." The consumers thus continue under the illusion of protection of inspection when they see the words: "U. S. Grade A" on uninspected, uneviscerated birds.

In my opinion, the only stamp or seal on such a poultry product, that would be an honest and reliable indication of its quality with respect to sanitation and wholesomeness, should bear the following or a similar legend: "Graded, on the basis of flesh, fat and finish but not inspected for disease. Buy and consume at your own risk."

I would suggest that, for the sake of the integrity and reputation of its labeling, the United States Department of Agriculture should discontinue the grade-labeling of any individual bird unless it has been inspected for wholesomeness.

EFFECTIVE INSPECTION

For the best results, the inspection of poultry and poultry products should be under the Bureau of Animal Industry which, because of long experience and know-how, is in a position to do this work most effectively and economically. The present state of confusion, resulting from several agencies attempting to do the same job, is ineffective and wasteful in many respects. Further, the attempt to justify an enlarged program of sanitation, administered by personnel not qualified as sanitarians by modern educational standards, is unfortunate but, nevertheless, now in operation under the Production and Marketing Administration.

Marketing of dressed poultry with the viscera in place (commonly referred to as New York dressed) should not be allowed for reasons so obvious that they deserve no mention at a meeting of this kind. The discontinuation of this undesirable practice cannot be accomplished at once, but the arrival of the day when this
goal will be reached can be hastened by not allowing the "U. S. D. A. Grade A Shield" to be placed on individual birds that have not been inspected. There is no real justification for continuing such a potentially deceptive practice. The time is long overdue when the consumer should realize the utter stupidity of buying a lot of more or less offensive waste materials along with a food product. No other foods are bought under like circumstances. It is, indeed, strange how tradition can blot out our good judgment on certain issues. Certainly, there is no valid reason why poultry should be marketed under less stringent regulations than those covering other food products.

Follow-up inspection should be made of poultry products that are subject to contamination or deterioration during handling, shipment and storage. In 1950, 28 per cent of the reported cases of food poisoning originated from poultry. This type of disease cannot be prevented entirely by inspection and condemnation antemortem and at the time of evisceration because the responsible microbes may sometimes be present without having produced perceptible lesions. Also, in many cases the food poisoning organisms are conveyed to food products by food handlers who carry such bacteria. Hence, there is an urgent need for education of food-handlers regarding the nature and prevention of food poisoning.

QUALIFICATIONS OF INSPECTORS

Lay inspectors may have to be employed because of the shortage of veterinary inspectors. However, in order to be effective they must be well trained, paid accordingly and not subject to any sort of company domination. Their employment may result in greater economy of production and may be satisfactory, but only if professionally supervised. Their activities will, of necessity, have to be limited to the detection of perceptible abnormalities and gross defects in the sanitary qualities of the plant, equipment and operation.

Inspectors in charge and supervising inspectors, must have a veterinary education. Their knowledge of anatomy, physiology, biochemistry, parasitology, sanitary bacteriology, pathogenic bacteriology, nutrition and pathology forms a foundation for an adequate understanding of the significance of the abnormalities observed and the sanitary problem of the plant or plants concerned. Needless to say, even the veterinary graduate must have special training to qualify him properly for this type of work.

The inspectors must be people with a marked sense of responsibility and devotion to their task. They must have reasonable working hours and not be made to carry an unreasonable load as is apt to be the case in mass inspection of poultry.
REPORT OF THE REPRESENTATIVE TO THE POULTRY BRANCH
PRODUCTION AND MARKETING ADMINISTRATION UNITED
STATES DEPARTMENT OF AGRICULTURE

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Those who heard the discussion of this subject at our meeting in Phoenix last year will not expect to hear that all of the practices complained of there have been corrected. They haven't. But gratifying progress has been made.

The Poultry Branch of the Production Marketing Administration of the United States Department of Agriculture, which has charge of poultry grading and inspection, held several public hearings during the year at which the producers and public health authorities were given an opportunity to express their views on the matter. Apparently this Association alone of the groups represented at these hearings has an equal interest in the welfare and growth of the poultry industry and in assuring the consumers of poultry products wholesome, attractive foods prepared in sanitary plants and honestly labeled.

Members of your Committee attended most of the public hearings referred to. I attended the Chicago hearing, Drs. Hendershott and Sussman attended the Philadelphia hearing and Drs. Hendershott, Sussman and Brueckner attended two hearings in Washington, D. C.

Of the two practices most severely criticized at our meeting last year—(1) grading and labeling uninspected, eviscerated poultry and (2) using lay plant employees for post mortem inspection in small plants where the limited operation did not justify the assignment of a government employed veterinarian—both were discontinued as of July 1, 1951. Of these measures I think it may be said that the first was a palpable fraud on the consumer and never intended to be anything else and the second was an absurdity. Both the poultry industry and the public-health authorities are well rid of them.

In addition to the foregoing a satisfactory sanitary code was initiated for all plants having either official grading or official inspection. This also became effective July 1st and while compliance left a good deal to be desired the first season there is reason to expect that it will be reasonably well enforced next season. Some of its provisions, such as those requiring the use of stainless steel which, because of the needs of rearmament, is in short supply, may have to be postponed.

A fourth improvement, which I am gratified to report, is a cooperative attitude on the part of the Poultry Branch officials. This is in sharp contrast to the attitude experienced in earlier contacts with those officials, which can be described briefly as a “to-hell-with-the-consumer attitude”. Certain important changes in the administrative personnel of the Poultry Branch probably accounts for the more cooperative attitude.

NEEDED IMPROVEMENTS IN POULTRY INSPECTION

There are a number of changes that we should like to see in operative procedure in the Poultry Branch:
1. A clarification of the regulations: At the lower level an "inspection" means a post mortem examination for wholesomeness and an "inspector" means a veterinarian or a lay employee trained to make such an inspection. An "examination" means an examination for condition. And a "grader" means a government employee trained to make such an examination. In higher echelons the two activities—grading and inspection—are utterly confused. There are "inspectors in charge" but no "graders-in-charge"; "district inspectors" but no "district graders". The regulations make no distinction as to duties, so under the regulation a grader in the position of district inspector may have supervision of all the post mortem inspection in a district and conversely an inspector might be the supervisor of the grading at several markets where no inspection and, conceivably, no processing takes place. If the regulations mean that, they should say it, if they don't mean that, they should be worded differently.

2. Requirement of formal schooling for lay inspectors: The number of veterinarians is insufficient to do all the veterinary work that needs doing in this country. In my opinion the number will not be adequate in the foreseeable future. The Poultry Branch is unable to obtain a sufficient number of veterinarians to conduct all the post mortem examinations of poultry for which there is a demand. The oft suggested remedy of paying higher salaries is not the solution. That would merely attract men from some other veterinary service where they are probably as much needed. The Poultry Branch must do as the Bureau of Animal Industry has long since done—employ lay inspectors to work under veterinary supervision.

The question then arises, what sort of training shall be required of these lay inspectors? What I have seen of on-the-job training for veterinary service has been unsatisfactory. I think the Poultry Branch should adopt a better plan. The medical profession met the problem of insufficient physicians to render all the medical service required, by training nurses and medical technicians to supply a part of it. The time is overdue for establishing a system of training for veterinary technicians that such personnel may be available for much of the veterinary service that is now rendered by the untrained, such as politically selected municipal meat and milk inspectors, vermifuge salesmen, hatcherymen and poultry remedy vendors. To educate nurses and medical technicians special schools had to be established. The training of veterinary technicians should be more simple. There seems little doubt the state colleges, in states having a large poultry industry, would be willing to supply such training if they were properly approached. Perhaps, since the field of veterinary medicine is so broad, more than one veterinary technicians course would be required. Possibly it were best to start with a technician's course in meat inspection. We should urge this upon the Poultry Branch.

3. Less integration of grading and inspection:—There is too much tying-in of grading and inspection. These are separate and different functions. In the case of red meat they are conducted wholly separately. It should be so with poultry meat. Grading is the more popular service with the poultry industry. It is something the processor can go out and sell the same day at a profit. Inspection is for the long haul. It builds a better and sounder future market. The results are not immediately conspicuous. Nevertheless, in the long view, it is more important than grading and there is no occasion for the Poultry Branch to treat it as a stepchild.
4. Official policy as to inspection—A definite statement of policy as to the future of poultry inspection is overdue. Even those engaged in the work have no information on this subject. It is bad for morale. It places public health authorities at a disadvantage in planning for improvements.

5. The New York dressed bird a piece of carrion—Finally, there is the New York dressed bird—the greatest insult of the poultry industry to the poultry consuming public since the days long ago when eggs half-incubated, or those in which cracking the shell loosed a resounding explosion of hydrogen sulfide, were put on the market. A great improvement in the quality of market eggs has resulted in enormous increase in per capita egg consumption. If eggs could be had at the old prices, this increase would be astronomical. Why the industry can’t see the advantage of getting rid of the uneviscerated bird passes understanding; although the appeal of the opportunities it affords the disreputable among processors for cheating in weights is not overlooked. The New York dressed bird is an inferior product as was demonstrated conclusively at the Kansas experiment station. Too often this bird is a piece of carrion under the skin, it is a filthy, slimy mess, unfit to enter a modern sanitary kitchen. If the bird is eviscerated by the neighborhood butcher it contaminates the rest of the meat he sells for the day, notwithstanding, of course, he immediately sterilizes his hands by wiping them on his apron. We object to inspection of the New York dressed bird before or after evisceration. We object to the official grading of such birds. We object to processing them in a plant operating under the sanitary code. It is not expected that there will be an early cessation of these abuses. They are buttressed by tradition and custom.

This is a voluntary program: It must not be forgotten that the government grading and inspection of poultry meat is a voluntary program; the poultry processors can take it or leave it. Changes—improvements, cannot be forced. They must be shown to be advantageous to be accepted. The public interest will not be served by unnecessarily increasing the cost of the service, or by setting standards so high that only the best plants will accept them.
REPORT OF THE COMMITTEE ON MEAT AND MILK HYGIENE


BRUCELLOSIS—MILK AND MEAT

Your Committee wishes to call the Association's attention to the continued incidence of brucellosis among farm families, slaughterhouse workers, and others. It is generally agreed that pasteurization of milk will render the product safe for consumption in so far as Brucella organisms are concerned. This protection, however, does not exist with respect to those of our population, mainly rural, who still drink raw milk. It goes without saying that your Committee most heartily recommends pasteurization of milk unless each and every cow of a herd is free of brucellosis. Your Committee take cognizance of the recent trend in health departments' thinking with respect to brucellosis and suggests that these trends be called to the attention of those of the livestock industry not yet aware of them. In line with this, we feel your attention should be directed to the contact possibilities of brucellosis by those handling infected swine and cattle populations or carcasses. It is important that sufficient emphasis be placed on the immediate planning in each jurisdiction of a target date when all herds, cattle and swine, will be under an approved plan. This must not, in our opinion, be lightly considered for the future planning of many milk importing areas stress disease-free cattle for quality milk and will, in fact, require compulsory elimination of brucellosis within a given number of years, in most cases by five years.

TRICHINOSIS

Trichinosis has been decreasing in incidence during the last decade in our swine population. Your Committee feels, however, that within each jurisdiction the pertinent points of trichinosis control in humans and swine should once again be stressed. All pork should be thoroughly cooked. Garbage to be fed to swine should be cooked. Rats should be eliminated wherever garbage feeding is practiced. The work of Moynihan and Musfeldt of Canada indicate that in spite of garbage cooking, rats where present, may continue the incidence of trichinosis in swine. The freezing in home and commercial lockers has undoubtedly had a part in decreasing the viable trichinae cysts being refed to swine. If our members, and others, would but make an effort to practice three points in swine raising, trichinosis in the United States could become a thing of the past in so far as meat hygiene is concerned. We enumerate them:

1. Cook all meat garbage and offal scraps prior to feeding to hogs, at least to 137°F.

1 Deceased.


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2. All pork meat used in sausages of all types, to be cured according to the United States Bureau of Animal Industry standard methods with respect to drying, freezing or cooking.
3. Eliminate all rodent vectors of this disease by (a) building them out of swine buildings; (b) killing them in swine buildings; (c) starving them by controlled feeding methods of swine.

POULTRY MEAT INSPECTION

The problem of the Administration of the Poultry Meat Grading and Inspection activities was taken up by this Committee last year and your present Committee has continued their thinking.

On June 25th, the chairman of this Committee acted as coordinating chairman at a hearing with Knox Hutchinson, Assistant Secretary of Agriculture, bringing this problem to his attention. At the meeting a series of statements was presented by representatives of the following Organizations: New York Conference of Health Officers, Westchester County Health Department, Nassau County Health Department, Conference of Public Health Veterinarians, New Jersey Health Officers Association, New Jersey State Department of Health, Ohio State Department of Health, Colorado State Health Department, Denver City Health Department, Conference of State Sanitary Engineers, American Public Health Association, Association of Food and Drug Officials of the United States, United States Livestock Sanitary Association, Jersey City Department of Health, State Department of Health of Kentucky, Illinois State Department of Health and New York City Department of Health. Our Association was represented by Ralph A. Hendershott and L. R. Brueckner.

The group's thinking was summed up as follows:
1. We health and livestock sanitary officials no longer have confidence in the ability or integrity of the Production and Marketing Administration to handle Poultry Inspection and Sanitation problems. We, therefore, request you to take appropriate action to see that no further breakdown of confidence in the symbol of the United States on poultry meat occurs in this respect by removing inspection and sanitation problems from Production and Marketing Administration Control.

2. We know that the consuming public is being misled and deceived into assuming that the grading legend on New York Dressed uneviscerated poultry connotes inspection for wholesomeness. In order to avoid this, we request the prohibition on your part of the individual grade labeling of uninspected birds.

Although repeated requests have been made to the Secretary for a statement as to the action the United States Department of Agriculture intended to take on these two proposals, none has been received. Livestock sanitary and health authorities of the country have been clear cut in their requests; they feel that sanitary supervision of programs must be in the hands of those qualified and trained for the work and not under the domination of economic, marketing and sales specialists. Your Committee feels that a typical example of the failure to implement the increased sanitary requirements as set up by the Production and Marketing Ad-
administration, and so highly touted by them, would be helpful to you in determining
the need for a change of administration.

In Plant "A" a mechanical line originally set for a speed of 250 birds per hour
was found running at a rate of 500 per hour. The point of sticking or cutting of
the birds to initiate their bleeding remained at the same point. The birds, con-
sequently, were not completely bled out by the time they reached the scald tank,
and instead were diving into the water alive, gasping, and in many cases, drowning
to death. After passing through the defeathering machine, many were falling on the
floor. These were eventually picked up andrehung. In the same general area of
this mess of fallen birds, dead birds were thrown from crates by the man hanging
live birds for slaughter. A member of this Committee and a representative of a
State Department of Agriculture on a joint visit observed these flagrant violations
of sanitary operation and recommended:

1. A lengthening of the blood trough to allow for varying sticking or cutting
points, depending on the speed of the line, thus allowing for the proper bleed-
ing out of the birds and preventing their drowning in the 120° water—water
warm enough for the incubation of all types of organisms. (Knowing the
birds' anatomy, you can well realize that but a few pumps of the heart, once
the lung is filled up with this liquid mess, and it could distribute the material
in the long bones and muscles.

2. A wire mesh to keep the birds off the floor, should the beaters unshackle them
(also new shackles were recommended).

3. A condemned can to be used to handle all dead birds.
The Management agreed to adopt all the above recommendations.

The next day the Regional Grading Supervisor—who is in charge of sanitation
and the licensed grader-sanitarian at this approved Production and Marketing
Administration slaughtering plant—told the management:

1. The screen to catch the birds from falling on the floor was unnecessary, and
would not actually work for the dirt would accumulate on it. He recognized
no difference between floor dirt and that from clean machines and birds. If
he is right, then your Committee facetiously suggests that no further efforts
be made to keep food products any cleaner than the floors they fall upon.

2. As to the lengthening of the bleeding time and consequently the trough, this
Regional Grading Supervisor (there are only four or five such in the United
States, so they are presumably top calibre) suggested that the birds have to
be somewhat alive to break the surface tension and that the man need not
lengthen his bleeding trough to meet the Production and Marketing Ad-
ministration's specifications. The specifications call for adequate bleeding. Your
Committee suggests that in this case lack of interpretation, know-how and will-
ingness all contributed to the drowning and resulting infiltration of the birds
with debris from the scald tank and could result in maladministration of the
sanitary provisions of any code.

3. The condemned can was agreed necessary if owner wished to obtain same.

Your Committee concludes that this illustration of the manner of interpretation
and application of sanitary requirements, points up the need for transfer of this
function to an organization mindful of public interests. *The Bureau of Animal Industry* within the framework of the United States Department of Agriculture is, we feel, just such a group. Your Committee has not to this date heard from the Secretary of Agriculture with regard to the Department's intention to take action on the criticism leveled at the Poultry Meat Program. Your Committee concludes that:

1. The Poultry Inspection Program is to be commended, that the sanitation program should be placed under that group's supervision because of their knowledge, training and background experience.

2. Graders should remain as graders, or if utilized in an inspection or sanitary capacity, they be properly trained and supervised by qualified professional personnel.

3. Employers cease having to pay tribute to a bureaucracy of grading by paying a fee to maintain a licensed grader (Sanitarian) in each plant, particularly since these people are not free to actually supervise sanitation or trained to do so. (Note: In some cases partner-owners of a firm have been issued licenses as grader-sanitarians and were supposed to order themselves to comply or shut down.)

4. Grading be continued for commercial needs, but that no bird be labeled U. S. Grade A or any U. S. Grade unless it is safe and wholesome; that such grade labeling guarantee as is presently practiced in misleading and deceiving to "Mrs. Consumer" unless the bird has been properly inspected.

5. The United States Department of Agriculture exceeds its authority, both legally and morally, in delegating the administrative supervision over the federal labeling of food products to a company paid employee.

6. A uniform poultry meat inspection code is needed but that printed words and codes are not the answer to workable and working inspection systems, for it must be realized that when the *Mrs. Consumer* sees "U. S." in a shield on orange juice that states "Packed under the continuous inspection of the United States Department of Agriculture", she relates that same shield insignia to the one she sees on her U. S. Grade A (uninspected-unveiscerated bird). That codes alone cannot handle administrative mismanagement, that, therefore, local uniform codes cannot give blanket acceptance for federally labeled foods unless, as we urgently request, a clarification on the national scene is made at once.

7. Through concerted education, the consuming public must be advised of the difference between:
   a. Birds that are eviscerated, inspected, properly labeled and packed.
   b. Birds that are still carrying intestines, feces, dirt and waste; and of the fact that no other animal food product is so handled or sold.
   c. "Inspection" which means the observation for wholesomeness, freedom from disease and all sanitary supervision incident to the production of poultry food products.
   d. "Grading" which means the separation into areas of value solely with
respect to appearance, age, and method of dressing and can in no way connotate or guarantee inspection for disease.

Finally, we conclude that if the wrong path is followed in Poultry Meat Inspection and Sanitation Administration, ominous shadows will be cast for possible future attempts to change our now internationally famous "United States Red Meat Inspection System"—a backward step toward that of a packer and marketing specialist dominated system so evident in the present Federal Poultry Sanitation and Grading Programs.
SOME EPIDEMIOLOGICAL CONSIDERATIONS IN THE CONTROL OF RABIES

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Atlanta, Georgia

During the last decade, great strides have been made in the development and application of sound rabies control practices in the United States. Laboratory research and field demonstrations have contributed immeasurably to our present knowledge of rabies control. The broad principles of adequate diagnostic facilities, accurate reporting systems, elimination of stray animals, registration of dogs, canine rabies vaccination and wildlife control programs have been established as the basis for complete rabies control. It is the purpose of this paper to consider some of the epidemiological factors which may affect our efforts to control the disease in the light of our present knowledge.

In rabies control—as in the control of all communicable diseases—the most important factor is the ability to diagnose the disease quickly and accurately. Next in importance is the gathering and analysis of related facts by the control agency. The facts needed are:

1. The cases of rabies, by animal species.
2. The population density of susceptible animals, by species.

From the analysis of these facts relating to a specific area and to a definite period of time, the control agency is able to visualize the existing situation and to evaluate the elements of epizootiological risk. These facts must be taken into consideration in deciding the need for, or measuring the results of, a control program.

Following the theory that prevention of transmission will eliminate the disease, only the susceptible animals of those species important to the perpetuation of the disease need be considered.

Here, then, are means of measuring the effect of the disease in a community and of measuring the progress made in controlling the disease. The following measures relate to specific areas during a specific time interval. They are measures of effects of the disease on specific animal populations during a specific time period:

1. Dog rabies cases during the time period, divided by the number of susceptible dogs at the beginning of the period.
2. Rabies cases in predatory animals, by species, divided by the estimated predator population.
3. Rabies cases in domestic animals other than dogs, divided by the susceptible population of domestic animals at the beginning of the period.
4. Cases of human rabies divided by the human population.

Items one and two are mortality incidence rates; they relate to the species of animals important to rabies epizootiology and are useful in evaluating control methods and in demonstrating the need for control. Items three and four are also...

¹ From the Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Georgia.
mortality rates and they reflect what might be called "leakage" of the disease out of the normal host species. Although man and farm animals represent a vast liability in terms of public health and agricultural economy, thereby contributing the greatest reason for control, as far as rabies epizootiology is concerned they are blind alleys. They seldom transmit and thereby seldom perpetuate, the disease.

In a recent nation-wide survey of dog rabies by counties in the United States for the year 1949, an attempt was made to overcome the difficulty of securing an accurate dog census by using an index reached by dividing the number of reported dog cases by the human population. This measure is a substitute for a dog census. The assumption is made that the dog population has a direct relation to the human population and that a particular human population in one part of the country will be associated with the same number of dogs as its counterpart elsewhere. These assumptions are not without justification. The weakness apparent in the use of the index is the fact that the degree of accuracy in reporting dog rabies incidence varies in different locations. The index is most useful, however, for comparison of dog rabies epizootiology between rural and urban areas and between urban areas in different parts of the country. It is a crude measure of the probability of human infection from the most likely source.

A nation-wide survey on a county-by-county breakdown of known rabies cases shows the influence of such geographic factors as terrain, drainage basins and natural barriers. In order to apply the index to a given area, the population factor must be taken into account. The consideration of these factors—incidence, geography and population in any given area at a specific time—provides a rapid method for defining those areas which should be considered as critical. An adequate description of the canine rabies problem is the first step in achieving effective control.

Why is canine rabies enzootic in some areas, epizootic in others and completely absent in still others? To answer this we must examine carefully the principal epidemiological factors of dog rabies, such as the size of the dog population, the frequency of contact between dogs, the presence of rabies in cohabitative animal populations and the importation of rabid animals into the area. Thus, the epidemiological status of the infection will depend upon a quantitative determination of a combination of these factors which influence its ability to survive, as well as the magnitude and acceleration with which it is able to do so. It is the intelligent adjustment of these factors which forms the basis for sound control practices. Is it possible for rabies in an area to shift from enzootic to epizootic proportions? This phenomenon has been observed in many areas throughout the country. For one thing, we are dealing with a wound infection disease which is characterized by a long and variable incubation period. For another, a relative changing of the weights of the epidemiological factors just mentioned may very conceivably cause this explosive shift. It is when this shift occurs that communities are moved to do something about initiating control procedures.

In recent years, our attention has been drawn increasingly to the importance of various species of wild fauna in the spread and transmission of rabies. In the Americas, the disease has been reported sporadically in practically every kind of susceptible wild animal. In the United States, the principal large-scale sylvatic vectors are the fox (genus *Urocyon*), the skunk (genus *Spilogale* and genus *Mephitis*),
and the coyote (Canis latrans). The recent outbreak of rabies in Puerto Rico has been established as being primarily an epizootic in the mongoose (Herpestes javanicus) population of the island, with secondary incidental transmission to dogs and other domestic animals. In South America, Central America, Mexico, and Trinidad, the vampire bat (Desmodus rotundus) is an important vector of the disease. Recent reports from Mexico indicate that vampire bat rabies seems to be moving northward and eastward from the western Mexican mountain states, and both the bats and the disease have been reported as far north as Namiquipa, in the State of Chihuahua, just 100 miles south of the United States border. Besides the heavy toll in livestock losses, eight human deaths have been reported thus far this year from paralytic rabies inflicted by the bites of vampire bats in the states of Sinaloa and Jalisco.

In the United States at the present time, the red and the gray fox are responsible for substantial enzootic areas of campstral rabies along the Appalachian Mountain range from New York State to northern Florida, and westward across the southern tier of states to east Texas. Large populations of small spotted skunks (civet cats) and large striped skunks have served as an important focus of the disease during the past few years in Iowa and northern Missouri. During the last year, the infection in skunks has been moving northward and westward from this center into areas which have been essentially rabies-free for many years, notably Minnesota, Nebraska, South Dakota, and North Dakota.

There can be no doubt that the greatest single contribution to rabies control practices in recent years has been canine rabies vaccination. The effectiveness of this method of rabies control has been proved many times. It has been demonstrated that the usefulness of canine vaccination lies not merely in its application, but rather in the manner of its application. Experience has taught us that a community's rabies problem will not be solved by depending upon the sporadic, voluntary vaccination of dogs in veterinary hospitals, staggered throughout the year. Furthermore, if a control program with mass immunization is visualized, the following precepts should be kept in mind: Community interest must be organized through every available medium; all rural areas surrounding the city or town should be included in the campaign; as many clinics as possible should be set up at one time; the location of clinics should be selected with reference to population density and rabies incidence; and the campaign should not last more than two weeks. If any measure of success is to be expected, it is essential that the swift reduction of susceptible animals be achieved by a mass immunization program in which at least 70 per cent of the dogs are vaccinated in the shortest possible period of time.

In the matter of wildlife rabies, the epidemiological aspects are not so well understood. Although it may be assumed that many of the same factors influence the spread of rabies in the sylvatic host as in the canine host, manifestly, the adjustment of these factors cannot be achieved with the same facility. Our knowledge of the behavior of the disease in wildlife is limited. We observe that an epizootic in an overpopulated species decimates the species and usually overflows into other wildlife, livestock and pet animals, and we frantically devise empirical wildlife reduction schemes which we hope will be effective in abating the spread of the disease. In many parts of the country trapping programs actually have been quite successful.
in achieving this goal, especially when they are integrated with a well organized canine rabies control campaign. But the fact remains that the epizootiology of rabies in wildlife is not fully understood and that an investigation should be conducted to provide information necessary for its intelligent and effective control.

Such a program is now being planned and will be in operation in the near future. It will include the study of the basic biology and natural behavior of foxes and skunks and the factors which influence their relative susceptibility; the extent of the movement of rabid wild animals; the population threshold required to support the disease and the measures necessary to regulate the threshold; methods of census-taking; and an evaluation of present rabies control procedures.

In the fight against rabies, when we balance our liabilities against our assets, we must be cognizant, first of all, of our liabilities. We are dealing with a disease which is characterized by a long and variable incubation period, a diversified host range and a ubiquitous spread. Perhaps the greatest liability is the ignorance, misconceptions and general lethargy on the part of a substantial number of our population.

On the other hand, when we consider our assets, we find that a continuing program of research gives promise that we soon will have the answer to many of our questions; that sound scientifically proved techniques have been successful in controlling, and even in eliminating, the disease in many areas; and that livestock disease control officers and public health officials are now consolidating their activities to lend the required momentum to an expanding program of rabies control throughout the country.
The rabies situation is at a standstill or getting worse, despite the fact that there were a few less cases this year than in previous years. New territory has been invaded, and the incidence of the disease in a number of states, where it has appeared over the years, is still high.

Although primarily a disease of animals and, therefore, essentially a veterinary problem, it is of equal if not greater importance to the medical profession and the public health services which are responsible for the administration of human anti-rabic treatments following exposure to suspected or proven rabid animals, especially dogs, foxes, cats, skunks, etc.

There has been inadequate coordination of resources and effort by the state bureaus of animal industry, the public health services, fish and wild life services, and the veterinary profession. The United States Bureau of Animal Industry does not have authority to engage in a national program, and we do not have an adequate national program at the present time.

During the past several years there has been developed in the United States an avianized, live virus type of rabies vaccine which, in rather large scale experimental and field tests, has given evidence that it may become a highly important factor in the control and prevention of rabies. This product is now being manufactured and utilized under a special license from the Bureau of Animal Industry, United States Department of Agriculture, and further investigations with respect to its potentialities should be actively prosecuted.

The Veterinary Division of the United States Public Health Service is commended for instituting rabies diagnostic courses for laboratory directors and technicians. These schools have done much to improve the accuracy of laboratory diagnosis.

The Committee recommends that an act be drawn up for introduction at the next session of Congress authorizing the United States Bureau of Animal Industry to participate in rabies control in dogs.

This Association, at its 1947 annual meeting, approved the report of the Conference on Rabies, held in Philadelphia, April 9, 1947, which among other things, concerned itself with a National Rabies Control program.

Paragraph No. 7 of this report reads as follows:

"In view of the essential existing responsibility of the Bureau of Animal Industry of the United States Department of Agriculture, the U. S. Public Health Service, and the United States Fish and Wildlife Service, this Conference recommends that the function of coordinating a campaign for the control of rabies on a national scale be vested jointly in these three agencies. A plan for accom-
plishing this on a cooperative basis can undoubtedly be worked out through consultation of representatives of the agencies involved”.

The United States Public Health Service and the Fish and Wildlife Service have authority to engage in a national program. The Bureau of Animal Industry does not have this authority. It has not been possible, therefore, to have the three government agencies engage cooperatively with the states in a national program. Cognizance of the lack of authority by the Bureau of Animal Industry in such a program was brought to the attention of this Association by its Committee on Resolutions, which submitted the following at the 54th Annual Meeting of the Association held at Phoenix in 1950:

Resolution No. 5—Rabies Control

“BE IT RESOLVED that the United States Livestock Sanitary Association petition the Secretary of Agriculture of the United States to secure from the Congress authority for the Bureau of Animal Industry to take its rightful place in rabies control on a national basis with the United States Public Health Service and the Fish and Wildlife Service in cooperation with State agencies and to provide funds for the prosecution of the duties so imposed”.

Your Rabies Committee has prepared a rough draft of a bill which would enable the Bureau of Animal Industry to take its place in a rabies program. It is recommended that this Association, through its legislative committee, have this bill introduced into the Congress at the earliest possible moment and that it (the Association) be prepared to actively support this bill when hearings are held by the Congress.

There is herewith appended a report from the United States Bureau of Animal Industry on the incidence of rabies in the calendar year 1950.

A BILL

To amend the Act of May 29, 1884, as amended; the Act of February 2, 1903, as amended; and the Act of March 3, 1905, as amended and extended; to include all domestic animals within their provisions, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled; That:

Section 1. The Act entitled “An Act for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleurpneumonia and other contagious diseases among domestic animals”, approved May 29, 1884, as amended; the Act entitled “An Act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of livestock and for other purposes”, approved February 2, 1903, as amended; and the Act entitled “An Act to enable the Secretary of Agriculture to establish and maintain quarantine districts, to permit and regulate the movement of cattle and other livestock therefrom, and for other purposes”, approved March 3, 1905, as amended and extended, are hereby further amended to include within their provisions all domestic animals, and wherever in said Acts the term “livestock and/or live poultry” appears, the term “domestic animals (including live poultry)” shall be substituted therefor, and wherever in said Acts, except in section 11 of said Act of May 29, 1884, the term “animals” or the term “domestic animals” appears the term “(including live poultry)” shall be added after it.
### Rabies in the United States by States During the Year 1950

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<td>32</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>8</td>
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<tr>
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<td>1</td>
<td>1</td>
<td>8</td>
<td>Fox</td>
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<tr>
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<td>3</td>
<td>-</td>
<td>-</td>
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<td>Skunks</td>
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<td>19</td>
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<tr>
<td>Wyoming</td>
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<td>-</td>
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<td>-</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4979</td>
<td>948</td>
<td>33</td>
<td>48</td>
<td>85</td>
<td>428</td>
<td>5</td>
<td></td>
<td>1375</td>
<td>7910</td>
</tr>
</tbody>
</table>

* Includes coyote, fox, rabbit, mice, gopher, ground squirrel, rat, squirrel, skunk, wild cat, raccoon, opossum, mule, ferret, lynx, hamster, ox, civet cat, mole, ground hog, deer.

Alaska reports 1 dog and 3 foxes.
Hawaii reports that rabies has never occurred in the Territory.
Puerto Rico reports 11 dogs, 5 cattle, 2 swine, 1 cat, and 6 mongooses.

Section 2. Section 3 of said Act of May 29, 1884 is hereby amended to read as follows:

"Sec. 3. It shall be the duty of the Secretary of Agriculture to prepare such rules and regulations as he may deem necessary for the speedy and effectual suppression and extirpation of contagious, infectious, and communicable diseases of domestic animals (including live poultry), and to certify such rules and regulations to the executive authority of each state, and invite said authorities to cooperate in the execution and enforcement of this Act. Whenever the plans and methods of the Secretary of Agriculture shall be accepted by any state in which any such disease is declared to exist, or any such state shall have adopted plans and methods for the suppression and extirpation of any such disease, and such plans and methods shall be accepted by the Secretary of Agriculture, and whenever the Governor or other properly constituted authority of any state signifies his readiness to cooperate for
the extinction of any such disease in conformity with the provisions of this Act, the Secretary of Agriculture is hereby authorized to expend such sums as may hereafter be appropriated for carrying out the provisions of this Act, in such investigations, and in such disinfection and quarantine measures as may be necessary to prevent the spread of the disease from one state into another. As used in this section, the term "state" includes the District of Columbia and the Territories and possessions of the United States".

Sec. 3. Section 11 of said Act of May 29, 1884, is hereby amended to read as follows:

"Sec. 11. The Secretary of Agriculture, either independently or in cooperation with states or political subdivisions thereof, farmers' associations, and similar organizations, and individuals, is authorized to control and eradicate tuberculosis and paratuberculosis of animals; avian tuberculosis; brucellosis of domestic animals;

southern cattle ticks; hog cholera and related swine diseases; scabies in sheep and cattle; dourine in horses; rabies in domestic animals; and contagious or infectious diseases of animals (including live poultry) such as foot-and-mouth disease, rinderpest, and contagious pleuropneumonia, which in the opinion of the Secretary constitute an emergency and threaten the livestock or live poultry industry of the country; including the purchase and destruction of diseased or exposed animals (including live poultry), or the destruction of such animals and the payment of indemnities therefor in accordance with such regulations as the Secretary may prescribe. As used in this section the term 'state' includes the District of Columbia and the Territories and possessions of the United States".

INCIDENCE OF RABIES IN THE UNITED STATES

CALENDAR YEAR 1950

Statistics on the number of cases of rabies in the United States in the calendar year 1950 have been collected by the Bureau of Animal Industry of the United
States Department of Agriculture. There were 7,910 cases reported. There were 4,979 cases in dogs, 948 in cattle, 33 in horses, 48 in sheep, 85 in swine, 428 in cats, 5 in goats, 1,375 miscellaneous, and 9 in man.

This material was compiled from a questionnaire sent by the Bureau to the livestock sanitary official and the health officer in each state. In some instances, data from both sources in a state were used. When there was a difference in the number of cases reported for the same species, the greater number was used, since it is believed that the reported cases do not represent all of the cases that occurred.

Table 1 gives the number of cases reported in each state by species. The map on page 106 shows the distribution of the cases by states.
CURRENT LITERATURE ON NEWCASTLE DISEASE

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INTRODUCTION

In three previous reviews (Proc. Ann. Meeting, U.S.L.S.A., 1943, pp. 122-177; Ibid. 1949, pp. 202-220 and 1950, pp. 132-153) the author has dealt with most of the literature on Newcastle disease excepting for the period 1944-1947. The present review concerns papers for the fiscal year ending in July. There is also appended a list of papers for the years 1944-47, plus other papers that were not available at the time reviews were made.

GEOGRAPHIC DISTRIBUTION AND INCIDENCE

United States: According to Zargar and Pomeroy (16) Newcastle Disease (NCD) was first diagnosed in Minnesota in May, 1946 and to January 1949, 321 outbreaks have been confirmed in 76 of the 87 counties.

Canada: As of March, 1950 Walker and Powell (3) reported 18 outbreaks in Canada: Nova Scotia 1, Quebec 1, Ontario 15 and Saskatchewan 1.

Puerto Rico: The first outbreak was reported by Perez and Gongales (71) as occurring near San Juan. Of 20 sera tested only 2 failed to inhibit agglutination below a 1-80 dilution in the presence of 4 agglutinating units. Each of 5 samples sent to the Bureau of Animal Industry neutralized more than 1,000 fatal embryo units, and a suspension of lungs, trachea and spleens from 2 birds killed 3 embryos within 72 hours.

Hawaii: Adler et al (56) found the first outbreak in August 1947, on a large farm on Oahu. The diagnosis was confirmed by Beach by virus isolation, positive HI (hemagglutination inhibition) and refractivity of recovered birds. Eight more outbreaks were diagnosed in the next 2 months. A survey was begun in March, 1948. Samples from the original flock were still positive except from recently added birds. Of 154 samples from larger flocks on neighboring islands only one gave positive HI and serum neutralization (SN), but there was no history of previous infection.

On January 13, 1949, an outbreak was diagnosed on a broiler plant in 4-week old chicks by virus isolation and positive HI. Another occurred in Hawaii in 3-week old chicks on a farm where the adults were HI negative. The other parts of the shipment on different farms were not affected. Molokai and Kauai have been spared, but on March 18, 1949, the disease appeared in a flock of 18,000 on Maui of which 10,000 were layers. The disease began in adults and from production records it was estimated that the disease had started 3 weeks previously. The virus was recovered

1 Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, the State University of New Jersey, Department of Poultry Husbandry.
and HI tests were positive. Another outbreak on this island diagnosed by positive 
HI tests seems to have started 2 months prior to the above. 

_Mexico:_ Reports of heavy losses in poultry reputedly from NCD were received 
by the Bureau in late 1950 and early 1951. Two strains of virus—one designated as a 
"septicemic type" (causing 100% mortality in adults) and another as a "respiratory 
type" (40% fatal for six weeks old chicks) were examined in Washington (83). 
Sera from survivors of either type neutralized about the same quantity of California 
11914 virus as well as either type of the Mexican virus. Hemorrhages in the pro-
ventriculus characterized the "septicemic" and involvement of the air sacs the 
"respiratory" type. 

_Europe:_ At a conference in Bern on September 11–14, 1950, called by the Inter-
national Office of Epizootics the NCD situation was reviewed by Vaysse (63). 
Referring to Europe, Flückiger (64) reported that the only countries spared were 
Denmark and Finland, that Norway alone had few outbreaks, and that presently, 
Switzerland may be considered as practically free after experiencing 450 outbreaks 
from the fall of 1946 to the summer of 1947. The number of infected communes and 
farms in European countries for a given time limit according to the official reports 
follows:

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>PERIOD</th>
<th>COMMUNES INFECTED</th>
<th>FARMS INFECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>February 16–28</td>
<td>18</td>
<td>79</td>
</tr>
<tr>
<td>Germany (East)</td>
<td>June 1–15</td>
<td>21</td>
<td>62</td>
</tr>
<tr>
<td>England</td>
<td>June 16–30</td>
<td>No Indication</td>
<td>6</td>
</tr>
<tr>
<td>Belgium</td>
<td>June 16–30</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Germany (West)</td>
<td>June 16–30</td>
<td>48</td>
<td>202</td>
</tr>
<tr>
<td>France</td>
<td>June 16–30</td>
<td>48</td>
<td>88</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>June 16–30</td>
<td>78</td>
<td>1004</td>
</tr>
<tr>
<td>Austria</td>
<td>June 16–30</td>
<td>29</td>
<td>172</td>
</tr>
<tr>
<td>Poland</td>
<td>June 16–30</td>
<td>48</td>
<td>179</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>June 16–30</td>
<td>314</td>
<td>3053</td>
</tr>
<tr>
<td>Hungary</td>
<td>June 16–30</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>June 1–30</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Greece</td>
<td>June 1–30</td>
<td>45</td>
<td>545</td>
</tr>
<tr>
<td>Holland</td>
<td>June 1–30</td>
<td>8</td>
<td>59</td>
</tr>
</tbody>
</table>

Exact reports for Spain and Portugal were not available, but the general im-
pression is that the disease rages there. For a while Belgium and Holland were free, 
but in January 1950, Belgium and in March, 1950, Holland were invaded. In Hol-
land a slaughter program was initiated and the movement of dressed poultry re-
stricted so that no new cases had appeared to September 1. Only a few cases oc-
curred in West Germany till December, 1948, but since January 1950, the disease 
has spread. 

In France the disease began to spread in the fall of 1949, and reached the highest 
incidence in March and April. 

The disease has been more or less common in Italy and Austria for several years.
In Europe as a whole, however, the incidence has decreased since the spring and summer of 1950.

Between Christmas Eve, 1950 to January 2, 36 outbreaks were reported (48) to the Ministry in England. And later (49) East Anglia was referred to as the "black spot" because of 31 outbreaks. Elsewhere there were 3 in Kent, 1 in Northampton, 1 in E. Sussex. Of these 4 were on domestic plants, the others on general and commercial farms. The 3 largest outbreaks were at Carbrooke, Norfolk where 6,000 were slaughtered, at Thriplow, Cambridgeshire (7200) and at Downham, Essex (8000).

Between January 4 and 10, 51 outbreaks were reported and 30,000 has been slaughtered till the 9th. The distribution was: Norfolk 13, E. Suffolk 5, Essex 5, Isle of Ely 6, Cambs 2, Staffs 1, London 1, Wilts 1, Herts 1, Kent 2, Cornwall 2, Gloucester 1, Northampton 3, W. Sussex 2, E. Sussex 1, Berks 2, Lancs 1 and Shropshire 1.

Africa: According to Jesierski (2), the disease appeared in the Provinces of Katanga and Kasai of the Belgian Congo in September-October, 1948, and generally in indigenous fowl on small native farms.

Mornet et al. (38) reported that NCD appeared at Dakar in French West Africa in 1949, that at this time it was observed by the natives in the Soudan, Upper Volta and the Ivory Coast.

In South Africa Kaschula (37) reported that more than 250 outbreaks occurred in Western Province in the last year and involved 250,000 birds.

In Palestine (33) 6, 12 and 7 outbreaks, respectively, were reported for April, May and June, 1950.

Asia: A strain of virus isolated at Nhatrang in Central Vietnam (Indo-China) in 1949, was studied by Jacotot et al (47). The disease was said to occur frequently in the north and south.

Susceptible Species

Jezierski (2) was unable to produce symptoms in parrots by the inoculation of a million fatal fowl doses, but turtle doves and other small birds were susceptible. He found that turkeys were as susceptible as fowls, but ducks and pigeons were non-susceptible.

According to Mornet et al. (38) Kaki Campbell ducks and peafowl were not affected by contact with NCD, nor were they able to infect pigeons, ducks, peafowl, the Crowned crane (Balearica regulorum), the Moine crane (Necrosyrtes monachus) experimentally. Small passeriformes such as quelea quelea and weavers (Ploceus circullatus) were susceptible.

Adler et al. (56) observed that Japanese doves on infected premises in Hawaii were negative to the HI test and susceptible to challenge.

Kaschula (37) caught and tamed wild birds for a month before injecting them intramuscularly with 0.1 cc. of allantoic fluid of eggs inoculated with a Cape strain. Of 2 Cape pheasants (Francolinus capensis) inoculated, both died in 4 and 7 days. Six Turtle doves (Streptopelia capicola) resisted, but 5 of 6 Laughing doves (Stigmatopelia senegalensis) died in 6, 6, 7, 7 and 9 days, respectively. Four Cape sparrows (Passer melanurus) died in 6, 9, 10 and 17 days, respectively. Paralysis, especially of the legs, was seen in all birds that died, and virus was recovered.
A spontaneous infection in a Great horned owl (Bubo virginianus virginianus) from the Columbus Zoo was reported by Ingalls et al. (93). The specimen had been captured by a farmer who presented it to the zoo 6 weeks previously. Two weeks later the bird developed oposthotonos and torticollis. The bird’s serum agglutinated chicken red cells, but 2 days later another sample was collected and was HI positive at 1–160 when turkey cells were used. The bird died and autopsy revealed only an exudate in the air sacs. A pool of brain, spleen, lungs and serous membranes treated with penicillin and streptomycin and injected into 4 eggs 9 days old killed all embryos by the 4th day. The fluids of the first egg passage hemagglutinated at a 1–160 dilution and fluids of the second passage in a 1–1280 dilution. The virus was neutralized by NCD serum.

Zuydam (95) was unable to produce disease in wild rats by feeding infected tissues or eggs containing massive doses of virus.

Reagan et al. (61) inoculated 0.05 cc of amnio-allantoic fluid of the 24th egg passage of California 11914 virus intracerebrally into 4 cave bats (Myotis lucifugus). The bats developed typical symptoms in 4–6 days, except that there was no excessive salivation as seen in other mammals. A second passage was made in 6 bats. A 10% brain suspension of bats of the first and second passages inoculated into 12 eggs 10 days old caused death of all embryos within 72 hours. The presence of virus in a pool of egg fluids was established by an SN test, and in the brain material by electron micrographs.

Reagan et al. (17) injected each of 3 ferrets intracerebrally with 1 cc of a 10% suspension of the 300th hamster brain passage and observed symptoms within 48 hours. In the second passage 2 of 3 developed symptoms which appeared in 2 and 3 days, and in the third passage 2 of 3 developed symptoms in 3 and 4 days, respectively. None of the 3 ferrets of the fourth passage was affected. Of the 10% brain suspensions prepared from ferrets of each passage 0.06 cc was inoculated into each of 4 hamsters with development of symptoms in each case within 48 hours except in the fourth which resisted. A similar series in rabbits resulted in symptoms in 2, 2, 2 and 3 days, respectively, of 4 inoculated with 1 cc each. In the second passage symptoms developed in 2, 3 and 3 days in 3 of 4 animals, in the third 3 of 3 developed symptoms in 3, 3 and 4 days, in the fourth of 4 in 4 days, and in the fifth 2 of 4 in 4 and 5 days, respectively. The sixth passage failed. Each passage material produced symptoms in all hamsters in 2 to 4 days, but in the fifth only 3 of 4 developed symptoms in 2, 3 and 5 days, and the sixth failed.

With similar material in 20% suspension Reagan et al (20) made intratesticular inoculations into 4 hamsters 35 days old. Each testicle received 0.06cc and symptoms appeared in 3 animals in 6, 7 and 8 days, respectively, and 10 successive passages were made. Distribution of virus in the body was studied in 9th passage material. Possibly contaminated material (feces, etc.) was treated with antibiotics prior to inoculation intracerebrally into hamsters (0.06cc) and embryonated eggs (7 days). Virus was recovered from brain, spinal cord and testes in both hamsters and eggs. The concentration of virus in brain and cord of the 10th passage reached titers of 10^-5 and 10^-5.4, respectively.

Six egg-adapted strains of NCD (California, Colorado, Connecticut, Delaware,
Kentucky, and Minnesota) were successfully transmitted to the cave bat (Myotus lucifugus) by Reagan and Brueckner (53). Doses of 0.2 cc were inoculated intradermally and intraperitoneally, and 1 drop intranasally. The animals developed typical symptoms and died. Brain suspensions (10%) of the bats inoculated into eggs killed embryos within 99 hours and the virus was identified by SN tests. Intranasal instillations were positive in 5 of 6 animals in 3 to 5 days, intradermal in 5 of 6 in 4 to 5 days, and intraperitoneally in 4 of 6 in 3 to 4 days.

In a review paper by Brueckner et al (79) covering their experiments of NCD virus in mammals it was pointed out that the 16th egg passage of California 11914 virus was passed 6 times more in eggs before intracerebral inoculation into hamsters in which, after 8 passages, it produced 100% mortality. The average incubation period was 96 hours and death in another 12-18 hours in the first few passages. The incubation period decreased with passage to become 48 hours by the 70th passage, and from the 160th to 190th to 24 hours. After 190 passages, symptoms developed in 12 hours. The titer of the virus increased slowly and was $10^{-5.3}$ from 49th to 72nd, $10^{-4.3}$ by the 200th and $10^{-4.7}$ by the 300th passage.

Intranasal instillation of 16th passage material (0.1 cc of 10% brain) infected hamsters in the first passage only, but with 245th and later passage material, intranasal infection resulted which could be carried serially by this route. Intradermal and intratesticular inoculation of hamsters with 300th passage material produced infection which could be carried in series with brain virus.

As a result of serial passage in hamsters no change was observed in the pathogenicity for chickens at the 17th to 29th passages, but at the 49th it produced only a 4% loss in 6-week old chicks with no change in pathogenicity for embryos. The 51st passage produced no symptoms in chicks and to the 82nd was nonpathogenic, but the same virus grown in eggs remained slightly pathogenic for chickens.

Attempts to adapt the 16th hamster passage to Swiss mice were not successful beyond the first passage, but at 203 hamster passages mice were infected and the virus was carried serially through 20 passages.

Virus of the 21st passage was infectious for monkeys, but could not be carried serially, and while a combination of intramuscular, subcutaneous and intradermal injections with 50-60th passage material was not infectious the 310th passage produced infection which was carried through 15 passages.

Guinea pigs, but not rabbits, responded to an intracerebral inoculation of 16th hamster passage material but the virus could not be carried serially. At the 300th passage, however, the rabbit was infected and the virus was carried to the 5th passage only. Similarly, ferrets were infected with the same material but serially through the 4th passage only.

A sheep was infected with 36th passage material intracerebrally but its brain was not infectious for chickens. A calf was also infected with no attempt to recover or pass the virus.

In a brief note Yates (96) recorded the isolation of a virus from the lung fluid of a calf that died of a respiratory disease. The virus killed embryos, was inactivated by a known Newcastle serum and acted like Newcastle virus in other tests. The person attending the calf had cared for a flock of chickens affected with Newcastle disease.
CURRENT LITERATURE ON NEWCASTLE DISEASE

SYMPTOMS AND LESIONS

In connection with some breeding experiment Guha and Chatterjee (29) had occasion to inoculate 1679 chicks 8 weeks old subcutaneously with 0.3 to 1.0 cc of infected liver and spleen of the Mukteswar strain. There were 826 R.I.R. 685 Leghorns and 168 Desis inoculated in 3 lots of 538, 553 and 588, respectively. The first symptoms appeared on the evening of the second day, the last on the sixth day of which the most common were drowsiness, ruffled feathers, cyanosis of head, loss of appetite, rise in temperature, increased thirst and a tendency to stand in a sleeping posture. Some mucus was discharged from the beak, but rarely from the nostrils. Diarrheal discharges were often streaked with blood and there was mucus soiling around the vent. Respiration was heavy and lameness with paralysis of legs or wings and convulsive nervous movements seen.

In the first 2 lots of 1091, a Leghorn cockerel which had had the disease previously was the only survivor. Two Reds survived in the third lot or a mortality of 99.82% for the 3 groups. The daily mortality from the first day was: 6, 3, (exhaustion or injury), 374, 1045, 206, 24, 12, 1, 0 and 1 or an average survival time of 3.9 days.

In a few of the 1644 birds autopsied subcutaneous hemorrhages were seen, particularly around the stifle joint. There was distension of the crop with foul-smelling gas and, in very few cases, subcutaneous edema. Infrequently there was congestion of the keel. Kidneys, liver and lungs showed some congestion, and in a small number, fluid in the pericardial sac. Involvement of the intestine was constant with bran-like ulcerations in various degrees. Mottling of the proventriculus occurred in 89.6% of the cases, hemorrhages of the proventriculus in 69.6% petechial hemorrhages in 36.74% and in gizzard fat in 9.37%. No differences were observed with respect to breeds.

Mornet et al. (38) noted the usual symptoms, but have not seen the edema of the wattles described by others. A discharge from the nares or beak was particularly common, especially when the head was held down. Nervous symptoms were common early or late in the outbreak. Of particular interest were the pseudomembranous formations of mouth, pharynx and larynx. In 40% of the cases there was a serofibrinous pericarditis. The more constant lesions of the digestive tract included petechial hemorrhages in the proventriculus, congestion of intestine with ecchymotic or petechial hemorrhages, ulceration and congestion of ceca and cloacal mucosa. A sero-fibrinous peritonitis and hepatic degeneration were occasionally seen. In the order of frequency the changes ran: inflammation of cloaca, intestinal congestion with or without ulceration, congestion of ceca, hemorrhages in proventriculus, cerebral congestion, pericarditis and peritonitis.

In the Belgian Congo, Jezierski (2) observed a type of NCD that killed birds in 3 days and a type that killed in 5 to 8 days. The birds showed greenish diarrhea, cyanosis of the comb, weakness, paralysis and torticollis. A few survived, but retained a deformed neck. In another type there were respiratory symptoms associated with false membranes in the larynx. There was also cyanosis, paralysis and extension of the head and neck, but death did not occur until 5 to 15 days.

Regardless of type all birds showed tracheitis, hemorrhages on the epicardium, pleura, and in the proventriculus and duodenum.
Knox (35) studied the effect on egg production of an outbreak that occurred, during the 1947–48 laying year which affected production from January to March. The expected 60% production was reduced to 17% for Outbred Reds, to 40% for the Incrosses, and to 34% for the Crossbreds. Studies were confined to 285 Outbred R.I.R., 117 Inbred R.I.R. × Inbred W. Leghorns and 59 Outbred R.I.R. × Outbred W. Leghorns on which comparative data were available for the 1945–46 and 1946–47 seasons except for data on Crossbreds not represented in 1945–46. The average egg production for Outbred R.I.R. for the 1945–46 through the 1947–48 (outbreak year) seasons was 218.6, 219 and 198.6, respectively, or a loss of about 20 eggs. For the Incrossbreds, production for the same periods was 226.1, 240.2 and 227.8 or practically no loss. In the Crossbreds the average production in 1946–47 was 228.8 and in 1947–48 201.8 or a loss of about 20 eggs. The decrease was less than anticipated, the average egg weight for the 3 months was decreased and this was reflected in the average annual egg weight for all groups. The mortality increase was slight, but there was a considerable increase in the average yearly mortality.

The commonly observed effect of NCD on egg shell texture prompted Clegg and Mueller (60) to study where the effect is centered in the over-all calcium metabolism of the bird—whether it was a glandular disturbance upsetting the mechanism controlling the Ca content of the blood, or a disturbed secretory function of the uterus. The authors reasoned that if it were the former then some abnormality might be expected in the Ca content of the blood, but if it concerned shell secreting tissue, blood calcium would probably be normal. Serum calcium studies were made of birds in the acute stages of NCD and again 3 weeks after production was resumed in comparison with normal hens and normal hens laying eggs of poor shell texture. The total calcium mg./% for 15 samples of Group A (normal) was 22.1 ± 2.9 for 9 samples in Group B (acute NCD) 10.2 ± 3.3, for 10 samples in Group C (Group B 2 weeks after resumption of egg production) 23.3 ± 3.25, and for 5 samples of Group D (normal but low quality shells) 22.9 ± 4.5. Thus, values for C and D compare with the normal Group A, and that for B with that expected for non-layers. The authors concluded that the poor quality is caused by a malfunction of the shell-producing organ, that is, the uterus, and that this in turn, may be the direct effect on the uterus or upon the disturbance of factors controlling shell secretion.

DIFFERENTIAL DIAGNOSIS

In French West Africa, Mornet et al. (38) diagnose NCD on the basis of a negative culture, a positive Chamberland L3 filtration, a positive HI test and egg inoculation. In this area (a) spirochetosis is differentiated by finding the blood parasites, (b) typhoid by the lack of nervous symptoms, the characteristic spleen and liver lesions and a positive culture, and (c) cholera by positive culture.

From an outbreak in Upper Bavaria in April, 1949 a virus was isolated that has been referred to as Virus N and which has been the subject of previous studies. The virus bore certain characteristics in common with NCD and fowl plague. In previous studies the results of HI and SN, as well as immunization tests, seemed to justify the conclusion that it was an independent immunological agent. Dinter and Bakos (40 and 44), however, revised their opinion when high titer hemag-
glutinating sera were used. A fowl plague (FP) immune serum of high titer inhibited agglutination by its virus as well as by the N virus and while a high titer N serum inhibited its own virus it had a lesser effect on FP virus. The Brescia virus was also included for comparative study. The FP strain distinguished itself by a higher HA titer and a quicker killing effect on embryos and chickens. The Brescia virus was less active in embryos and chicks while the N virus, although capable of cultivation in eggs, was apathogenic for chicks. Having satisfied themselves that N virus bore no relation to NCD on the basis of studies made with a strain from Sweden, the authors excluded this virus from their studies. In HI tests, an anti-Brescia serum inhibited agglutination by Brescia and FP viruses, but not by NCD. An anti-N serum inhibited agglutination by N virus but had no effect on Brescia and slight effect on FP viruses. A low-titer anti-FP serum inhibited Brescia and FP viruses but had no effect on N virus in contrast to a high titer serum which had some inhibiting effect.

In SN tests made in eggs and using virus dilutions of $10^{-5}$ and $10^{-6}$ with serum non-diluted and diluted 1-5, an anti-Brescia serum (titer 1/5120) neutralized its homologous virus as well as FP, but had no effect on N virus. On the contrary, an N-immune serum (titer 1/2560), whether diluted or not, neutralized only the homologous virus. An anti-FP serum of low titer (1/320) acted like the anti-Brescia serum except that when diluted 1/5 it failed to neutralize the $10^{-5}$ dilution of Brescia or FP viruses. A high titer FP serum (1/10240), however, neutralized Brescia, FP and, when non-diluted, also showed marked neutralization of N virus.

Trials were repeated with other sera, but with no change in the results so the authors concluded that the antibodies for N virus in high titer FP serum resulted from an amount of this antigen in FP virus. Thus, the difference in antigenic structure between Brescia and FP viruses results from the absence of an N component in Brescia virus, consequently, even a high titer Brescia serum failed to exhibit any action on N virus. This, the authors believe, would justify classing Brescia as type A, N as type B and FP as type Ab of classical fowl plague.

Chickens were immunized against N virus by using live virus since it is apathogenic. Birds that developed low HI values (1-60 to 1-320) had no immunity against a challenge with FP or Brescia and died in about the same time as the controls. But, birds having a high titer (1-2560 to 1-5120) died only after a longer time and 2 even survived—one each challenged with Brescia and FP, respectively. Birds immunized against Brescia were resistant to FP and, reciprocally, FP-immune birds were resistant to Brescia. Finally, birds immune to N, a combination of N and FP, or N and Brescia, were still susceptible to NCD.

In a discussion of the spread of NCD in the United States, Beach (54) reported that Beaudette and Black mistook the respiratory symptoms present in New Jersey outbreaks in 1944-45 for those of bronchitis. On the contrary, these outbreaks in adults were a subject of discussion because of their marked effect on production. At the time, (October 1944) chick flocks were not affected so that there was no opportunity to observe the nervous symptoms commonly seen in chicks and which would have given a clue to the nature of the disease. However, in February an infected chick flock was seen in South Jersey and NCD virus was recovered. It was also an error on the part of Beach to assume that the disease was widespread in
New Jersey at this time. Although several outbreaks were diagnosed in South Jersey from February none was found in Central Jersey until July and none in North Jersey until September.

In the same paper Beach makes the ridiculous suggestion that the highly fatal disease in the east in 1924-25 and again in New Jersey in 1929, might have been incorrectly diagnosed as fowl plague, that in reality it was NCD which has since lingered in a benign form. Since this reviewer had personal experience with both outbreaks it seems important to state that the disease referred to was so different from the most virulent outbreaks of NCD that the question of differential diagnosis would not justify extensive discussion. Suffice it to say that neither respiratory nor nervous symptoms characterized the disease, the duration of illness was short, edema of head parts, keel and feet was common (almost never seen in NCD in the United States, and often not even in the exotic type). Blisters on the comb and wattles were seen in the natural as well as the experimental disease. Recovery almost never occurred. Autopsy revealed hemorrhages in the proventriculus, gizzard, heart, beneath serous surfaces that were remarkably profuse and constant. Virus could be found in any tissue or fluid examined and inoculated birds usually died at least a day before the earliest symptoms or NCD appear.

Strangely enough, the disease often failed to spread to birds in close contact, whereas NCD never fails, and because of this fact, quarantine and slaughter effected prompt eradication.

Beach thought the question "worthy of consideration since thus far no explanation of the presence in the U. S. of a virus related to either Newcastle or fowl plague has been forthcoming". But, it is a matter of record that plague virus was brought to an eastern institution from France prior to 1924 to be used for demonstrational purposes, further, that the virus was handled in such a manner as to make its escape to poultry flocks possible. Moreover, it may now be revealed that another institution (not in New Jersey) had a strain of plague virus after the 1924-25 outbreak and prior to the 1929 outbreak in New Jersey. It is not believed, however, that this was handled in such a manner as to permit its escape.

The reviewer (82) discussed the differential diagnosis of NCD, bronchitis, laryngotracheitis, epidemic tremor and vitamin E deficiency on the basis of the symptoms, autopsy findings, distribution of virus in the body, changes in embryos, serology and immunology.

Hitchner et al. (88) pointed out that whereas most NCD strains kill embryos in 2 to 3 days, the B1 strain kills in 3 to 5 days in the majority of cases, but that this is true only when eggs come from non-immune birds. In eggs from immune stock the mortality is spread throughout 11 days post inoculation with a peak at 6-7 days. This concerns eggs inoculated with 0.1 cc. of a 10^-2 dilution of allantoic fluid.

The authors inoculated the California 11914 and B1 strains into eggs from susceptible and immune birds to study growth rates. The eggs were candled at 1, 6, 12, 24 and 36 hours and at 6 hour intervals through the 94th hour and removed 5 live embryos at each candling to be harvested separately and the fluids pooled only after the results of sterility tests were known. Each dilution of a pool was inoculated into 4 eggs in the titration which showed that little difference in the
growth rate occurred whether the virus was grown in eggs from immune or non-immune birds.

The HA titer of B1 virus frequently went to 1-2560 and the yield of fluid per egg was 5 to 10 cc, and as much as 15 cc. have been recovered.

Lesions in embryos dead in 2-3 days include reddening of the feet, congestion of the yolk sac, liver and kidneys, but hemorrhages are seldom seen. Embryos dead on the 4th day and later show stunting and curling which becomes more pronounced with time. If death occurs during this period hemorrhages are seen on the chorioallantoic membrane and yolk sac. The amnionic sac is tightly enveloped and the fluid almost non-existent, and the yolk has a thicker consistency.

The authors concluded that the changes described by Fabricant as characteristic for bronchitis are not valid for B1 virus. An attempt to demonstrate the presence of bronchitis virus by using immune NCD serum failed.

HISTOPATHOLOGY

According to studies made by deMoulin (94), the histological picture is one of an encephalomyelitis with the usual degeneration of ganglia and subsequent polyneuritis. Perivascular infiltrations with lymphocytes and leucocytes were not found, but the vegetative nervous system and the endocrine system appeared to be affected. Bronchopneumonia was rare and the lungs showed atelectasis without inflammation. The author believed the cause to be a disturbance in the respiratory center and respiratory muscles and therefore of nervous origin. The heart muscle was not degenerated but was infiltrated with monocytes. The endothelium of vessels occasionally showed hyperplasia and arteritis was without infiltration. Hemorrhages in the proventriculus and hyperemia of the intestine were present, but the author found no necrotic foci in the intestine. The spleen was always anemic and free of necrosis and hemorrhage.

Malpighian corpuscles showed atrophy in the acute disease, but only hypertrophy during immunization.

Clearly separated foci of dark cells were found in the spleen pulp after infection and these disappeared in direct relation to recovery of the Malpighian corpuscles.

The thyroid was very atrophic but the para-thyroids remained normal or perhaps became a little hypertrophic. In the hypophysis there was a decrease in the number of chromatophilic cells. The acidophilic cells especially lost their granulations and the basophilic gonadotrophic epithelial cells were vacuolized. This is cited to explain the decrease in egg production.

The suprarenal glands showed vacuolization, shrivelling of the nuclei, breaking down of cell structure and slight edema. Because of the mutual relationships between glands and internal secretion the degenerations are not considered as a result of a direct action of the virus but rather as a secondary connection with the pathological changes of the vegetative nervous system.

Disturbances of circulation in visceral organs was attributed to insufficiency of the suprarenals. According to the author this permits an unlimited resorption of histamin from the intestines because it can not be broken off and, the histamin is credited with attacking blood vessel endothelium resulting in capillary hemorrhage which explains the necrosis reported by some investigators. The author believes
that the visceral as well as the pneumatic changes are of nervous origin, and, he
believes that the virus is only neurotropic and not entero- or pneumotropic.

**HUMAN INFECTION**

Bang et al. (25) concluded that a satisfactory neutralization test for antibodies in human serum requires that it be heated for a half hour at 56°C. If non-diluted serum is used against varying dilutions of virus, and that mixtures be incubated for one hour prior to inoculation.

The authors agree that a heat labile neutralizing substance is commonly present in human sera, but that the titer of this substance is not significantly decreased by decomplemeting the serum. It is suggested that any loss in activity resulting from decomplemeting, as reported by one worker, might be explained by the lability of the substance itself. Thus, there was no evidence in favor of adding complement or attempting to use fresh serum for neutralization tests in determining antibody rise.

Of 7 persons in close contact with NCD virus the serum of only 1 had heat stable neutralizing antibodies which could be consistently demonstrated over a period of two years. None of 3 cases of NCD conjunctivitis developed measurable antibodies.

Keeney and Hunter (34) record that to date there have been 7 reports covering 30 clinical cases of NCD infection in humans involving 9 laboratory workers, 19 kitchen personnel, 1 feed salesman, 1 broiler plant operator, 1 veterinary student and 8 of unknown occupation. In only 4 reports covering 7 cases has virus been recovered from conjunctivae and identified. The case reported by the authors concerned a laboratory worker who became contaminated at 11 AM January 19, 1950, with material from a crushed egg inoculated 48 hours previously with Beaudette No. 2 strain. The first reaction was noted the following morning when the conjunctiva was found to be quite red. The patient recovered in 2 weeks, but a dusky hyperemia in the lower fornices persisted for another 10 days.

Epithelial cells removed from the conjunctiva on the 2nd and 5th days showed small, granular, cytoplasmic inclusions in the protoplasm from Burgundy to dark bluish purple in color after staining with Giemsa. Scrapings made on the 17th day were normal. This picture could not be reproduced in the epithelial cells of the rabbit eye inoculated with the virus.

On the second day there was a leukopenia, with a count of 5850 and a relative lymphocytosis of 42% (segmented granulocytes 52%). The leucocyte count returned to 9500 on the 6th day.

One eye treated with aureomycin borate drops (0.5%) and the other with penicillin (5000 units per cc.) gave no evidence that either was effective.

The virus was recovered from conjunctival washings (time of collection not stated) inoculated into embryonated eggs and was carried through the third passage. A transient viremia (the first to be reported) was also demonstrated and a significant rise in the HI titer of heat-inactivated serum was demonstrated a week after infection.

Gustafson and Moses (55) record that a veterinarian actively engaged in poultry disease work developed a moderate inflammation of the right eye on December 13, 1949, after having handled chickens on two successive days prior to the infection.
One of the chicken cases had been identified as NCD by virus recovery and the other serologically.

The inflammation involved the conjunctiva and sclera, but not the cornea. One cc. of eye washing treated with 50 mgs. of streptomycin and 5000 units of penicillin (each in 0.5 cc. of water) was inoculated into 8 eggs, 12 days old in a dose of 0.2 cc. The embryos died in 136 to 184 hours. The harvested material was sterile and the egg fluids agglutinated red cells. A second passage with 5 samples was made and all embryos died in 50 hours and again the fluids caused HA which was inhibited by a positive serum.

Of 3 chicks (2 weeks old) inoculated intranasally with 0.1 cc. of a 10⁻² dilution of second passage material (10⁴ embryo doses), one died on the 6th day and the others showed symptoms on the 7th day. Blood samples at this time showed HI.

The patient’s plasma, collected 36, 42, 53 and 60 days after the infection was noticed, was used in sn tests against the homologous and CRE strains. The 53rd day sample was heated to 56°C. for a half hour. Titors of 10 to 1000 neutralizing units were found in non-heated plasma, but none in heated plasma. HI antibodies were not found.

Lépine et al. (23) described 3 cases of eye infection acquired in the laboratory when virus spurted from a syringe that became detached from the needle during an inoculation and the third presumably from droplet infection from a pipette. The first two cases showed bilateral and the third unilateral infection. In spite of immediate application of a 2% argyrol solution in the first 2 cases the infection developed in 20-30 hours as in the third non-treated case. The first two cases were treated from the second day on with aureomycin, but the duration of illness was no shorter than in the third case. The authors were unable to recover the virus from the first 2 cases, a failure which is attributed to the use of aureomycin. The virus was recovered by egg inoculation from the third case on the second and third days of illness and the virus was passed through 5 passages. At this time the egg virus gave a positive HA test. Sera of the first 2 cases collected at 40 hours and at 10 and 40 days did not neutralize the virus, while serum from the third case at 48 hours was negative, that collected at 10 and 40 days was positive. The authors were unable to infect the eyes of mice or monkeys.

MICROSCOPY

Reagan et al. (32) studied the microscopy of NCD virus in spinal cords of hamsters inoculated by various routes. Fifteen each were inoculated intradermally and intranasally with 0.1 cc of a 10% brain suspension of the 18th intradermal and the 25th intranasal passages, respectively, of hamster-adapted virus. Two groups of 15 and 5 were given intracerebrally and into each testicle 0.06 cc each of a 10% brain suspension of the 200th brain and 29th testicular passage, respectively. The injections produced 80, 73.3, 100 and 60% moribund animals.

Pooled 10% suspensions of brains of moribund animals in each series were centrifuged at 1000 rpm. for 3 minutes and the supernatant centrifuged at 50,000 rpm. for 3 hours. The resulting sediments of each series were resuspended in 2 cc of saline and, after infectivity was established for each lot by the intracerebral in-
jection of 4 hamsters each with 0.06 cc, preparations were made for electronic microscopy. Then the virus from each pool was cultivated in eggs for several passages. Preparations were again made for electronic microscopy as before. In all series a few thin tail-like forms were found similar to those in allantoic fluid of egg-adapted NCD virus.

In another paper (57) it is reported that a 10% brain suspension of the 210th hamster passage inoculated into 2 monkeys (M. rhesus) intracerebrally produced typical symptoms in 4 and 9 days. A second passage was made in 3 monkeys and when 1 of these developed symptoms in 8 days a brain suspension of it was inoculated into 8 eggs of which only 1 died on the third day. In the second egg passage all embryos died within 72 hours. In the 7 passages made in eggs only a few virus particles were seen in each of the first 6 passages. Virus was demonstrated in eggs of the 7th passage and a pool of 60 cc centrifuged 5 minutes at 1000 rpm, the supernatant recentrifuged for 2 hours at 44,620 rpm and the sediment suspended in 3% saline, placed on parlodion-prepared screens, shadowed with chromium at arc tangent 1/8 showed virus particles with uniform tail-like structures, some round forms and several which appeared to have 2 heads connected by a filament. Other figures suggested that the virus particle might divide between 2 head-like forms to form 2 virus particles.

Five strains of virus obtained from Kentucky, Colorado, Connecticut, Minnesota and Delaware, which had already been passed 6 times in eggs were passed 6 more times. Fluid from the 12th passage of each strain was inoculated into 9 day old eggs and the harvested material identified as NCD virus by SN tests before preparing as described above for electron microscopy. The studies showed that all 5 pools contained many virus particles some of which had tail-like structures; a few filamentous forms were also seen. Morphologically the 5 strains were alike except that in the Connecticut strain the particles appeared less compact.

Lastly (61) a pool of the first and second bat-passed egg material examined under EMU electron microscope revealed virus particles with uniform tail structure. The tails appeared to be segmented.

RECOVERY IN VAPORS FROM FROZEN SUSPENSIONS

Stein and Rogers (18) placed various infectious agents in 1 cc quantities in ampoules (without cotton) and attached these to a lyophil apparatus which was evacuated at 50 to 10 μ on the Stokes-McLeod gauge. Vapors were condensed in a flask held at −78°C. Cultures of a cotton filter plug between the condenser and the pump, and of the oil in the pump, showed that infectious material was not present. The studies were carried out with several bacterial species and viruses, and, of the 6 viruses used, the only one recovered from the condensed material (distillate) was NCD virus.

VIABILITY

In a search for an antiseptic active against bacteria, but not against virus or tissue cells, Atanasiu (5) studied phenylmercuric borate which was already known to have no activity against the encephalitic group of viruses or fibroblasts, epithelial cells or macrophages. The agent was found to be non toxic for 11 day eggs in doses of
0.15 cc. The results of studies with fowl pox and vaccinia as against a fixed rabies and NCD viruses are very interesting. The fowl pox and vaccinia viruses were used in a dilution of $10^{-4}$ with equal quantities of the antiseptic diluted $10^{-4}$, $10^{-6}$, and $10^{-6}$ and held for 37°C. for 15 minutes prior to inoculation. In the case of pox, the $10^{-4}$ dilution of antiseptic killed all virus in experiments, the $10^{-6}$ dilution was also 100% effective in 4 out of 5 tests, but the $10^{-8}$ dilution was 20% and 50% effective in the 2 experiments. Against vaccinia, the $10^{-4}$ dilution was 100% effective in 4 experiments; the $10^{-8}$ dilution 70% and 80% effective in 2 of 4 tests and 100% in 2 of 4 tests. The $10^{-8}$ dilution was 50% effective in 1 test.

The rabies virus titered $10^{-7}$ and the antiseptic was used in $10^{-4}$ and $10^{-8}$ dilutions which were not toxic for mice. All mice inoculated with virus exposed to the antiseptic died of rabies in 2 experiments. Similarly the Var. strain of NCD virus used in $10^{-4}$ and $10^{-6}$ dilutions with the antiseptic in a $10^{-4}$ and $10^{-6}$ dilution was not affected. Thus, pox and vaccinia act like bacteria with reference to the antiseptic which kills E. coli in a $10^{-4}$ dilution.

In viability studies Prier and Alberts (19) prepared virus by grinding whole embryos dead from the 2nd to the 4th day after allantoic inoculation. One part of virus was mixed with 4 parts of 50% buffered glycerol (pH 7.6) prepared by dissolving 1.62 g. of anhydrous dihydrogen phosphate in 375 cc of glycerol (C.P.) and 350 cc of distilled water. Aliquots of 75 cc were placed in each of 9-500 cc rubber-stoppered bottles and 3 bottles each stored at 25°C, 3°-5°C and -17°C. Each of 3 strains of virus tested was treated in the same way, and as controls 20% embryo suspensions in buffered water (pH 7.6) in duplicate were held at 5° and 25°C. Viability was determined by inoculating 0.1 cc amounts into each of 3-10 day old eggs. Fluids of embryos dying from the 2nd to the 6th days were tested for HA. The virus was considered dead if the embryos lived for 6 days or if the fluids were negative to the HA test. The results showed that virus stored at 25°C was inactive by 114 days, and one sample was inactive at 80 days. Samples held at 5° and -17° were all viable at 353 days except one sample each of one strain held at 5° and one at -17°. The latter was contaminated with bacteria. The control samples held at 25° were inactive at 73 and 95 days, and those at 5° at 80 and 119 days, respectively.

Immunogenicity of vaccine of 3 strains held at 5°C was tested by vaccinating 15 chicks 13 weeks old by the "stick" method and challenging these 3 weeks later with 1 cc of a $10^{-8}$ dilution of California 11914 strain subcutaneously. Two of the 15 birds vaccinated with the B strain developed paralysis and of the 13 challenged, 80% survived. Of those vaccinated by the L strain none died incident to vaccination and all 15 survived challenge. Of the 15 vaccinated with the I strain 4 died incident to vaccination and 53.3% survived challenge. The survival of controls was 16.7%.

Fortner (66) reported that he and Dintner found that a 1% solution of Rohmul-tisept (23% active chlorine) killed NCD virus in 1–2 hours, that a 0.5% solution of Caporit (66% active chlorine) killed in 1–2 hours, that 2% formalin (0.8% formaldehyde) killed in 1–2 or 3 hours, and that a 3.5% solution of caustic soda did not kill in 2 hours.

In viability studies, Olesiuk (76) used the Massachusetts strain 9251 in the form
amnioallantoic fluid from the 87th passage as seed virus. Strips of burlap, paper and cotton cloth (1 x 2 inches) held in cotton stoppered tubes were infected with 0.5, 0.2 and 0.2 cc, respectively, of a 1:10 dilution of virus. One to 10 virus dilutions in broth at pH 7.2 and in saline at pH 7.8 were prepared, and 1 g. samples of mash (pH 5.7) and feces (pH 6.3) were infected with 1 cc of virus and held in rubber stoppered tubes. Two grams samples of egg shell (cork and cotton stoppered) and soil (pH 5.2) were infected with 1 cc of virus and the latter held in rubber stoppered and screw capped containers. Chick down stored in rubber stoppered vials was infected with 0.3 cc of virus, and eggs were inoculated with 0.2 cc of non-diluted virus.

In one trial at incubator temperature (37°C.) the shortest survival was less than 10 days (burlap, paper, and egg shells) and the longest 74 days (in eggs). In a second trial survival ranged from 2 (soil) to 126 days (eggs). At room temperature (20°-30°C) in one trial the shortest survival was 16 days (burlap) and the longest 235 days (eggs). In a second trial virus on the same materials survived for 9 and 196 days, respectively. In a hen house (−11 to 36°C.) the shortest survival was 108 days (burlap) and the longest 255 days (eggs and down). In the refrigerator (3°-6°C.) survival was 123 days (burlap) to 538 days (broth, feces, down and eggs), and in the deep freeze (−26°C.) all samples contained live virus at 538 days, the oldest samples tested.

VIRUS IN EGGS, EXUDATES AND EXCRETA

Walker and Powell (3) established infection in a group of 12 hens and 2 roosters that were HI negative, and in 6 chicks 6 weeks old in a separate unit by an intratracheal inoculation of 0.5 cc of a 10⁻⁸ dilution of virus. Symptoms appeared in 6 days, and the hens ceased production for 12 days and returned to normal in 70 days. Two chicks died on the 5th and 11th days. Throat and fecal swabs collected weekly were diluted in broth and prepared for egg inoculation by adding 600 units of penicillin and 200 micrograms of streptomycin per cc. Eggs were collected for 30 days but only twice weekly thereafter for 12 months, and a weekly HI determination was made on each bird. Two or 3 eggs were pooled from each collection for inoculation into eggs and the rest were incubated and candled on the 7th and 17th days. Pools of infertile eggs and dead embryos were tested for virus and the chicks that hatched were observed for disease. Each inoculum to be tested for virus was injected into eggs in doses of 0.2 cc, and fluids of typical embryos were tested for HA and inhibition by positive serum.

By this procedure it was shown that in both groups of birds virus was recoverable from throat swabs at 7, 14, and 21 days, but not at 29 days, but none was found in the feces at any period. Antibodies were found from 14 days on. No virus was found in fresh or infertile eggs or in dead embryos, and the chicks that hatched remained free of disease and some of them showed antibodies. Contact chicks were likewise free of disease and contained no antibodies. As evidence that the inoculated hens were not carriers, 6 serologically negative Rocks placed with them for 6 months beginning 6 months post inoculation showed no disease, developed no antibodies and their eggs were free of virus. At the time these birds were added one of the males was removed and put with 6 Rocks which, 5 weeks later, developed a respira-
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...tory disease, ceased production and one hen developed nervous symptoms. Although no virus was recovered from the hens or their eggs, antibodies appeared so that the authors believe the male was a carrier. Since this is the first evidence of a carrier state, and since 5 weeks elapsed before the disease appeared, it would seem wise to wait for confirmation.

Since Minnesota outbreaks seemed to be associated with the arrival of day-old chicks Zargar and Pomeroy (16) considered the possibility of live virus vaccine causing egg infection and hence hatchery infection. They recovered the virus from two commercial vaccines and produced amnioallantoic fluid for vaccine. Vaccine 1, in a 10^{-3} dilution, was applied by the stick method to 159 pullets and 20 cockerels, and Vaccine 2, in a 10^{-1} dilution, was given to 103 pullets and 7 cockerels in a dose of 0.5 cc subcutaneously. Representative samples of eggs collected daily were examined by egg inoculation after treating each cc of a 3 yolk dilution with 0.2 cc each of antibiotics (1,000 units penicillin and 0.5 mgs. streptomycin).

Vaccine 1 was recovered from eggs from the 2nd to the 9th day post inoculation. Of 41 fresh eggs, 28 or 68.2% yielded virus, and every egg examined from the 4th to the 8th day yielded virus. The eggs that were not examined during the 18 days post vaccination were incubated and the infertiles and dead embryos removed at 7 and 18 days. Virus was recovered from 19 (55.9%) of the 34 eggs produced from the 2nd to the 9th day after vaccination and removed on the 7th day. In the same period, no virus could be recovered from 35 dead embryos or infertile eggs from the 8th to 17th day post incubation. Although some of the chicks that hatched showed nervous involvement no virus was recovered from the 8 examined. Eight groups of 5 chicks (4-6 weeks) each inoculated with recovered virus resulted in a loss of 6 and virus was recovered from these. The survivors were immune to challenge with California 11914.

Of 32 eggs collected between the 3rd and 9th days from the flock given Vaccine 2, 20 or 66.7% yielded virus. Fifty-three eggs collected between the 3rd and 5th days were incubated after holding 8 days. Each day 2 eggs were removed and examined for virus which was found 5 times, that is, from eggs incubated 5, 7 and 9 days. Two fecal samples, collected on the 4th day after applying Vaccine 2, yielded virus and it was recovered from the shells of eggs laid on the 3rd to the 5th days. Of 40 chicks (4-5 weeks) given 0.2 cc of a 10^{-1} dilution of recovered virus, 4 developed paralysis and 2 died.

From the study the authors concluded that since virus occurs on the shell, hatcheries could be infected and the disease spread to distant points.

Hitchner et al (91) collected 2 dozen eggs daily for 10 days post vaccination with strain B1. Four pools of 6 yolk sacs each in 5 cc of broth were made from each collection and 3 eggs inoculated per pool. The vaccine virus was recovered from 1 of 4 pools of the 6th day pools, from 2 of 4 pools on the 7th day, and from 1 of 4 on the 8th day.

Doll et al. (21) were unable to demonstrate transmission to the chick from the artificially inoculated egg. Of 126 eggs inoculated in the yolk sac with 100 embryo doses of Ky. 2 virus and incubated, 43 were removed as infertile or dead embryos on the 9th day and 11 as dead on the 18th day. No examination for virus was made...
of the 59 removed. From the 67 eggs remaining, 40 chicks hatched which showed no symptoms during 3 weeks, were HI negative at 2 weeks and were susceptible to exposure at 4 weeks.

Two lots of 54 eggs each were given $10^4$ and $10^4$ embryo doses in the yolk using the Iowa 23131 strain. All eggs receiving the $10^4$ embryo doses were removed on the 8th day as infertile or dead. Those receiving $10^8$ embryo doses showed 48 infertile or dead on the 8th day. Two more died on the 9th, 1 on the 12th, 2 on the 14th and 1 on the 16th day. Virus was recovered from the embryos dying on the 14th and 16th days. In a second test with this strain 2 lots of 54 eggs each received $10^4$ and $10^4$ embryo doses in the albumen. Candled on the 8th day 44 were removed from the $10^4$ group as dead or infertile. Virus was recovered from 2 that died on the 19th and from 1 that died on the 15th day. Of the 54 that received $10^4$ doses, 47 were removed on the 8th day. One that died on the 15th day yielded virus. On the 19th day the 7 and 6 eggs, respectively, remaining from the $10^4$ and $10^4$ dose groups were inadvertently discarded.

In another trial the virulent GB Texas strain was inoculated into the albumen of 107, 110, and 110 eggs in doses of $10^4$, $10^4$ and $10^4$ embryo doses, respectively. On the 9th day 50, 67, and 77, respectively, were removed and virus was recovered from dead embryos of each group. It was also recovered from 3 dead on the 10th day in the $10^4$ group, but not from one dead in the $10^4$ group. Embryos dead on the 11th, 15th and 19th days in the $10^4$ group, on the 11th and 19th days in the $10^4$ group, and on the 13th and 19th days in the $10^4$ group failed to yield virus as did liver suspensions of 33 embryos which failed to hatch. The number of chicks hatched was 38, 23 and 22, respectively, of which 5 died during 6 days, but no virus could be recovered. The chicks showed no symptoms, were HI negative and susceptible to challenge at the end of 3 weeks.

In the last test the same strain was injected into the yolk of 40, 50 and 49 eggs in $10^4$, $10^4$ and $10^4$ embryo doses, respectively. On the 8th day candling, 37, 47 and 48 eggs were removed. One embryo each in the $10^4$ and $10^4$ group died on the 10th day, but no virus was recoverable. The remaining 15 embryos were alive on the 19th day. Five failed to hatch and were negative for virus. The 10 chicks showed no symptoms, were HI negative and susceptible to challenge at 3 weeks.

Thus, virus was isolated from embryos dead by the 9th day and from those dead on the 10th, 14th, 15th and even the 16th day of incubation, but not from a 19 day dead or those that failed to hatch.

Bivins et al. (30) examined eggs from a flock that had been injected intramuscularly with 0.2 cc of a 2% solution of amniocallantoic virus on November 18. Only a few eggs were examined during the phase of decline. Of 7 eggs laid 4 days post inoculation none yielded virus. Of 5 laid on the 5th day, virus was recovered from 4, but not from 1 examined on the 6th day. On the resumption of production 20 eggs were set about twice a week between the 27th and 77th day post inoculation. These were candled daily after the 3rd or 4th day of incubation and infertiles and dead embryos removed. Yolk collected from each infertile as well as liver suspension from each dead embryo was injected into eggs. Of the 96 non-contaminated samples of the 100 inoculated none yielded virus.
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HEMOLYSIS

Burnet (43) often noted in HA tests that mumps and NCD virus caused hemolysis, especially when cells were treated with virus in phosphate rather than in saline solution. When active virus was incubated with chicken cells below 30°C, adsorption, agglutination, elution, enzymatic destruction of the cell receptors and complete or partial stabilization of the cell occurred. At higher temperatures, according to the author, there is an irreversible adsorption of a portion of virus to the cell surface, with resultant phenomena of agglutinating normal cells, agglutinability of such cells by specific immune serum and by many sera of patients with infectious mononucleosis, hemolysis and an unduly great reduction in electrophoretic mobility.

The technic used by Burnet and Lind (42) in studying the character of hemolysis by Newcastle virus consisted of making dilutions of virus in 1 cc volumes of normal saline buffered with phosphate at pH 7.35. These were warmed to 37°C and 0.25 cc of a 5% red cell suspension added. If methanol precipitated virus was used incubation was for 1 hour, but with non-treated virus this was extended to 3 hours. The amount of hemolysis was determined by centrifuging the tubes and comparing the supernatant fluid with standard tubes showing 50 and 25% hemolysis or a hemoglobin determination was made by a photoelectric colorimeter. In another technic suitable dilutions of virus in phosphate were warmed to 27°C after which cells were added to make a final concentration of 1%. At intervals, samples were removed, chilled, spun rapidly and the hemoglobin content determined by a photoelectric colorimeter. Methanol precipitated virus caused hemolysis of human, guinea pig, sheep, ox, mouse, and pigeon cells to titers of 100 to 160, that is, dilutions producing 25% hemolysis of 1% cells in one hour at 37°C. Rabbit cells were not affected and horse cells only weakly.

Methanol precipitated virus or allantoic fluid virus heated to 54°C. or higher for 30 minutes caused the hemolytic action to disappear in parallel with the ability of the virus to make a firm union with the cell.

At temperatures below 30°C the rate of hemolysis by precipitated virus diminished and at room temperature amounted to only a trace after 20 hours. Non-hemolyzed cells washed in saline and tested for agglutination with normal saline resulted in agglutination of cells treated at temperatures at which no appreciable hemolysis took place, but these cells were not affected by immune fowl serum. Cells treated at temperatures which produced hemolysis and washed were then stable in saline, but were agglutinated by immune serum. Hemolytic curves showed a flat terminal portion indicating that hemolysis stops at a certain level—a phenomenon not due to an exhaustion of hemolytic activity, but to the development of resistance to hemolysis by the cells. Hemolysis by NCD virus was inhibited by agents which destroyed virus receptors of the cells. Experiments showed that with active precipitated virus initiation of hemolysis is virtually completed at an early period, that once started it required neither the presence of surface receptors nor a high incubation temperature. Reduction of hemolytic activity was observed in saline containing 0.1% calcium chloride. Confirming the report of Kilham it was found that immune fowl serum inhibited hemolysis in a titer corresponding closely with the anti-hemagglutinating titer of the serum.
F. R. BEAUDETTE

SERUM NEUTRALIZATION (SN) TEST

Cunningham (41, 75) used the sera of 100 SCW Leghorns aged 100 to 600 days maintained at the Regional Poultry Laboratory at East Lansing to get an index of the SN power of normal birds. On autopsy, 87 of the birds were normal, 8 had lymphomatosis (7 visceral, 1 neural), and 5 were affected by reproductive disorders. Equal quantities of serum and virus dilution were incubated 1 hour at room temperature and 5-10 day eggs were inoculated with each mixture in a dose of 0.1 cc. The l.d. 50 neutralization index (NI) was 0 for 52 sera, 10$^{8.1}$ to 10$^{10.4}$ for 47 sera and 10$^{10.4}$ for one serum.

The log 10 NI was 0 for 79 sera, 10$^1$ for 20 sera and 10$^2$ for 1 serum. Consequently, the author concluded that the l.d. 50 NI was more accurate than the log 10 NI for the evaluation of SN tests when 5 eggs were used per dilution.

MECHANISM OF AGGLUTINATION

French and Ada (9) reported that erythrocytes treated with an enzyme found in culture filtrates of V. cholerae are no longer agglutinable by viruses of the mumps-influenza group. The enzyme is referred to as a "receptor-destroying enzyme" (RDE), and during treatment of cells agglutinability for various strains of virus is lost in sequence to a pattern that is obtained when viruses are arranged according to the extent of their own enzymatic action on cells. The phenomenon has been termed the "receptor gradient." It is also pointed out that the progressive loss of agglutinability of human cells when treated with viruses or RDE is paralleled by a reduction in their electrophoretic mobility. Guinea pig cells behaved in the same fashion.

A highly purified form of RDE enabled in vivo study. The intracardial injection of 50,000 units of the enzymes, in 1 cc, into a guinea pig was well tolerated. The electrophoretic mobility of cells 24 hours later was from 1.11 to 0.33 μ/sec./volt/cm., thus removing the receptors for all viruses other than MIL in the series which included MEL, PR8, NCD, WSE, swine influenza, Lee and BEL. Cells of normal mobility (fast) first appeared in the peripheral circulation on the 4th or 5th day, but normality was not established until the 20th day.

Following the injection of enzyme, the titer of the serum inhibitor for heated influenza virus Lee fell sharply and did not return to its original level until 16-20 days. A sample from a guinea pig drawn a half hour after a transfusion of an equivalent of 6 cc of treated guinea pig cells contained 13% slow cells which dropped to 8% at 24 hours and to normal in 72 hours.

The rapid disappearance of the slow cells could be accounted for by assuming (a) that they are removed abnormally fast and replaced with normal cells, that (b) normal guinea pig cells have a life span of less than 20 days, or (c) that there is actually no destruction of treated cells, but rather a regeneration of virus receptors while the cells remain in circulation. After eliminating the first two hypotheses, the authors favored the third, that is, of surface regeneration.

In samples drawn at various times after the administration of enzyme (with the administration of an anti-RDE serum 24 hours after transfusion to neutralize the remaining enzyme) the agglutinability of cells by various viruses returned in an
order which was the mirror image of that obtained by the action of the RDE. Thus, the authors reasoned that if simple replacement of treated cells by normal cells was occurring, a uniform agglutination by each of the viruses would be expected since such a result is had when artificial mixtures of normal and treated cells of varying proportions are used.

Ada and Stone (12) studied the electrophoretic mobility of human cells after treatment at 37°C. with allantoic fluid preparations of influenza A or B, mumps, NCD or with the RDE of V. cholerae. Arranged in a gradient series on the basis of the average mobility ($\mu$/sec./volt/cm.) the pattern formed closely resembled that when the arrangement was based on the action of the various viruses themselves on the agglutinability of the red cells. The authors pointed out, however, that the mobility values for swine influenza and NCD viruses are considerably lower than expected on the basis of their position in the agglutinability gradient. With purified virus preparations, lower values were obtained for mumps which was interpreted as evidence of inhibitors for these strains in allantoic fluid.

Stone and Ada (14) treated human red cells at 37°C. to successive action of 2 of 2 viruses in a series that included the viruses of mumps, NCD, influenza A (MEL, PR.8, or BEL strains), influenza B (Lee or Mil), swine influenza or to the action of these followed by the RDE of V. Cholerae. After treatment the cells were tested for agglutinability with various viruses and for electrophoretic mobility in comparison with cells that had received a single treatment only with each of the agents tested. The results showed that the agglutinability of the cells after double treatment was the same as after treatment of normal cells with the second agent alone. Markedly lower mobility readings were obtained when cells were treated first with NCD virus and then with any virus other than swine influenza than with the corresponding second agent alone.

AGGLUTINATION OF MAMMALIAN CELLS

Winslow et al. (45) examined the HA ability of 31 strains isolated over a period of 15 years in the United States, Canada, England and Italy for cells of various animal species. Most of the strains had undergone 2 to 8 egg passages and 6 had undergone passages up to 60. In most cases, cells from 5 or more individuals of the species tested were used. When possible, cells were obtained from divergent types of a species. The virus sample represented a pool of 4–5 eggs and two dilutions (1–10 and 1–20) were used. Each tube contained 0.5 cc of virus dilution and 0.25 cc. of 1% suspension of cells. Incubation was at room temperature and readings were made at 30 to 45 minutes.

Cells of 5 species (man, guinea pig, mouse, dog and bison) were agglutinated by all virus strains. All samples of fox cells failed to be agglutinated by any strain of virus. The cells of the horse, cow, goat, sheep and elk were agglutinated by some strains, not by others, and inconsistently by still others. Comparative tests of 25 strains of virus on the cells of the horse, cow, goat and sheep showed that 6 strains agglutinated none, 13 agglutinated from 1–3, and 6 agglutinated the cells of all species.

The effect of pH on agglutinability of cells was investigated and was shown to have an influence in some species. Thus, the percentage of strains agglutinating
cow cells increased from 38 to 82% when the pH was decreased from 7.8 to 6 and agglutinability of sheep cells increased from 28 to 66%. The effect of temperature other than at 25°C, was not studied, and the number of egg passages had no influence in the case of 2 strains studied (5th-to 60th and 5th-to 55th).

HEMAGGLUTINATION INHIBITION (HI) TESTS

Doll et al. (58) made comparative tests on 158 sera of birds immunized by various strains (B1, Ky. 50, Ky. 127, Ky. 201 and GB), using the beta procedure with 5 and 10 agglutinating units of Ky. 127 virus in 0.25 cc amounts with 0.25 cc of serum dilution incubated 10 minutes at room temperature before 0.5 cc of a 0.5% suspension of cells was added. The tests were read at 45 minutes. The titer was not changed for 73 or 46.2% of the samples whether 5 or 10 units of virus were used. The titer was reduced 2-fold for 73 sera with 10 units as compared with 5, and 4-fold for 7 sera or 4.4%. A 2-fold increase occurred for 4 sera, and a 4-fold increase for one serum. The average titer with 5 units was 1-74, and with 10 units 1-53, thus not a strict quantitative relationship. For both concentrations of virus 92.4% were within 2-fold limits, and 96.8% fell within 4-fold limits.

Comparative studies were also made on 174 sera. In one series (beta) serum dilutions were made in saline, virus added and incubated 10 minutes before the addition of cells, and in the second (modified Salk) serial dilutions of serum were made in red cells and then the addition of virus. In this comparison complete inhibition at the 1-10 dilution was considered as positive. With this index, all the 174 sera were positive with the regular beta test and 154 (89%) positive with the modified Salk test. Of the 20 negatives to the modified Salk test, 13 had titers of 1-10, 5 had 1-20 and 2 had 1-40 with the regular beta test. Of the 154 causing complete inhibition at a 1-10 dilution or higher, 26 (16.8%) gave the same titer with both testing procedures. With the modified Salk test, the titer was reduced 2-fold for 79 (51.3%) sera, 4-fold for 28 (16.8%) and 8-fold for 10 (6.4%) sera. One sample showed a 2-fold increase in titer by the Salk test.

The average titer of the 154 samples which reacted positively to both tests was 1-945 for the beta, and 1-550 for the modified Salk procedure. Thus, there was good agreement in identifying positive samples when the diagnostic titer was 1-40 or higher with the beta procedure, but when sera inhibited at 1-10 or 1-20 by the beta test, the modified Salk test had an efficiency of 40%.

In a study of the HI values of normal serum Doll et al (15) used 0.25 cc of serum (2-fold dilutions beginning at 1-2.5) with an equal quantity of virus (5 agglutinating units) and incubated the mixtures at room temperature for 10 minutes before the addition of cells. The reading was made at 45 minutes.

Of 283 samples of chicks, from 1 day to 10 weeks old, 74.8% showed no activity or incomplete inhibition in a 1-2.5 dilution, 22.6% showed complete inhibition, and 2.6% showed complete inhibition at 1-5 dilution. All chicks were susceptible to a challenge, and it was concluded that chicks, from susceptible hens, either showing or having a history of a respiratory infection and giving complete inhibition at a 1-10 dilution probably indicates infection and complete inhibition at 1-20 is regarded as positive.

The HI response was studied in chicks vaccinated with B1 intranasal vaccine at
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1 day, 5 days and 5 weeks old. Considering inhibition in a 1–10 serum dilution as significant 7.8% reached this on the 6th day, 29.3% on the 7th, 43.7% on the 8th, 14% on the 10th and 4.7% on the 12th day, thus giving accumulated percentages for these days of 7.8, 37.1, 80.8, 94.8 and 100.

Two lots of 15 chicks 6 weeks old were exposed intramuscularly and intranasally, respectively, to the low virulence Ky. 90 strain. Positive titers were shown by 16.6% by the 6th day, 96.6% by the 9th day and 100% by the 12th day. In a similar test with the California 11914 strain none was positive on the 6th day, 63.3% by the 9th and all on the 12th day.

In order to follow HI and SN titers 60 chickens, 8 weeks old, were divided into 4 groups which were given 10⁶ embryo doses of Ky. 90 virus intramuscularly and intratracheally and California 11914 by the same routes, respectively. Of 56 samples collected 2 days before exposure only 2 gave SN of more than 10 embryo doses, 42 neutralized none and none of the same samples caused complete inhibition. Of 53 tested on the 6th day the SN range was 0 to 10⁴⁻⁸; 22 gave negative results; 11 neutralized less than 10; 9 neutralized > 10 but < 100, and 11 neutralized 100 or more but < 1000. At the same time 48 of the 53 were HI negative, and the titers for 1, 2 and 2 were 1–5, 1–10 and 1–20, respectively.

On the 9th day SN titers ranged from 10³·¹⁶ to 10⁴·⁵ for 39 chickens, with only 2 below 10⁴, but HI values varied from incomplete inhibition with non-diluted serum to 1–640. The Ky. 90 virus, however, administered by either route produced HI titers of 1–20 or higher in all chickens. The California virus intramuscularly, however, gave HI ranges from complete inhibition with non-diluted serum to 1–40, but only 8 of 13 were HI positive at 1–20 or higher. Administered intratracheally, the California strain elicited less response with a range of no inhibition with non diluted serum (6 samples) to complete inhibition in 1–20 (6 samples).

The HI values of tests from the 12th to the 42nd day varied from 1–20 to 1–2560 with greater average responses with Ky. 90 than with California 11914. Also, the response was somewhat lower to intratracheal than to intramuscular administration. There were no appreciable differences in SN titers for this period. In 80 tests containing 1–9 samples each no correlation could be established between HI and SN titrations.

On the basis of these tests the authors concluded that an SN titer of 100 or more may be regarded as evidence of existing infection or previous experience with the disease, but titers of more than 10 but less than 100 may be questionable. The authors observed that HI antibodies persisted for only a short period following either method of exposure, but developed at the same rate. The duration of response, however, was much longer with the more pathogenic strains and these produced higher average titers in similar groups. Usually B1 vaccinated chicks lost sufficient titer in different age groups to be classed as negative in 30 to 70 days. B1 vaccinates responded more quickly to a challenge than susceptible chicks, the former showing a response on the 5th day with a rapid increase through the 8th, whereas susceptibles did not show a significant titer until the 8th day and the rapid increase from the 9th to the 12th day.

The authors point out that the rate and height of the HI response after the second experience with virus is of value in determining the susceptible status of
chicks used in immunization experiments, that chicks having a yolk-transferred immunity show no symptoms when challenged with low-virulence virus and develop a low and transient HI response, but when rechallenged some weeks later they show an anamnestic response characteristic of chicks which have had previous experience with the virus.

The HI antibody content of eggs laid from 105 through 120 days after a natural outbreak was determined as well as in serum samples collected at the beginning and end of this period. The average HI titer on 266 eggs was 7.82 with a variation for eggs of individuals from 2-to-16 fold. The average serum titer was 1-230 at the beginning and 1-96 at the end of the egg collecting period with an average of 1-159.4. There was a close overall agreement between yolk and serum titers.

Hanson et al. (36) gave each of 6 hens 5 cc of formalin-inactivated NCD virus intravenously and 4 days later found HI and SN values of 20 and 10^4 respectively. A peak of 80 and 10^4 was reached at 8 days after which the HI titer decreased and was negative at 6 weeks at which time the SN titer was still 10^4. In 3 of 4 birds SN titers of 10^4 or greater could be demonstrated as long as 6 months. On the other hand 6 hens given 1 cc of live virus all had high SN titers 6 months later but only one retained an HI titer. In one bird a peak SN titer of 10^4 was recorded after HI could no longer be demonstrated. In field trials with 3 commercial live virus vaccines about 5% of 51 sera were negative in HI tests 6 months later and 20% had very low titers.

By fractionation of a pooled serum sample of 2 cows immunized with formalin killed virus it was shown that HI and SN activity may be a function of separate antibodies. The various fractions were reconstituted in phosphate buffer pH 7.2 in a concentration equal to that in which they existed in whole serum. On separation of the serum into supernatant and crude globulin and the latter into gamma and beta globulin, SN and HI antibodies remained unaltered in both crude and gamma globulins but neither was found in the beta fraction. When the gamma fraction was separated into gamma 1 and 2, SN and HI antibodies were found in the former but only SN antibodies in the latter. Finally, of the subfractions of gamma 1, gamma 1^a was inactive while gamma 1^b showed only SN activity.

**PARENTAL IMMUNITY**

Alberts and Millen (28) studied the duration of parental immunity after observing 4 outbreaks of NCD in chicks from flocks vaccinated with live virus 5 to 8 months previously. In 2 outbreaks the losses were less than 15% but in 2 others they were 44 and 62%, respectively. The tests were made on 100 day old chicks from each of 20 pullet flocks vaccinated by 1 of 3 commercial live virus vaccines. The chicks came from 4 hatcheries and were selected from 537 flocks on which HI determinations had been made and on which dates of vaccination were known. The University flock which had had the disease at 8-12 weeks of age was used as a naturally recovered flock to supply eggs 7 months later. Finally, a flock known to be susceptible by an HI test done 3-7 days before eggs were collected served as a control.

Chicks were challenged with a 10^{-9} dilution of California 11914 strain (egg titer 10^{-9}) administered by the wing stick method. The survival rates of chicks in lots of
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282 to 513 from vaccinated flocks challenged at 1, 7, 14, 21 and 28 days were 91, 87.4, 77.2, 55.3 and 35%, respectively. Lots of 20 to 50 chicks from a recovered flock challenged at approximately the same intervals gave survival rates of 96 to 100% for chicks to 17 days of age, 82% at 21 days, and 53.6% at 28 days. And, lots of 25 to 101 susceptible chicks challenged at 1, 7, 14, 21 and 28 days gave survival rates of 12, 10.9, 10.2, 16.5 and 21.1%, respectively.

Chicks from flocks vaccinated with 3 different commercial vaccines were challenged at 7, 14, 21 and 28 days of age. Vaccine 2 gave the best results with survival rates, for the ages mentioned above, of 90.2, 81.6, 60.4, and 38%, respectively, as against 87.2, 76, 47 and 37.7% for vaccine 1, and 80, 70, 48 and 17.2%, respectively, for vaccine 3. A challenge of lots of 19 to 26 chicks from flocks vaccinated 3 to 7 months previously failed to show a relation between time of adult flock vaccination and resistance of the chicks.

Doll et al. (89) challenged chicks at 1, 2 and 3 weeks of age intranasally with the KY. 50 strain. The chicks were from eggs laid 256 to 270 days after a natural outbreak in the parent stock which, at the end of egg collection, still had an SN titer of 10^4. The loss from death and/or paralysis was 2.5, 2.5 and 0.0%, in lots of 77, 78 and 20 chicks, respectively, at 1, 2 and 3 weeks of age. The 22 controls, 34 days old, suffered a loss of 31.7%. An intramuscular challenge of similar chicks (but hatched from eggs 286-305 days post infection) and with the more virulent GB strain caused losses at 1, 2 and 3 weeks of age of 22.6, 86.8 and 100%, in lots of 31, 38 and 29, respectively. All of the 36 controls 28 days old died.

In contrast, a flock vaccinated at 4 weeks of age with B1 intranasal vaccine supplied eggs 180 days later from which chicks were hatched and of 24 challenged intramuscularly and 36 intranasally at one day of age all died or had paralysis. The loss in 63 chicks in contact with these was 93.7%. Even when vaccination with B1 was delayed till 4 months of age and the eggs from which chicks were hatched were collected 103 days post vaccination they showed little resistance to a challenge with the GB strain at 7 days of age. Of 36 challenged intramuscularly 91.6% developed paralysis or died and of 35 challenged intranasally the loss was 76.1% and 73.9% in the 115 chicks in contact with the inoculated. In a fifth trial the parent stock had been vaccinated with B1 at 10 weeks of age and the chicks were hatched from eggs collected 150 to 190 days post vaccination. At 1 day of age 100% of 20 challenged intramuscularly, 95% of 20 challenged intranasally and 41.6% of 60 contacts died or had paralysis. Challenged at 7 days of age the loss was 95% of 20 challenged intramuscularly, 75% of 20 challenged intranasally and 41.6% of 60 contacts. At 14 days of age the loss was 95% of 20, 75% of 20 and 41.6% of 60 challenged, respectively, by intramuscular and intranasal injection and contact. The 36 controls challenged intranasally at 35 days of age suffered a loss of 100%, and in 25 contacts (25 days old) the loss was 90%.

In 3 additional experiments the parent stock had been vaccinated by the stick method. In the first of these, vaccination was at 4 months of age and the eggs supplying the chicks were collected 120-150 days post vaccination. The loss in the day old group challenged with GB was 70% of 20 challenged intramuscularly, 40% of 20 intranasally and 35.9% of 64 contacts. At 7 days of age the loss was 75%
of 20 intramuscularly, 65% of 20 intranasally and 57.3% of the contacts. And, at 14 days, the loss was 65% of 20 challenged intramuscularly, 30% of 20 intranasally and 39.9% of the contacts.

In a second trial the stick vaccine was applied at 6 months of age and 258 (or 268) days later eggs were obtained to supply the chicks which were challenged at 5 days of age with the GB strain. The loss was 100% of 20 challenged intramuscularly, 90% of 20 challenged intranasally and 64.5% of the contacts. This trial in comparison with the previous one would suggest that the longer period after vaccination (8-9 months compared with 4-5 months) at which eggs were collected to supply chicks might account for the greater loss at various age levels. In one part of the next experiment, however, the parent stock had been vaccinated at 6 weeks by the stick method and the eggs collected for chicks 210 days post vaccination, but the same strain (GB) used to challenge the chicks at 5 days of age resulted in a loss of only 40% of 20 challenged intranasally, 65% of 20 intranasally and 15.6% of the contacts. Chicks from eggs of the same flock laid 224 days post vaccination, but challenged with the Ky. 157 strain, suffered a loss of 55% of 20 challenged intramuscularly, 30% of 20 intranasally, and 20.5% of 63 contacts. Again, chicks from eggs of the same flock laid 258 days post vaccination challenged with Ky. 127 strain showed 10% loss of 20 challenged intramuscularly, 0.0% of 18 intranasally and 4.7% of the contacts. The same strain, that is Ky. 127, inoculated into susceptible chicks 5 days old produced a loss of 65% of 20 challenged intramuscularly, 70% of 20 intranasally and 33.7% of 62 contacts.

EFFECT OF PARENTAL IMMUNITY ON CHALLENGE AND RECHALLENGE

Doll et al. (88) recorded losses of 2.5, 2.5 and 0.0% in chicks from a naturally recovered flock (SN titers of 10⁶) when challenged with the Ky. 50 strain at 7, 14 and 21 days, respectively. A rechallenge with the virulent GB strain 48 days later showed 55, 79 and 95%, respectively, immune. The prejudicial effect of parental immunity is here clearly shown. Thus, at a young age, (7 days for example,) the parental immunity is strong and neutralizes most of the challenging virus (Ky. 50) so that little free virus is left to stimulate an active immunity—in this case, only 55% were immune to rechallenge with GB virus. In contrast, the challenge at 21 days with Ky. 50 found most of the parentally acquired immune bodies exhausted so that the challenge virus was free to stimulate an active immunity, hence, on rechallenge with GB virus 95% were found to be immune.

IMMUNIZATION

Live Virus

Zargar and Pomeroy (16) made observations on 2 commercial vaccines. Vaccine 1 was applied in a 10⁻⁴ dilution by the "stick" method to 159 pullets and 20 cockerels. Twelve birds developed paralysis or leg weakness and the flock returned to normal in 45 days. Production dropped from 71 to a low of 14% and was still at 39% 4 weeks after vaccination. Egg quality was affected and weak or soft shells, or eggs without shells were laid as well as eggs with abnormal shapes and/or of white color. The albumen was more fluid. Egg color and texture returned to normal when
the flock returned to normality. Fertility dropped from 95.7 to 85.3% during 8 days when virus was recoverable, and to 75.1% during 9 days beginning 11 days post-vaccination. For the same periods, hatchability dropped from 55.6% to 36.5% and to 33.3%. The authors point out that some of the loss in fertility, and hence hatchability, was probably due to inactivity of the cockerels.

Vaccine 2 was administered in a $10^{-1}$ dilution subcutaneously in a dose of 0.5 cc to 103 pullets and 7 previously vaccinated cockerels. The birds showed respiratory symptoms, loss of appetite and diarrhea and returned to normal in 30 days. Production dropped from 48% to a low of 5% and returned to 30% by 30 days. Egg quality was disturbed about the same as described above. Fertility and hatchability were 84.2 and 70.4%, respectively.

Olson et al. (22) applied 2 commercial vaccines by the stick method to the flocks of 5 commercial hatcheries. Blood samples were drawn from 8–10 days before and 20–80 days after vaccination, pooled and tested as a single sample by the HI test. In all, 255 flocks were vaccinated of which 24 or 10.3% had HI values greater than 40 before vaccination. After vaccination 163 of the 255 flocks (64%) had a titer greater than 40, and 92 showed titers of 40 or less. A retest of 61 of the 92 flocks showed a titer of more than 40 in 45 flocks. Thus, considering the recheck, 81.6% of the flocks showed a significant titer after vaccination.

No difference was found in the titer in relation to the time the sample was collected in relation to vaccination. Of 63 samples collected 30–39 days after vaccination 63% gave significant values and of 19 samples collected 60–69 days post-vaccination, 63.2% had significant titers.

Mortality incident to vaccination varied with age and in birds vaccinated between 2–4 months (20,841) the loss was 0.64%; in those done between 4–6 months (13,838) it was 0.4%, and 1.2% in 8918 done between 6 and 30 months of age.

The effect on egg production was studied in 76 flocks. Of 35 flocks 4–6 months old and just beginning production, 51.4% showed no change; 22.9% a slight decrease; 14.3% a moderate decrease and 11.4% a marked decrease. Of 41 flocks 6–30 months old and in good production, 21.8% showed no change; 4.9% a slight drop; 7.5% a moderate drop, and 54.8% a marked drop. Strangely enough, no correlation could be shown between pre- and post-HI titers with marked changes in egg production.

An opportunity to observe spread of infection from vaccinated birds was afforded on 4 farms each of which had separate flocks, but the disease did not spread to non-vaccinated birds as determined by serological tests. Separate caretakers were provided, however.

Fifty-one shipments of chicks were diagnosed as NCD during the spring and summer of 1951, of which 14 were from 3 of 5 Nebraska vaccinated hatcheries; 17 were from non-vaccinated Nebraska flocks and 20 were from out-of-state flocks with unknown vaccination history. Of 12 shipments from one Nebraska vaccinated hatchery, 9 developed the disease within one week after delivery, and of the 9, 5 were day olds and 4 were started chicks 7 to more than 14 weeks old. The 3 remaining flocks developed the disease after being on the buyer's farm more than a week. The remaining 2 shipments from separate Nebraska vaccinated hatcheries concerned shipments that acquired the disease a week or more after delivery.
Of the 17 infected shipments from non-vaccinated Nebraska hatcheries 10 got the disease within a week and 7 not until a week or more after delivery. Finally, of 20 infected shipments of out-of-state origin, 14 acquired the disease within a week and 6 not until a week or more after delivery. Thus, of the 51 infected shipments, regardless of vaccination of parent flocks, 33 acquired the disease within a week after delivery. No reduction in mortality was noted in chicks from vaccinated stock, and in 30 outbreaks the disease spread to other flocks in 27 cases.

Hitchner et al. (91) reported that 2 flocks vaccinated by the stick method with Van Roekel’s strain have been tested for SN antibodies and found to be solidly immune—the last tests were made 43 and 38 weeks post vaccination.

Kaschula (37) reported on experiments made on Robben Island in S. Africa with the New Jersey Roakin strain. The strain was first used on half the birds on the island, that is, 1300 in 49 flocks. After 4 months HI tests failed to show any spread of infection to non-vaccinated flocks. In one small flock of 28 birds 8 were vaccinated and allowed to run with the others which were still HI negative after one month. In another flock of 80 birds 2 hens, each with 15 chicks, were vaccinated and failed to spread the disease to the chicks.

In laying birds a drop in egg production began a week after vaccination and reached 20% of the original production with complete recovery usually in 4 weeks. Six cases of incoordination developed, but recovered and 8 birds died during the 3 weeks post vaccination. The vaccinated birds resisted a challenge with Cape and Natal strains. Because of possible spread of the disease by free-flying birds the author believes that vaccination offers the best means of prevention.

Beaudette (50) reported that flocks experimentally vaccinated in the spring and summer with the Roakin strain were not affected during the 1948–49 season or during the serious outbreaks of 1949–50 except in 2 flocks. Other flocks vaccinated by poultrymen or crews in 1949 suffered a loss in production by about one-half during the winter of 1949–50. Investigation of a few trap-nested flocks showed that the reduction did not affect all birds equally, that about half the birds maintained full production and the others fell to near zero. At least some of the “breaks” could be charged to faulty vaccination practices, particularly to stretching dosage. It was pointed out that during the 2 previous vaccination seasons the loss incidental to vaccination was usually low, and when higher than normal was usually associated with some intercurrent disease, but that during the past season some higher than normal losses were experienced that were not associated with an intercurrent disease.

Because of the several “breaks” in 1949–50, many poultrymen revaccinated before housing in 1950. In consequence of faulty vaccination practices in 1949, the 1950 chick crop had a low grade parental immunity resulting in outbreaks in chicks at an early age. About this time intranasal vaccine became available and was used because it was recommended for chicks which enjoyed parental immunity or not. Experience showed that many flocks so vaccinated suffered “breaks” at 6–8 weeks of age, and, delaying vaccination to 10 days of age did not prevent breaks.

**LIVE VIRUS**

*(Intranasal)*

Doll et al. (13) compared the HI response of susceptible chicks of 5 days and 5 weeks of age each to an intranasal and intramuscular dose of 0.05 cc of non-diluted
B1 virus. The HI titers of 5 week old chicks inoculated intramuscularly were < 1/40 except in 2 birds, and the majority did not exceed 1–10, whereas intranasal instillation resulted in titers of 1–40 to 1–640 by the 12–15th day and which receded by the 15–18th day. The response in 5 day old chicks was similar for both routes, being somewhat higher in the intranasal group, but not exceeding 1–160, hence, less stimulation by the intramuscular route. The 5 day olds were refractory 30 days later and 5 week olds were immune 21 days later to 10⁴ embryo l. d. 50 of the Ky. 50 strain. Since the 5 week olds vaccinated intranasally showed no symptoms on challenge and the intramuscularly vaccinated did, it was concluded that the former route produced a stronger immunity.

The HI titers persisted at 1–10 for relatively short periods and fell to < 1–2.5 to 1–10 in 4–5 weeks; in some it persisted at 1–40 to 70 days. Chicks vaccinated at 3 weeks of age had slightly higher titers than those done under 1 week of age. Comparing chicks vaccinated at 1 day and at 5 weeks of age the HI titers were much higher in the older chicks. These appeared earlier and were present at a higher level during the 30 days of observation, and it was concluded that if HI antibodies paralleled protective antibodies vaccination should be more satisfactorily accomplished in the older chicks.

In order to evaluate the protective action of B1 vaccine 59 two day old chicks were vaccinated and placed with 57 controls and 60 chicks inoculated intranasally with Ky. 50. Exposure was permitted 20 minutes after vaccination. All of the 60 inoculated died, 94.7% of the controls and 78% of the vaccinates.

In order to determine the influence of age at time of vaccination on rate of development of immunity, chicks were vaccinated at 2, 9, 16 and 30 days and challenged at 2, 4, 6, 7 and 8 days post vaccination. Vaccinated at 2 days no protection was shown at 2 days, 80% at 4 days, and 90% at 6, 7 and 8 days. Vaccinated at 9 days, chicks showed 33% protection at 2 days, 90% at 4 days, and 100% thereafter. Vaccinated at 16 days, 50% showed protection at 2 days, and 100% thereafter, excepting 80% at 6 days. Those vaccinated at 30 days showed no deaths on challenge, but 2 challenged at 2 days and 1 at 4 days developed nervous symptoms. The challenge virus was Ky. 50.

Reaction to vaccination varied with age and lots. Done at 4–5 days sneezing, deep labored breathing, hoarseness and rattling was present in nearly all chicks. Mortality varied from 1–10% in chicks 1–3 days old with an average loss of 5% for the first 2 weeks, and, in some lots some chicks grew poorly so that at 4–5 weeks an equal number could be classed as runts. In chicks 5–7 days old the less severe respiratory symptoms affected nearly all and the loss was usually under 3%. The respiratory symptoms were slight and transient in chicks 2–3 weeks old and vaccination at 4 weeks produced extremely mild respiratory symptoms. Vaccination of layers resulted in a drop of 20–50% with resumption of normal production in 2–4 weeks, and hatchability was reduced by 40% from the 4–10th days.

Chicks vaccinated at 1 day to 5 weeks were challenged with Ky. 50 (50% fatal for 3 week chicks) and the Texas GB strain (80% fatal for 7–8 week chicks) by various routes. One of 90 vaccinated at 1 day died on challenge at 40 days with Ky. 50. None of 2 lots of 20 vaccinated at 8 days and 3 weeks, respectively, died when challenged at 10 and 7 weeks, respectively. One of 30 vaccinated at 7 days developed torticollis on challenge at 7 weeks with the GB strain intramuscularly, and other
groups vaccinated at 5 days to 5 weeks were refractory to the same challenge 3 to 7 weeks later.

Chicks vaccinated at 8 days and at 3 weeks showed HI titers at 10 weeks of 1–2.5 to 1–40 and 1–2.5 to 1–10, respectively, and in both groups SN titers of $10^4.5$.

It was pointed out that the interpretation of challenge experiments has been made on refractivity to lethal infection, but that birds that had lost HI titer showed symptoms, and those of low titer exhibited an anamnestic response more rapidly than susceptible chicks. Chicks with HI values, however, showed no symptoms and no anamnestic response.

Day old chicks from eggs obtained 6 months post vaccination with B1 done at 18–28 days of age had no parental immunity as shown by a 100% death and paralysis rate in 23 challenged intramuscularly, and 35 intranasally with the GB strain, while 93.7% of 58 contact chicks died. Similarly, chicks challenged at 1 week of age from eggs collected 4 months after intranasal vaccination done at 10 weeks of age resulted in death or nervous symptoms in 76.1% of 35 challenged intranasally, and 91.6% of 36 challenged intramuscularly, and 73.9% of 115 contacts.

Whereas the above report concerned chicks from susceptible breeders another by Doll et al. (26) was based on tests with chicks from a flock recovered from a natural outbreak 50 days previously. Chicks vaccinated at 3 days of age intranasally and intramuscularly with 0.05 cc of B1 vaccine failed to show marked differences on periodic HI tests except that the intramuscularly vaccinated had somewhat higher titers than the non-vaccinated, and the intranasally vaccinated higher than the intramuscularly vaccinated. Challenged at 34 days intratracheally with 0.1 cc of Ky. 50, both groups of 29 and 26, vaccinated intranasally and intramuscularly (the former showed respiratory symptoms), were immune, while 7 controls died and the others were severely ill.

In another test, chicks from a flock recovered 6 months previously (SN titers $10^4$ or more) were vaccinated at 2 and 9 days. Challenged intramuscularly 31 days post vaccination with GB virus produced death, paralysis and/or nervous symptoms in 60.8% of the 23 vaccinated at 2 days in contrast with 35.7% of those vaccinated at 9 days, and 100% in the controls.

The prejudicial effect of parental immunity on immunization was also shown when chicks of the same source were vaccinated at 1, 2 and 3 weeks of age with 0.05 cc of the Ky 50 strain intranasally which killed 30% of the controls (7 weeks old), but only 2 of 77 one week old, 1 of 78 two weeks old and none of 20 three weeks old. Then, 48 days after the exposure the survivors were challenged with the virulent GB strain intramuscularly. Of the 70 exposed at 1 week 45.7% died or showed paralysis and/or nervous symptoms; of 75 exposed at 2 weeks 21.3%, and only 5% of 20 exposed at 3 weeks. And, of 35 controls (7 weeks old), 100% died or showed paralysis and/or nervous symptoms. In other words, exposure of chicks from immune hens at 1, 2 and 3 weeks of age immunized 54.3, 78.7 and 95%, respectively.

Birds vaccinated intranasally at 10 weeks of age with B1 virus supplied day old chicks 5 months later for intranasal exposure to 0.05 cc of Ky. 2, a strain of unknown pathogenicity. All of the 75 showed respiratory symptoms, 8 died and 3 developed nervous symptoms in the following 21 days. When the chicks were 54 days old 35
were challenged intranasally with GB and 2 died on the 4th day. Another group of the same chicks exposed to contact infection with chicks inoculated intramuscularly and intranasally with GB resulted in 45% deaths. Of the survivors, 24 were exposed intranasally to GB at 51 days of age and none died or showed evidence of infection. The same dose given to 54 susceptibles 9 weeks old resulted in 46 deaths, 4 with nervous symptoms and 4 sickened but recovered.

In a further report Doll et al. (31) recorded the results of vaccinating susceptible chicks at 3 weeks of age intranasally with 0.05 cc of the B1 strain. At 11 weeks of age (8 weeks post vaccination) 15 chicks were inoculated intranasally with the GB virus and 3 placed in each of 5 compartments of an 8 compartment battery. In 4 of the same compartments 3 vaccinated chicks and in the 5th 2 vaccinated chicks were placed for exposure by direct contact. In the 3 remaining compartments 7, 7 and 6 vaccinated chicks were placed to be exposed to air-borne infection. All vaccinated chicks developed significant titers (1-80 to 1-640) after vaccination but 6 weeks later these fell to < 1-10 to 1-80. The average titer of the 15 birds to be challenged intranasally was 16, 2 weeks before the challenge. This fell to 6 on the 4th day post challenge, began to rise on the 5th day and reached an average of 1280 by the 10th day. The 14 chicks exposed to the above chicks by direct contact had an average titer of 10, 2 weeks before exposure. This fell to 3 on the 4th day post exposure, began to rise on the 5th day and reached 1190 on the 10th day. The 20 chicks exposed to air-borne infection had an average titer of 6, 2 weeks prior to exposure, and, as might be expected, did not begin to rise until the 7th day post exposure to reach an average of 508 by the 10th day.

In contrast to the above, 2 groups of 19 chicks each vaccinated at 3 weeks as above, but, instead of exposure to active virus, were given 0.1 cc of formalized GB vaccine intranasally and intramuscularly, respectively. Two days before administration of the inactivated vaccine the average titers were 6 for the intramuscularly inoculated and 15 for the intranasally inoculated chicks and at 10 days post exposure to dead virus the average titers were 36 and 28, respectively.

None of the inoculated chicks or those exposed by direct or indirect contact died, but 34 of 35 non-vaccinated controls (7 weeks old) died after challenge. Virus was recovered from tracheal swabs of vaccinated intranasally-challenged chicks on the 3rd day, from those in direct contact on the 4th day and from those exposed to air-borne infection on the 4th and 5th days.

The authors reason from these results that the anamnestic response following intranasal challenge of B1-vaccinated chicks results from reinfection of respiratory epithelium and that fatal systemic infection is prevented by circulating antibodies and conclude that reinfection is not serious as a cause of morbidity or mortality, but that it may have implications in the epizootiology of the disease. In data to be published the authors report that: (a) chicks vaccinated intranasally at 1 day have been infected 40 days later with Ky. 50; (b) those vaccinated at 3 weeks have been infected 7 weeks later with B1; (c) but those vaccinated at 5 weeks have not been infected 4 weeks later with Ky. 50; and (d) those vaccinated intramuscularly at 5 weeks showed serological evidence of reinfection 18 days later with Ky. 50 administered intratracheally.

In a general article Hitchner et al. (91) state that parental immunity is so vari-
able that chicks often contract NCD before reaching an age to be vaccinated with the more potent "stick" vaccines and that such vaccines depress production so that many poultrymen hesitate to start a vaccination program. For these reasons, they argue, the relatively avirulent B1 vaccine fills the voids left by other live virus vaccines. They admit, however, that with low virulence vaccines there is some sacrifice in duration of immunity and also that vaccination at a young age is at some sacrifice to a better response, and finally, that parental immunity offers some interference.

In order to demonstrate the inadequacy of parental immunity in day old chicks from breeders vaccinated by the stick method lots of 10 to 40 chicks were challenged intranasally with 0.05 cc. of Calif. 11914 strain. The breeders had been vaccinated 18, 23, 27 and 42 weeks previously and the death or nervous symptom rate in chicks challenged at these periods was 23, 47.6, 60 and 42.5%, respectively, as compared with 100% in 20 controls.

Vaccination of layers was recommended when: (a) the flock is threatened by infection from chicks on initiating a vaccination program; (b) or threatened by a natural outbreak on the premises or nearby; and (c) in attempting to check losses in a vaccinated flock suffering a break. The effect of vaccination on layers depended on the rate of lay. In flocks beginning to lay production remained stable for about 2 weeks, but done at the peak of production a drop of 10 to 20% was observed. The use of B1 vaccine is cited in the case of a flock suffering a break and in which 31% of the samples in a non-affected pen were HI negative. Vaccine was applied to 38 pens with the result that only the 2 pens adjoining the affected pen became affected. Four weeks post vaccination all of 200 samples from vaccinated pens (100 from the pen previously showing 31% positive HI reactions) gave positive HI reactions. The authors also cite that 25 random samples from a B1 vaccinated hen flock 95 and 159 days later gave 95% positive SN reactions at each sampling, and 15 samples at 264 days gave 100% positive reactions.

Parentally immune chicks that had been vaccinated at 1 to 42 days were challenged at 14 to 78 days post vaccination with the Calif. 11914 strain intranasally. Of 130 tested, 33.8% were positive and 66.2% negative before challenge. Of the 86 negatives 86% were HI positive by the 6th day post vaccination. The authors point out that judgment based on humoral antibodies would result in condemnation of the intranasal method, and also, that an intravenous challenge is a measure of humoral antibodies and gives poor results for intranasally vaccinated chicks. Thus, when 100 chicks 39-77 days post vaccination were challenged intravenously with 500 chicks lethal doses (titered in 6 week old chicks) 80% developed paralysis. The immunity in intranasal vaccinated chicks is accounted for by assuming that it is a tissue immunity of respiratory epithelium and that, therefore, an intravenous challenge by-passes the first line of defense. It is then argued that when the first line of defense is attacked—as in natural exposure—the bird's defenses are stimulated to greater activity as manifested by the anamnestic response.

Then, in 2 experiments it was shown that there was a difference in the response to intranasal and stick methods of administering the B1 virus. These tests were made on 14 week old birds which were bled and challenged with 0.5 cc. of California
11914 virus intravenously. Of 11 vaccinated by the nasal route all were HI and SN positive and resisted the challenge. Only 3 of 11 vaccinated by the stick method were HI and SN positive and survived. One of 4 non-vaccinated controls survived. In the second trial 12 of 14 vaccinated intranasally, 2 of 14 vaccinated by the stick method and none of 4 controls survived the challenge. This experiment is cited to show that a low virulence virus applied to an alien tissue does not give the same response as when applied to the natural portal of entry. The authors concluded that life-long immunity might be better realized by a combination of low virulence strain vaccine in chicks followed by a more potent virus during the growing period. They do not recommend revaccination in broiler stock.

Markham et al. (90) see no reason for delaying vaccination of chicks to 7 to 10 days because to do so is to sacrifice 2 of the advantages held for the intranasal method, namely, economy in handling chicks and an earlier immunity. They demonstrated some susceptibility in parentally immune chicks by inoculating lots of 25 chicks 6 days old with $10^3$, $10^4$, $10^5$ and $10^6$ embryo doses of Isle virus intramuscularly with an overall mortality of 47%. A lot of 100 chicks from the same source and 100 from a susceptible source were vaccinated at 4 days of age and challenged 2 weeks later with a survival percentage of 77 and 74, respectively, and, a survival of 33 and 17% of the controls for the two groups.

In another trial 2 day old immune chicks were vaccinated intranasally with B1 and challenged 21 days later. A prevaccination pool of 12 samples gave an HI value of 512 and 9 tested 3 weeks after vaccination showed 7 negative, 1 positive at 1–4 and 1 at 1–8. Of the 6 challenged with GB virus intranasally 1 died as against all of the 11 controls. Four weeks later 4 of the survivors were again given the same challenge along with 27 controls. The vaccinated survived with no symptoms and 24 of the controls died.

Chicks from a known immune flock were vaccinated on the day of hatching and at 2 and 4 days of age with B1 intranasally and challenged with GB virus in a $10^{-8}$ dilution either 0.05 cc. intranasally or 0.25 cc. intramuscularly. At 22 days (vaccinated at 1 day), none of 10 and 5 challenged intranasally and intramuscularly, respectively, died. At 20 days (vaccinated at 2 days), the 10 intranasally challenged survived, but 1 of the 5 challenged intramuscularly died. And, at 18 days (vaccinated at 4 days), the loss was 1 in the intranasal and 2 of 5 in the intramuscular group. Of the controls, 2 of 5 challenged intranasally were lost but none of 4 challenged intramuscularly. Of 15 chicks vaccinated at 9 days of age and challenged 23 days later intramuscularly with the GB strain 3 died or were paralysed, and of 10 vaccinated at 14 days and challenged 28 days later, none of 10 died. In the control group, 13 of 23 were lost.

In another paper Markham et al. (85) point out the futility of vaccinating parentally immune chicks by the stick method because this brings the virus in direct contact with circulating antibodies, that on the contrary there is evidence that parental immunity is not an important factor in intranasal vaccination because the virus is brought in contact with tissue cells not completely bathed by antibodies.

The authors cite that a potency test requires manufacturers to vaccinate sus-
ceptible chicks at 1–2 days and challenge them at 14 days, that in 31 such tests using 490 chicks, less than 6% died, whereas in 496 controls, 93% became paralysed and 72% died.

In recommending day old vaccination it is pointed out that in older chicks the nostrils might become plugged. Apparently looking to other modes of administration, it was found that when vaccine containing dye was dropped in the conjunctival sac the dye appeared in the mouth. In an experiment 30 day old chicks from a susceptible flock were vaccinated in the conjunctiva and challenged 2 weeks later with a $10^{-1}$ dilution of the GB strain resulting in 1 illness and 1 death, but none sicken or died of 20 similarly vaccinated and challenged with the Baker strain. Other chicks were vaccinated intranasally at the same time and of 19 challenged with the GB strain none was affected, and 30 challenged with the Baker strain resulted in 1 sick. All of 24 contacts challenged with GB virus died, and all of 22 contacts challenged with Baker virus sickened and 21 died. Likewise, 10 and 19 controls challenged with GB and Baker virus, respectively, died.

In a second trial the same procedure was followed except that the chicks were from immune stock. Non-vaccinated chicks were placed with vaccinated, others were held in isolation and still others in another part of the battery containing vaccinated chicks. None of the intranasally vaccinated challenged at 5 and 7 weeks (10 and 14) sickened or died. Of the conjunctival vaccinated and challenged at 5, 7 and 10 weeks (10, 15 and 25 chicks, respectively), only 2 of 25 challenged at 10 weeks died. Eight of 10 non-vaccinated contacts sickened and 5 died, and of 20 held in separate compartments, 8 sickened and 6 died. Of the controls held in isolation and challenged at 5 and 7 weeks and 8 months (10, 7 and 3, respectively), all sickened and died except 1 of the 3 challenged at 8 months.

Johnson and Gross (77 and 72) reported that in earlier experiments on administration of B1 vaccine by atomization, the morbidity and mortality rate was high, but the method was restudied because of favorable field results with intranasal vaccine. In the work reported, known susceptible chicks were used except in field trials. Usually lots of 25 were treated at 24–48 hours of age by means of a 10 cc. capacity DeVilbiss No. 114 atomizer through the holes in the sides of a chick box—the top holes remaining intact. A dose of 2 to 2.5 cc. of vaccine suspension was used per 100 chicks and the exposure was 5 to 10 minutes. In final experiments a No. 40 DeVilbiss all-glass nebulizer was used. This appeared to have the advantages of keeping the mist in suspension longer and in requiring about half as much vaccine.

In a series of 10 experiments in which atomized virus was used in 8 and nebulized in 2, a total of 318 chicks was vaccinated at a day old. Eighteen died after vaccination, but none admittedly from NCD. The 218 chicks were challenged at 14 (or 10) to 123 days but mostly under 37 days (9 at 123 days and 6 at 92 days). Eight of the groups were challenged with California 11914 (0.05 intramuscularly) and 2 with GB. Of the 218 challenged 5 died of NCD and one developed torticollis. Of the 49 controls used 48 sickened but only 7 died.

In 3 additional field experiments on lots of 25, 500 (parents vaccinated by stick) and 2850 (some parents had natural disease, others vaccinated) chicks were atomized at 1 day and 66 were challenged at 22 to 33 days post vaccination with
California 11914 and 13 developed symptoms. Of 18 controls, 13 showed symptoms and apparently none died.

Based on these results the authors believe the evidence is conclusive that B1 vaccine by atomization or nebulization can produce as much immunity as by intra-nasal instillation. In the popular report (77) the authors suggest the possibility of an "assembly line" arrangement in which boxed chicks from the incubator are vaccinated as they move along a track, or, even vaccination by either method while the chicks are still in forced draft incubators. And, the authors record that in the meantime the "eye drop" method has supplanted intranasal instillation because it is quicker and the operator is less likely to miss any of the chicks—an occurrence in the nasal method where the operator must wait for the chick to inhale.

**Modified Virus**

Jezierski (2) observed that a Belgian Congo strain that killed in a 1–5 or 10 million dilution was fatal in no higher than a 10⁻² dilution after passage in eggs.

Doyle and Wright (6) reported that a fowl inoculated with an egg-passed He& virus failed to infect a contact in a fold-unit 4 × 12 feet, but if field virus were used spread always occurred.

Bankowski (24) reported further observations on the California 11914 strain modified by in vitro culture in modified Simm Sanders medium with bovine or chicken ultrafiltrates. The medium employed over liver and heart tissue of 10–13 day old chick embryos was composed either of bovine or chicken ultrafiltrate in 20% concentration in Simm Sanders salt solution. The virus grew as well in minced whole embryos.

The virulence of a passage tested by injecting 0.5 cc. of nondiluted culture intramuscularly into 2 chickens 22–81 days old, showed that the 10–20th passages were 33% fatal, the 31–40th passages 5% fatal, and virus of the 41–50th passages failed to produce mortality or induce symptoms, but HI antibodies were present by the 8th day and the birds were refractory to 2 × 10⁶ M.I.D. of virus. The virus was virulent for egg embryos in dilutions of 10⁻³ to 10⁻⁷.

The virulence of a 50th bovine ultrafiltrate passage for chicks 2 days old in a dose of 0.25 cc. and 0.25 cc. of a 10⁻¹ dilution for groups of 20 chicks was such as to cause losses of 15% and 35%, respectively. On the 9th day 8 of the survivors from each group were tested and although some showed no HI antibodies all were refractory to a challenge of 2 × 10⁶ M.I.D. On the 16th day the remaining chicks (9 and 5, respectively) were challenged with similar results.

Since the intramuscular route proved too highly fatal 2 (5 weeks) 2 (7 weeks) and 15 (30 days) chicks were exposed for one hour to atomized virus representing the 16th, 50th and 53rd passages, respectively, in bovine ultrafiltrate. The chicks were refractory at 8 or 9 days to the usual intramuscular challenge which killed 2 of 8 controls. In another trial 50 chicks 11 days old were exposed to 50th passage (bovine ultrafiltrate) culture. On the 10th day 3 of 16 challenged were susceptible. On the 13th day 3 of 10 were susceptible, and on the 26th day, 8 of 22 were susceptible. Fifteen contact chicks exposed to the vaccinates from the 13th to the 23rd day developed no antibodies and were susceptible on the 26th day.
Two field trials were made. In one, 606 chicks 9 days old confined under a brooder were exposed to vaccine dispersed from a Well's reflux atomizer at the rate of 18 titers/min. for 60 minutes using about 30 cc. of virus from the 50th passage in bovine ultrafiltrate. One chick died and by the 17th day 7 had developed nervous symptoms. Ten samples collected on the 10th day gave HI values of 80 to 320, and on the 24th day 20 samples gave values of 0 to 160. On this date 10 chicks were challenged and 3 were found susceptible. The pen adjoining the vaccinated group was empty, but the infection did not spread to other pens containing chicks 3 days to 5 weeks of age. The vaccinates suffered no further mortality to market age at 13 weeks.

In a second trial 2 groups were treated. One consisted of 610 three days old which were treated in a specially constructed plywood box for 75 minutes with 55th passage virus. Fifty chicks were withheld prevaccination, painted with picric acid for ease of identification and returned 24 hours later to serve as contacts. The loss in the next 3 weeks was 6.6% and 10 chicks showed permanent nervous involvement. The average HI titers at 8, 17 and 47 days were 58, 140 and 63, respectively. Two challenged at 47 days were refractory. The 50 contacts developed no HI titer and the few challenged were susceptible (4 at 17 days and 2 at 47 days).

The 705 chicks of the second group were 18 days old and 64 were deprived of vaccination and returned to the group immediately after vaccination as contact controls. Exposed for 15 minutes to 55th passage virus the chicks developed no respiratory but 6 developed nervous symptoms. The average HI values at 8, 17 and 47 days were 118, 60 and 113, respectively. Random samples of contacts revealed no HI reaction and the few challenged were susceptible.

Delaplane et al. (39) found that in the first 2 trials the New Jersey Roakin strain failed to grow after 1 or 2 passages on the skin. In a third trial 6 passages were made before the virus failed to produce “takes”. The virus was recoverable from birds that showed “takes”. Adaptation to growth in the skin was judged from the progressive severity of the “takes”. Fifty day old chicks from immune parents were inoculated on the skin with the 12th skin-adapted passage grown in eggs with the result that respiratory symptoms developed on the third day and several died.

Hamster-adapted Vaccine

Schenck et al. (84) inoculated eggs with 79th hamster passage virus and used the egg fluids in a dose of 0.2 cc. of a 1–10 dilution subcutaneously in 136 known susceptible chicks as shown by HI tests on pools of serum from each lot. The chicks were 6 weeks old at the time of vaccination. At the time of challenge each group was placed in a separate house and consisted of 15 normal controls and 15 vaccinated chicks (excepting the last group which contained only 14 vaccinated and normal) which were each inoculated with a 0.5 cc. of a 1–10 dilution of California 11914 virus (LD 50–10−4.5 in eggs and 10−4.8 in 6 week old chicks). To each group was also added 5 non-inoculated chicks to detect contact infection. Pre-challenge HI titers of the non-vaccinated chicks to be challenged or to serve as contacts varied from 0 to 10. The pre-challenge titers of vaccinated chicks depended on the time post vaccination and varied from 10 to 40 at 3 and 6 days, rose to 160 at the 10th and 14th days and fell to 10 to 40 at the 18th, 22nd and 26th days post vac-
cination. The challenge showed that 60% of the chicks were immune 3 days post vaccination, 93% at 6 and 10 days and 100% immune at 14, 18, 22 and 26 days. The mortality in non-vaccinated controls varied from 66.6% to 100% and that of non-inoculated contacts from 60% to 100%.

The authors point out that the results indicate that resistance develops before a high HI titer is reached. Since some of the vaccinated, but non-challenged chicks held under observation, developed NCD from 6 to 14 days after vaccination it is believed that some of the mortality following challenge of recently vaccinated birds may be attributed to the vaccination rather than the challenge.

In further experiments Reagan et al. (86) evaluated as vaccines various components of eggs inoculated with hamster-adapted virus. A pool of 20 brains of the 79th hamster passage was used in a dose of 0.15 cc. to inject 8 day eggs which die within 96 hours. With this material 4 vaccines were made: (I) egg fluid of 10 eggs; (II) embryos of above; (III) yolk sacs of above; and (IV) whole egg content of 10 eggs. Each component was made in a 10% suspension. The LD 50 egg titer of vaccines I and II was $10^{-2.4}$, and of III and IV $10^{-2.4}$. Chicks 8 weeks old and HI negative were divided into 4 groups of 50 to 54 chicks and each group vaccinated with a different vaccine in a dose of 0.25 cc. subcutaneously. Six non-vaccinated contacts were placed in each group. The loss incident to vaccination for Vaccines I to IV was 12%, 3.7%, 19.6% and 5.9%, respectively. The chicks were challenged 30 days after vaccination with 0.5 cc. of a 1–10 dilution of California 11914 virus and the per cent survival for the 4 groups was 97, 100, 100 and 93%, respectively, and for the corresponding contacts, 16, 33, 33 and 0%. Of 54 non-vaccinated controls challenged the loss was 75%.

The object of other experiments by Reagan et al. (73) was to study the response in vaccinated chicks to 3 common methods of challenge. To each of 150 HI-negative chicks 7 weeks old was given 0.1 cc. of a 10% suspension of hamster-egg virus of the 73rd passage, and to each of 120 in another lot non-diluted vaccine was administered by the stick method. Twenty-five and 20 non-vaccinated chickens, respectively, were added to the 2 groups as contacts. Then each of the 2 groups was subdivided into 3 groups to be challenged subcutaneously (0.5 cc. of 1–10 dilution of California 11914), intravenously (same dose as above) and intranasally (0.5 cc. of non-diluted virus), respectively, one month after vaccination. Chickens vaccinated by different methods and challenged by different routes were put in separate runways. The chicken LD 50 titer of the challenge virus by subcutaneous injection was found to be $10^{-4.27}$ and by the intravenous route $10^{-4}$, the titer by the intranasal route could not be determined. Incident to vaccination 10 of the 150 injected subcutaneously, and 6 of the 120 vaccinated by the stick method sickened or died. The survival rates of subcutaneously vaccinated birds by subcutaneous challenge was 40 out of 40, by intranasal challenge 39 out of 41 (one died too early to be significant), and by intravenous challenge 3 out of 42. The survival of chicks in contact with subcutaneously vaccinated birds after subcutaneous, intranasal and intravenous challenge was 1 out of 7, 5 out of 5, and 2 out of 6, respectively. The survival rate of "stick" vaccinates by subcutaneous challenge was 30 out of 32, by intranasal 35 out of 37 (one premature death), and by intravenous challenge 8 out of 32. The survival rate in corresponding contacts was 1 out of 3, 5 out of 5.
and 0 out of 6. Of the 30 controls challenged subcutaneously 9 survived. The authors concluded that intranasal challenge was too mild, intravenous too severe, and the subcutaneous the most reliable.

Davis et al. (81) reported the results of field trials on 71 flocks of about 22,767 birds 10 weeks to 2 years old vaccinated by subcutaneous injection, and of 38 flocks of about 41,629 birds vaccinated by the stick method with hamster virus. HI tests made 8 to 20 weeks after vaccination showed that about 80% were positive. One flock vaccinated by the subcutaneous method suffered a break 3 months later, and 3 flocks vaccinated by the stick method at 15 to 18 weeks had NCD 4 months post vaccination.

Reagan et al. (87) inoculated 32 monkeys intracerebrally with a 10⁻⁸ dilution of the Brunhilde strain of poliomyelitis virus with the result that 28 developed symptoms and 18 died. The 10 survivors and the 4 that resisted showed no SN antibodies at 27 days when each animal and 2 controls were challenged with 0.4 cc. of a 10% brain suspension of the 200th hamster-brain passage of NCD (hamster titer 10⁻⁴.⁵). Both controls died on the 6th and 21st days, respectively. Of the 10 recovered animals 5 died between the 7th and 19th days, and of the 4 that resisted the poliovirus all died between the 9th and 18th days.

Of 4 monkeys undergoing 8 intramuscular injections of 0.5–1.5 cc. of the Lansing strain of poliomyelitis virus 1 developed symptoms and another after an intracerebral challenge. The 2 remaining were challenged 28 days later with 2 cc. of a 10⁻¹ dilution of the 272nd hamster brain passage of NCD and died on the 7th and 8th days, respectively.

Then 4 monkeys were given 8 intramuscular injections of 1 to 2 cc. (diluted 1–5 to 3–5) of the 19th egg passage of NCD virus, and a week later each was given 1 cc. of a 10⁻¹ dilution of the 250th hamster-brain passage of NCD virus (titer 10⁻⁴ in hamsters) with the result that all remained well during 30 days of observation. All sickened within 10 days, however, when given 0.5 cc. of a 1–500 dilution of the Lansing virus. Three controls given the same dose died on the 2nd (atypical), 9th and 10th days. And, 3 controls given 2 cc. of a 10⁻¹ dilution of the 272nd hamster brain passage of NCD virus died on the 8th, 9th and 11th days.

**Inactivated Vaccine**

Doyle and Wright (6) were interested in developing an inactivated vaccine to suit the requirements of England which, having no land boundaries, was ideally suited to an eradication program. One of the vaccines was made from the “Herts” strain isolated by Dobson in 1934 from the Hertfordshire outbreak, and another from the “Turkey” strain isolated by Asplin. One batch each was made from the “Matale” and “Ampitiya” strains of Ceylon, a German strain and finally the Herts strain after 20 serial passages in pigeons.

The vaccine consisted of the content of 10 day eggs (excepting albumen) dead within 72 hours, passed through a colloid mill and filtered through sterile muslin. To 800 g. of mixture of a titer not less than 10⁻⁸ was added 200 cc. of crystal-violet ethylene glycol (1–400) and incubated 36 days at 37.5°. After incubation, the vaccine was diluted so that the dye content was not more than 0.00005%, and tested for sterility. As a safety test 2 chickens (6–8 weeks old) and 2 adults were given 1
and 5 cc., respectively, and were expected to remain normal and 10 days later show more than 40 inhibiting units.

Batches of vaccines made from 6 strains were tested for inactivity from the 9th to the 14th day of incubation by the inoculation of 0.1 cc. into each of 3 eggs per test. On the basis of these tests vaccines appeared to become inactive about the 11th to the 13th day, but comparative tests made with 4 vaccines on adult fowls (dose 5 cc.), chickens 10-12 weeks old (1 cc.) and 10 day eggs (0.1 cc.) showed the bird to be more reliable as a test object. The 4 batches tested consisted of 2 made from the Herts and turkey strains and 2 from the same after 3 passages in fowls and reisolation in eggs.

Viability tests were made on alternate days from the 11th to the 36th. The Herts batch was active in fowls to the 24th day of incubation, but not in eggs after 14 days. The Herts fowl-passage batch was positive in fowls to 20 days, and negative in eggs at 14. The turkey egg-passage batch gave the same results and the turkey fowl passage batch was positive in fowls to the 18th day and negative in eggs at 14. Greater accuracy of the fowl test was attributed to the larger dose permitted. On the basis of these tests it was decided to incubate vaccine 36 days, since inactivation appeared to be between 18 and 24 days.

Birds were given 0.1, 0.25, 0.5, 0.75 and 1 cc. intramuscularly, others the same dose repeated in 10 days and still others single doses intraperitoneally. All of the latter died on challenge with 100 mld. 49 days later. A single dose of 0.5 cc. in one case and in another a double dose of 0.1 cc. failed to protect. Since a double injection was impractical it was decided that a single dose of 1 cc. would be used. Birds injected intramuscularly and killed at 24 hour intervals failed to show any tissue changes resulting from the vaccine after 48 hours.

Twelve chickens allowed to inhale atomized vaccine for an hour on 3 successive days died when challenged 30 days later with 50 mld., but an equal number vaccinated with 0.5 cc. resisted.

Birds 14 weeks old vaccinated with 1 cc. and challenged from the 2nd day on with 100 mld. showed that immunity was established about the 7th day. Eleven of 12 controls died in a period of 4-8 days.

Of 17 birds vaccinated with the turkey strain 16 or 94% were protected against an intramuscular challenge 60 to 239 days later, whereas 7 of 8 controls died. When the same vaccine was used in a series composed of 2 vaccinates, a contact, and an inoculated bird to supply continuous infection, the 10 vaccinated survived, the 5 inoculated died as well as 3 of 5 contacts. In a test with vaccine made from the Herts strain 3 of 36 vaccinated died after an intramuscular challenge which killed 12 of 14 controls and caused paralysis in the other two. The 3 treated birds that died had been vaccinated 157, 187 and 216 days previously; the survivors had been vaccinated 120 to 365 days. Again, 2 and 6 birds vaccinated 266 and 247 days previously along with 2 contacts and 3 birds inoculated with field virus to supply infection resulted in death of the controls and contacts, but only one bird which had been vaccinated 247 days previously died.

To test the response in 7 week old chickens, 10 were vaccinated and challenged 106 to 365 days later. The controls died in 5-9 days but only one vaccinated bird, vaccinated a year previously died. Five groups of 5 chickens each were vaccinated.
(3 with 0.5 cc. and 2 with 1 cc.) at 6, 7, 8, 9 and 10 weeks of age and challenged with 1 control per group by 50 mld. All controls died as well as 2 vaccinates (1 at 8 weeks with 0.5 cc. and 1 at 9 weeks with 1 cc.).

Four turkeys 4 months old given 2–4 cc., 4 turkeys 2 months old given 1–2 cc. and 4 fowls 4 months old resisted a challenge of 100 mld. 30 days later except one turkey which died of blackhead in the meantime. The 2 control fowls, as well as 3 or 4 control turkeys, died.

Keeping quality of the vaccine was determined by vaccinating 6 cockerels 5 months old (2 each with 0.5, 1 and 2 cc. of vaccine held 160 days) and challenging the birds along with 2 controls at 21 days. The controls died and the vaccinated were protected. Each of 9 batches of vaccine held 88 to 452 days was tested in varying doses on 4 chickens, 16 weeks old per batch, which were challenged 37 days later with 100 mld. Three batches (355, 431 and 452 days old) conferred no protection. From the series it was concluded that potency was retained at least for 168 days. One batch was tested on 6 occasions at monthly intervals from the time of preparation by giving 2 birds each doses of 0.25, 0.5, 0.75 and 1 cc. The results confirmed those of previous tests, namely, that vaccine can be held for 5 months. All the controls died but only 2 of the vaccinates.

In preliminary tests it was found that 0.5 cc. of serum from a vaccinated bird neutralized $10^6$ mld., and that normal serum may neutralize $10^4$ doses. Twelve birds vaccinated 33 days previously with vaccines stored 118–327 days were bled and 2 pools of serum made, namely, one of 9 sera from birds that later resisted a challenge, and one of 3 sera from birds which died. Serum from immune birds in 0.5 cc. doses protected against $10^4$, $10^5$ and $10^6$ mld., but the same dose of serum from non-immunes or normal birds protected against no more than $10^3$ mld. All controls receiving $10^8$ to $10^6$ mld's died. Serum of birds immunized with the turkey strain gave the same results. Neutralization tests were also carried out in eggs with 7 sera from fowls vaccinated with old vaccine. Three were negative, 1 neutralized $10^4$, 2 neutralized $10^6$, and 1 neutralized $10^8$ mld's.

Sera of birds vaccinated with 1 cc. failed to inhibit more than 10 agglutinating units in about 90% of the cases; in the remainder the values were 20 to 40. With 5 cc. of vaccine the values were 10 to 20 with none higher than 40. These low values are considered an advantage since they would not interfere with the usefulness of the HI reaction as a diagnostic test.

In tests made in eggs with vaccines prepared with and without crystal violet (but with glycerine or ethylene glycol) it was found that inactivation took place at about the same time, but the results of immunity tests varied markedly. A batch of vaccine divided into two parts with crystal violet added to only one and used on 4 months old cockerels which were challenged 25 days later showed that the crystal violet fraction immunized whereas the fraction without this failed. Repeated with another batch the same results were obtained. The authors found that there was some evidence that ethylene glycol was slightly toxic for chicks under one month of age.

Cordier et al. (8) used the HI test to determine the amount and duration of immunity in response to inactivated vaccines. They used 4 agglutinating units of virus with 2-fold serum dilutions and found that birds vaccinated February 1 and
16 with adsorbate vaccines (carbon and aluminum) or virus incorporated in lanolin had titers of 0 to 1–80 by March 14 and resisted a challenge by cohabitation. By August 11 titers had reached 1–1280 or 1–2560. Other birds of the same lot subjected to the same challenge on June 18, resisted and, within 2 months, developed titers of 1–160 to 1–2560 excepting one bird. Five birds vaccinated with aluminum adsorbate vaccine on April 22 and May 7, showed titers of 0 to 1–40 on August 19, and after challenge on August 26, the titers rose to 1–160 to 1/1280. Six birds vaccinated with adsorbate and lanolin vaccine February 19 and March 10 were HI negative August 25, except one which showed a 1–40 titer. After challenge on August 26, titers reached 1–320 to 1–1280 by September 18.

In other experiments birds were challenged by intramuscular injection at 4 and 5½ months after vaccination, or by a combination of cohabitation and intramuscular injections. Still others were challenged 3½ months after vaccination and by the application of virus to the scarified skin. The pre- and post challenge titers followed the usual pattern. Finally, naturally recovered birds were shown to have HI titers of 0 to 1–40. August 25, except one which showed a 1–40 titer. After challenge on August 26, the titers rose to 1–160 to 1–2560 by September 18.

The authors concluded that the Hörst test was not a sufficiently reliable index of the immunity status of a vaccinated bird. The first immunization trails in Tunis were made with formalized spleen vaccine adsorbed on carbon or incorporated in a fatty base and were reported on in 1948 by Cordier et al. Further trials were reported in 1950 (1) with an egg-propagated Tunisian strain with an HA titer of 1–1024 to 1–2048 and virulent for birds in a dose of 0.05 cc. of a 1/3 dilution at a concentration of $1 \times 10^{-5}$. Originally only fluids and membranes were used, later yolk was incorporated and the whole diluted 1–6 to which was added superactive prolana carbon No. 200 in a concentration of 2%. Virus suspensions in a 1–3 dilution were also adsorbed on an equal volume of aluminum hydroxide (Wiltstäter). Vaccines were formalized at 0.4% and held at 28° for 2 days and thereafter at 4°. Finally, formalized pulp in a 1/6 dilution was incorporated with an equal weight of sterilized lanolin with 3 times by weight of liquid vaseline and the whole homogenized.

Two injections of 1 cc. of adsorbate vaccine or 5 cc. of lipo vaccine intramuscularly at 15 day intervals were used, or, half this dose for birds under 3 months of age. Groups of 2, 3 or 4 birds challenged 1, 3 and 6 months after vaccination by cohabitation resisted while controls died in each case. Six birds given one-half the dose of aluminum adsorbate vaccine resisted a challenge for about 4 months. Two groups of 6 birds each (vaccinated 4 and 5½ months previously), and 2 groups of 9 and 6 vaccinated 3 and 4 months previously (the latter 2 groups also exposed for 4–5 weeks by cohabitation) all resisted an intramuscular challenge of 0.1 cc. of a $1 \times 10^{-3}$ dilution of virus. Finally, 4 birds vaccinated 3½ months previously with aluminum adsorbate vaccine resisted a “prick” challenge of 11 drops of a $1 \times 10^{-3}$ dilution of virus.

Jezierski (2) ground the whole content of the egg in a Waring blender with an equal volume of aluminum hydroxide (Waldman) at 1.5% or 0.25% concentration. Other vaccines were made with 0.7% sodium borate and 0.5% potassium alum (according to Acevedo and Mendoza). Birds treated with 2 cc. of either vaccine gave equally good results (resisted $10^4$ to $10^5$ fatal doses). The time between vac-
cination and challenge was not stated. A safety test consisted of an intramuscular injection of 10 cc. of a batch 10 days after formol had been added at 0.3 to 0.5%. Efficacy of the vaccine was tested by challenging 4 birds (vaccinated with 2 cc. each) at 14 days with 10^6, 10^5, 10^4 and 10^3 fatal doses.

Two series of vaccines protected birds against 10^4 and 2 series against 10^5 fatal doses. A commercial adsorbate vaccine from Behring Co. of Marburg, Germany, in a dose of 2 cc. protected only against a challenge of 10^5 fatal doses. In 1949, the vaccination of 4000 birds in infected areas is claimed to have moderated the disease, but credit is also given to improved sanitation. The birds were still well 7 months after vaccination.

Kaschula (37) recorded that 3 of a million doses of commercial dead vaccine were used in the Western Province of S. Africa with satisfactory results. The value of vaccination was more striking in lowering the mortality. Several vaccinated flocks contracted the disease with a loss of about 1% against a loss of 60–90% in non-vaccinated flocks. The drop in egg production in affected vaccinated flocks was, however, severe and lasted 9 weeks in some cases. The author concluded that the vaccine is not practical on a large scale over a long period because the cost is prohibitive.

Adler et al. (56) used commercial adsorbate vaccine in Hawaii in a dose of 0.5 cc. for chicks under 2 weeks of age, and 1 cc. for all others. Any loss in egg production incident to vaccination was attributed to the handling. The disease appeared in the last group of hens vaccinated on a farm where others had 14 days in which immunity could develop.

Virus was recovered from a group vaccinated 3 weeks previously. On a farm having survivors of an outbreak 2 years previously and also vaccinated birds, the former suffered no significant loss in production and the latter dropped from about 60% to 30%. In the original outbreak the drop was from about 60% to 10%. Birds treated with inactivated virus alone showed moderate rales and very little mortality on exposure. Those that received dead virus followed by live virus did not contract the disease, and old birds which received live virus alone had more marked and persistent respiratory symptoms. Chicks 4 days old that received dead vaccine contracted the infection a month later. The mortality was slight, a few developed nervous symptoms, but a number developed into culls. Those given adsorbate vaccine at 9 days of age suffered only a minor loss on exposure.

Huebner (74) vaccinated 1000 day old chicks and 50 day old turkeys with 0.5 cc. of formalin-killed alumina gel vaccine intramuscularly, and held an equal number of each species as controls. The mortality in chickens to 4 weeks was 9% in vaccinates and 8.2% in the controls, and for the turkeys 18% in the vaccinates and 16% in the controls. No deaths were attributed to vaccination. The basis of these percentages is not explained, but within the interval 356 vaccinates and 335 controls (from the chicken flocks) and 28 vaccinates and 20 controls (from the turkey flocks) had been removed for challenge tests. In any event, at 10, 15, 20, 25 and 30 days, and at 6, 8 and 12 weeks groups of from 60 to 108 birds from the vaccinated and control chicken flocks were removed and challenged usually with 0.5 cc. of a 10^{-4} or 10^{-5} dilution of California 11914 virus or, in one instance, each with 10^{-4}, 10^{-5} and 10^{-6} dilutions. With one exception in which more controls survived than
vaccinates (challenge dose $10^{-9}$ dilution) the results were in favor of the vaccinates ranging from 8% to 44%. The survival among vaccinates varied from 36 to 72% and among controls from 0 to 70%.

The turkeys were challenged at 2, 4, 8 and 12 weeks of age in lots of 10–15 with dilutions of $10^{-7}$, $10^{-6}$, $10^{-5}$, and $10^{-4}$ respectively. Again, the results were in favor of the vaccinates with percentages varying from 30 to 53. The survival among vaccinates varied from 73 to 100%, and among controls from 20 to 60%.

A second lot of 500 day old chicks was obtained from supposedly susceptible stock and 250 vaccinated and 250 held as controls. At 10, 15, 20, 25 and 35 days groups of 40 to 45 were removed from each lot and challenged with $10^{-9}$, $10^{-7}$, $10^{-4}$, $10^{-7}$ and $10^{-6}$ dilutions, respectively. Excepting at 10 days (95% of each survived a $10^{-9}$ challenge) the results were in favor of the vaccinates with percentages varying from 15 to 50. The survival among vaccinates varied from 15 to 95%, and among controls from 0–95%.

Finally, 30 chicks vaccinated at 4 weeks of age with 1 cc. and challenged at 14 days with a $10^{-8}$ dilution resulted in a 17% loss as against an 87% loss in 15 controls.

**Sero Vaccination**

With the failure of vaccines to give protection in infected surroundings Lucam (4) carried out experiments with immune serum. The hyperimmune serum was produced in turkeys by a preliminary injection of inactivated NCD virus and fowl pest virus. Then after a second dose of vaccine $10^{-7}$, $10^{-6}$, $10^{-4}$ and $10^{-3}$ dilutions of virus in 1 cc. doses were given intramuscularly at 10 day intervals.

Maximum neutralizing power as determined by SN tests in eggs was observed when serum was collected at 40–50 days after hyperimmunization and reached a value of neutralizing $10^7$ units of virus whether titered against NCD or fowl plague.

The procedure of evaluating the protective power of the serum was to inoculate a single susceptible fowl and allow it to spread infection to other susceptibles while other birds were treated with serum. In the first of such trials the inoculated bird sickened on the 2nd day and died on the 4th. The other 4 controls contracted the disease in from 6 to 12 days and all died in from 9 to 13 days. In the meantime 4 birds each received 1 cc. of serum intravenously and intramuscularly. The former sickened from the 9th to the 12th days and died on the 10th to 14th days, the latter sickened on the 12th or 13th days and died on the 13th or 14th days.

In a second trial serum was given the 1st, 3rd, 6th and 7th days and was administered intramuscularly, subcutaneously and intravenously, to 3 birds each. The source of infection for this and subsequent trials was that remaining in the pen from the first experiment. The 5 non-treated died by the 9th day, and the 9 treated sickened and died except one that had received serum intramuscularly and had recovered by 30 days.

In the third trial 1 cc. of polyvalent vaccine and 5 cc. of serum were given to 6 birds on the first day and repeated on the 7th. Of the 3 controls one recovered as did one of the treated birds. The duration of illness was somewhat prolonged in the treated birds.

In order to avoid any neutralization of the vaccine by the simultaneously administered vaccine the injections in the next trial were 1 cc. of vaccine on the 1st
day, 2 cc. of serum on the 3rd and 5th days and 1 cc. of vaccine on the 7th day. The 3 controls died in 6 to 12 days, and the 6 treated birds sickened in 6 to 12 days and died in 8 to 25 days, hence only prolongation of the course of the disease.

No actual tests on the therapeutic value of serum were made and yet opportunity to make observations was afforded. Thus, in the second experiment, there were 6 sick birds on the 6th day which received serum with the result that 4 died within 24 hours and 2 in 5 and 7 days, respectively. The author concluded that since controls usually die within 24 hours of the appearance of symptoms serum may prolong development of the disease but does not protect. Similarly, in the third experiment 4 birds received 5 cc. of serum on the appearance of symptoms but none survived.

Davis et al. (81) made a survey of the vaccination results in the broiler area of Maryland. They point out that field trials made in the summer when the disease is not prevalent are generally satisfactory, but that when the disease is prevalent in the winter some vaccines gave questionable results. In the summer of 1948, wing vaccine seemed satisfactory, but in the winter the reaction was so severe that owners changed to killed vaccine. Four hatcheries vaccinated 28 million day old chicks with killed vaccine and experienced breaks in about 20% of the flocks in from 3 to 8 weeks with a loss of 10% to 30% which was about the same as experienced in non-vaccinated flocks.

The survey showed that in 14 flocks (about 188,000 birds) vaccinated with killed vaccine at 1 day to 2 weeks, breaks occurred in from 4 to 10 weeks and the virus was recovered in 11 cases.

In 41 outbreaks in which the vaccination history was unknown virus was recovered 25 times.

Tabulated results showed that in 53 flocks (about 620,500 birds) vaccinated with killed vaccine at 1 day to 3 weeks (1 at 6 months) breaks occurred in from 2 to several weeks and caused losses varying from 3–50%. In 11 flocks (about 120,200 birds) vaccinated by the stick method at 3–5 weeks, breaks occurred with losses varying from 2–35%. In 6 of these flocks, however, the break occurred a week after vaccination which could hardly be interpreted as a break but rather as a loss incident to vaccination, or else natural infection before immunity could be established.

In 24 flocks (about 246,000 birds) vaccinated intranasally at 1 day to 4 weeks of age breaks occurred with losses varying from 7–50%. Here again, the break began in 7 flocks so soon after vaccination as to suggest natural infection.

The authors estimated that in the last 3 years about 75 to 100 million birds have been vaccinated, the majority under 4 weeks old, and with vaccines administered by the stick method, subcutaneously and intranasally. Breaks were more prevalent in the winter, and when they occurred, there was little difference in the loss regardless of the type of vaccine used. It was also pointed out that vaccinating crews had little interest in their work, that they worked against time and stretched dosage. Flock owners were of the opinion that live virus vaccines gave the best results.

Means of Spread and Sources of Infection

In the Belgian Congo Jesierski (2) attributed spread of NCD to the sale of infected native birds and the close proximity of flocks to the more or less domestic
Brousse birds. The inoculation of a million fatal doses of virus into a parrot produced no symptoms but filtrates of fecal samples killed fowls.

In 18 Canadian outbreaks Walker and Powell (3) observed no connection and suspected eggs as a source of infection.

On finding the virus on the shells of eggs from flocks vaccinated with live virus vaccine Zargar and Pomeroy (16) decided that the disease could be spread to hatcheries by means and from these to remote parts of the country.

Mornet et al. (38) expressed the belief that the disease was brought to French West Africa by importations of birds from France after the war. The fact that the original outbreaks occurred in “European” or improved flocks supported this view. The numerous poultry transactions and the disregard of natives for the rules of animal hygiene are listed as factors favorable to the spread of the infection. In a recent importation (Nov., 1950) of birds from France the disease began on the boat, and by rigorous measures outbreaks in Dakar were confined to the imported breeds (Leghorns, R. I. Reds and Sussex).

Some idea of the relative importance of vaccinated birds as a source of infection in comparison with naturally infected birds can be gleaned from the work of the Millers (27). Four chicks 10 weeks old were each inoculated intratracheally and 4 intramuscularly with 0.2 cc. of nondiluted amnioallantoic vaccine virus. Each chick was placed in a separate cage and with it a non-inoculated chick of the same age as a contact. Daily observations for 10 days showed that the symptoms in intramuscularly inoculated chicks were milder and of shorter duration that in those inoculated intratracheally. Only 1 of 4 chicks in contact with intramuscularly inoculated chicks showed symptoms, whereas the 4 in contact with intratracheally inoculated chicks developed respiratory symptoms. At the end of 10 days the intramuscularly inoculated chicks were destroyed as well as their contacts. All of the former showed evidence of NCD (cloudy air sacs or mucus in the trachea), whereas the contacts showed no changes. The intratracheally inoculated and their contacts all showed evidence of NCD, but, whereas both showed air sac infection, tracheal mucus was found only in the contacts.

Blood and tracheal samples were collected from each chick daily for 10 days post inoculation and an 11th day sample from 4 contacts and 1 inoculated chick of the intratracheal series. These samples were examined for virus (mucus treated with antibiotics). In the group inoculated intramuscularly, none of the blood or mucus samples from the 4 contacts yielded virus (80 samples), but the 4 inoculated birds were positive on one or more occasions. In one, the 3rd, 4th and 5th day mucus samples were positive; in a second, only the 6th day mucus sample; in a third, the 3rd day blood sample and the 5th and 6th day mucus samples; and in the fourth, the 5th and 6th day mucus samples.

In the intratracheally inoculated group all yielded virus from the trachea. In one for the first 6 days; in a second for the first 5 days; and in the remaining 2 birds on the 3rd, 4th and 5th and on the 2nd, 4th and 5th days, respectively. Only one of the inoculates yielded virus from the blood and this bird showed positive mucus samples on the 2nd, 4th and 5th days. In every case the contacts showed virus in the mucus on the 1st day, but then not again for several days. In 2 birds it was present daily from the 7th through the 10th days; in another from the 6th through
the 8th days; in a third on the 5th, 6th, 7th and 9th days. Only one blood sample of a contact was positive and this was on the 8th day in a bird that yielded positive mucus samples on the 1st and 7th through the 10th days.

The low incidence of virus in the blood was attributed to the mildness of the infecting strain. Attention was called to the fact that in intramuscularly inoculated birds virus appeared in the blood before it was recovered from the trachea, whereas in the intratracheally inoculated birds the reverse was true.

In the intramuscularly inoculated birds virus appeared in the tracheal mucus for 1 to 3 days beginning not earlier than the 3rd day and not lasting more than the 6th day post inoculation. In contrast, virus appeared earlier in the trachea of intratracheally inoculated birds, but was not found after the 6th day. The contact birds, however, showed virus in the mucus on the 1st day and in various birds from the 5th day through the 10th day. Its presence in the mucus on the first day was assumed to represent recently inhaled virus which then penetrated the mucosa to multiply and reappear in 5 to 7 days as shed virus.

From these studies it was concluded that intramuscularly inoculated birds (vaccinated) shed less virus by way of the respiratory tract than those inoculated intratracheally (natural infection).

Kashula (37) believes that there are important sources of infection other than the introduction of birds because a satisfactory explanation of the source of infection is lacking in most outbreaks. He cited that on one 7000 bird plant the disease appeared at a point most distant from the nearest neighbor, that on a 13,000 bird battery plant it began at a point most distant from the gate. Red mites were found in the thatched roof and sparrows fed freely from the troughs. On a third plant of 2,000 birds the disease began in a run fartherest from the house. Since there had been no introductions of birds into any of these plants the author expressed the belief that wild birds might spread the disease.

Adler et al. (58) observed respiratory symptoms in adult game birds shipped in individual boxes but in a common carrier—ship or train—from many parts of the mainland and that most of the birds had a clean bill of health from a veterinarian at the point of origin. On arrival, 58 of 124 blood samples were HI positive, and many had rising titers to indicate recent infection.

Dobson (65) pointed out that in February 1947, the Ministry of Food in England permitted the bringing in of dressed poultry from continental Europe and that within 14 days an outbreak of NCD occurred. It is believed that because of the restricted rations for poultry the practice of gathering wastes from hotels, etc. has sprung up and favored spread of the disease.

Pieces of skin of eviscerated poultry from continental Europe suspended and inoculated into eggs or birds (the latter more reliable) have demonstrated virus in fowl, young birds, geese, ducks and turkeys.

According to Hess (67) the disease first appeared in Switzerland and near Zurich in September 1946, and was associated with the feeding of hotel wastes containing refuse from imported poultry. The same source of infection was found in other cases. In some cases foreign workers had thrown away scraps from imported birds which caused an outbreak in an absolutely clean area. Still other outbreaks began at the frontiers where tourists had had camp meals. Imported frozen poultry was con-
sidered particularly dangerous because a shipment held in storage 6 months still yielded virus.

Zuydam (95) was unable to recover virus from 12 wild rats trapped on infected poultry farms in Barneveld, nor from the feces of 8 rats that had been fed infected muscle, brain and liver. Unchanged virus, however, was excreted for 0 to 2 days by 5 rats which had been fasted for one day and then fed eggs containing massive doses of virus. Because of the short period of excretion the author did not consider the rat an important means of spreading the disease.

**PREVENTION**

Mornet (38) recommended careful disinfection after slaughter of lingering cases.

In an editorial (48) it is revealed that the British Association urged the government to ban imports from pest-infected countries, that the present policy results in continuous infection and nullifies the efforts of the Ministry of Agriculture to eradicate the disease. The belief is expressed that otherwise the slaughter program would be effective because of well defined frontiers, and that mere evisceration of dressed poultry in the country of origin is not necessarily an effective means controlling the disease.

It is pointed out (51) that the new form of the disease, by virtue of its mildness, is considerably different from the European type, that since its recognition about 60,000 birds have been slaughtered at a cost in indemnities of 75,000 pounds, and, that the condition is expected to worsen. In spite of the request from the P.A.G.B., the Ministry of Food continued to import poultry from infected countries; that if it were not for these importations, it is believed the slaughter plan would have eradicated the disease. Although the original outbreak in 1947 is credited to imports from Europe, it is believed that the American type of disease first appeared in E. Anglia and was associated with imports from America. For this reason, arrangements were made with American authorities for adequate treatment of all swill from camps.

It is pointed out that this new form of NCD, in many ways, is more serious than the European type because of the difficulty of recognizing it, and that it has occurred on farms where every precaution has been adopted. It is believed by some that wild birds are responsible for spread.

On the basis of Ministry reports it is estimated (49) that 25,000 to 30,000 birds have been slaughtered and concern was expressed (52) that, unless spread could be stopped within the next 2 or 3 weeks the Ministry might have to stop the plan to eradicate by slaughter and discontinue payments. The Ministry prohibited the sale of day old chicks in markets and requested poultrymen to disinfect incubators. The mild type of the disease appeared in the National Poultry Show in December, 1950.

The preventive measures included boiling of all refuse from poultry carcasses before allowing birds access to it, sterilization of containers, washing the hands before handling food for birds, avoiding purchases unless from a healthy flock and isolation of such birds for 28 days. Disinfection of all crates coming to the farms and exclusion of visitors was advised as well as handling of birds by other poultry keepers.
Hatcheries are advised to use eggs only from healthy flocks, to avoid contamination of these during transit, and to ship these in new or disinfected containers. Carrying chicks in a lorry used to collect eggs was discouraged and eggs were to be fumigated on receipt or after setting as well as fumigation of incubators. Egg handlers were advised to wear overalls and to wash the hands after handling each consignment. Separate handlers were advised for eggs and chicks, and the latter were to be dispatched in new or disinfected boxes. Buyers were discouraged from returning dead chicks. The hatchery was to be disinfected with washing soda and hot water.

Farm visitors were advised to keep away from poultry, that if contact were necessary, the person should wear coveralls and disinfect boots after each visit. Only disinfected crates were to be accepted at the farm.

Poultry sellers were advised to use non-returnable containers and, if used sacks were necessary, to disinfect these before use.

Housewives and domestics were advised not to feed poultry trimmings to poultry. Formaldehyde was recommended for the disinfection of fiber containers and eggs, and a 4% soda solution for crates, utensils, etc.

Adler et al. (56) recorded that the Island of Oahu in Hawaii was quarantined and that poultry was admitted only if it came from a flock that had shown no NCD for 60 days, and all importations were required to be vaccinated with live virus vaccine 45 days prior to shipment.

REGULATIONS

According to Mornet (38) NCD is now listed as a contagious disease in French West Africa (decree of August 1, 1950, promulgated in French West Africa by general agreement No. 4789 S.E. of August 27, 1950—J.O. French West Africa of September 9, 1950).

As pointed out by Dobson (65) the first outbreak occurred in England in 1926 at Newcastle-on-Tyne and that a few cases were found the following year. The disease reappeared in 1933, and raged in a large flock in Hertfordshire. In these outbreaks no indemnities were paid, but in 1936 NCD and fowl pest were included in the list of diseases covered by the “Fowl Pest Order” of 1936. The term “Fowl Pest” was selected for the end designed by the decree. From 1936 to 1947, Great Britain was free of the disease but in the latter year the disease was introduced presumably in dressed poultry from the continent and the decree was applied for the first time. A complimentary regulation intervened at this time which imposed sterilization of all wastes before feeding to fowls.

The decree gives the Ministry of Agriculture extended powers which are modified or added to from time to time. Any person having a fowl or carcass suspected must give notice to the police, and the same applies to a veterinarian who examines a suspect bird. The police refers the case to the regional official local veterinarian of the Ministry who, in turn, informs the Central Bureau and visits the farm where the disease is suspected. If he is not able to diagnose the disease, cadavers of blood samples are sent to the Ministry Laboratory. The veterinarian explains the regulations to the owner who must keep a list of all sales or incoming birds for the purpose of establishing origin of infection or to limit spread of the disease.
After estimation, the flock is destroyed, and the houses and equipment disinfected. Indemnity is paid only on birds not affected. A period of 21 days must elapse before the farm is restocked. If nearby farms are endangered, restrictions of movements in and out of these may be imposed.

A so-called “Standstill Order” may be applied to a region which prevents any movement of birds within the area, except under certain circumstances when birds may be moved for slaughter. The order has been effective in reducing the incidence of the disease but has disrupted the industry.

Believing that most outbreaks arise from feeding garbage contaminated with refuse from European-imported poultry, the industry has asked the government to enforce prohibition of importation of any carcass from infected countries. At first the imported birds were only plucked, then it was required that the head, neck and feet be removed and the carcass eviscerated which reduced the amount of inedible waste that might reach poultry flocks. When cases (packages) are found to be infected on the basis of examination of skin the shipment is directed to areas where the poultry industry is not well developed. Recent revisions under “Decree on the importation of dressed birds of 1950” make it possible to restrict importations from several countries. There is also a “Poultry and Hatching Eggs Order” of 1947. Shipments of hatching eggs are to be accompanied by a certificate of the veterinary official of the government of the country of origin.

According to Fortner (66) a disease similar to pest appeared in Germany in 1941. The shorter course of pest, and the lack of immunological relationship differentiated the new disease from pest so it was referred to as atypical pest. Its identity with NCD, however, was suspected but confirmation was not possible until the war ended when studies were made at the Robert Koch Institute on the virus in comparison with a California strain obtained from the American Military Government. But, whereas the American strain killed about 70%—young more than old—the German virus killed almost every bird and autopsy showed hemorrhages and ulcerations of the intestines, which were lacking in birds dead of the American virus. Transmission by contact was more certain with the German virus and it could always be recovered whereas the American virus was sometimes not found—even in the brain.

Authority for instituting control measures resided in a law of 1909, which was modified and reinforced by a police ordinance relative to epizootics of December 12, 1942. The owner of an infected flock was obliged to report an outbreak. The sick and well were to be separated until slaughter and eradication. The yards and the entrance of affected communes were posted with “avian pest” placards. When the presence of the disease was established by veterinary authorities all birds had to be slaughtered. Birds are dressed, eviscerated, and may be sold after boiling or stewing. All of them must be sterilized. The owner is indemnified and the premises may be restocked in 6 weeks. The eggs laid in infected communes may be used in factory canteens, hospitals, etc.

Fortner pointed out that in ordinary times no difficulty is experienced in controlling an outbreak but under present conditions black market operations favor spread of the disease. Vaccination has been attempted but Fortner believes this will fail because it encourages laxity in regard to preventive measures.
An attempt to avoid reintroduction of the disease is made by requiring evisceration of imported dressed birds as decided at a meeting on Jan. 17, 1950. It is pointed out that a strict differentiation between plague and NCD is not required since the veterinary police measures are the same for both diseases.

Control of the disease in Switzerland (67) was effected through immediate slaughter, sale of drawn birds, destruction of wastes, litter, etc., and disinfection of the houses. Convinced that the disease was brought in in imported poultry, prohibition was started January 6, 1947.

Originally, examinations were made of liver and brain of shipments of frozen poultry on arrival at the border, but when only drawn poultry was admitted the veterinarians collected 50 heads from each 10 tons. These are sent in a frozen state to a laboratory where the brains are removed, pooled, and thoroughly emulsified so that if only one brain is infected the virus can be detected in spite of the dilution. If the carcasses lack heads, then necks or bone marrow are collected. Each pool is injected into each of 2 chickens 5–10 months old in a dose of 1 cc.

Since the end of November 1947, 140 shipments or 1,600 tons have been examined. Of 25 shipments or 200 tons found infected, 19 contained pest and 6 Pasteurella.

By means of these measures the disease has not been allowed to become established so that each new outbreak is considered the result of a reintroduction.

According to Alegren (68) the disease appeared in Sweden in May and June, 1947. In all, 6 farms were infected: 2 in Södermanland, 1 in Kalmar, 1 in Holland, and 2 in Göteborg Bohus. By means of immediate slaughter, destruction of cadavers and disinfection of premises, the disease was eradicated. The disease was believed to have been brought in from Europe by frozen poultry so that now a decree requires cooking of refuse before feeding to poultry.

In 1948, there were 2 outbreaks, 1 in March in Stockholm and 1 in April in Solleftea Government of Västernorrland. The source of infection was thought to have been imported dried eggs in the first case, and frozen poultry in the second case. The last recorded outbreak occurred in the Government of Gävleborg in March, 1950. The source of infection was not determined.

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SOME REMARKS ON FOWL PEST

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Dr. STAFSETH: Gentlemen, when I was asked to make a few remarks about fowl pest I was assured I would not have to prepare a paper, and that is why I accepted the assignment.

My successor on this program, Dr. Beaudette, knows a great deal more about this particular topic because he investigated it twice.

This is a disease which has been mentioned as a potential weapon in biological warfare. I imagine, it could be so used, if we ever have biological warfare.

Fowl pest has been known in certain parts of the world for a long time—in fact, since 1878, when Perroncito in Italy described it. It was described again by Delprato and Rivolta in 1880. After it appeared in Italy and was so recognized, it spread into Germany in 1898, into the Tyrol particularly, and it became rather common in Germany in 1901 following a poultry exhibition. I might say that exhibitions or shows or shipment of breeding stock constitute excellent means of spreading this particular disease.

Fowl pest has been widespread in Austria and Switzerland, and occasionally has been brought into France, Holland, Great Britain and Belgium. It is not uncommon in the Far East; they speak of it quite a bit in Asia, China and India. It has also been observed in South America as well.

This disease appeared in the United States in 1924. I don’t know whether Dr. Beaudette will make any remarks as to how it was brought to the U.S.A.

We had it in Michigan, and I was extremely fortunate in having with me, at the time, Dr. Alexander Kotlan, from The Royal Hungarian Veterinary College, Budapest, Hungary, who knew the disease well.

The first man in Michigan to see the disease was Dr. S. R. Johnson, then with the State Department of Agriculture of Michigan. He described it and showed pictures of typical symptoms and lesions. Finally, we decided to pick up the virus and make some studies of it in our own laboratories.

In Michigan the outstanding features of the disease were the usual manifestations, both in turkeys and in chickens, of loss of appetite and ultimately marked somnolence. I have seen birds asleep, sometimes lying down, and sometimes standing. Chickens would go to sleep and lower their heads almost to the floor. Turkeys often stood sleeping, their beak resting on the floor. If we stirred them up a bit, they would wake up for a moment and then go back to sleep. Their heads swelled up and became cyanotic. Chickens sometimes died during a paroxysmal spasmodic attack.

The strain of the virus which we had in Michigan was a virologist’s dream as far as something to work with was concerned. It worked with a regularity that seemed to be nearly perfectly timed. At that time I happened to have a group of short course students. Incidentally, we train poultrymen and other farmers in sanitation. In the class there was a comparatively large number of people of a certain religious profession, who did not believe in bacteria as causes of disease. They said disease is all
mental. It gives one a rather queer feeling to have to stand before such people day after day and try to teach sanitation, when the students do not believe there is such a thing as communicable disease.

We went to work with this virus. Strangely enough, they became rather interested, because every so often I would take them into the laboratory and show them that, if I injected fowl cholera bacilli, I killed rabbits and chickens overnight, sometimes in such a short time that, if we made the injection late in the afternoon, the birds and rabbits would be dead by the following morning.

When I injected the fowl pest virus, the rabbits would live and the chickens died. There was always a certain number of days before the symptoms appeared. I was able to tell them when they should come in to observe the first symptoms. Also, I was in position to tell them, that at approximately such-and-such an hour of a given day, the birds would die, and I invited them to come into the laboratory and make their own observations, if they so desired. They usually were there on time.

Some of them admitted reluctantly that perhaps I was right in my thinking regarding these diseases. When they got away from me their spiritual adviser most likely informed them of their error, so they probably forgot what I had told them, and also what they had seen.

The lesions were also very characteristic. They appeared with textbook regularity. Hemorrhages in the proventriculus, in the passage between the proventriculus and the gizzard and throughout the serous membranes were abundant and very conspicuous.

We had this virus in our laboratories for about three months. Finally Dr. Kotlan advised me not to continue to cultivate this virus in our laboratory. He said I should put the whole thing into the autoclave and destroy it, now that I knew the disease and would readily recognize it, if it should ever appear in our state again.

The reason for his advice was that he felt certain that the disease would disappear from the United States. This seemed unlikely to me because it was quite prevalent throughout several states. I had seen it in Detroit in dressing plants, and also in some of the smaller towns where there were poultry collecting stations and small dressing plants.

I asked him why he made such a prediction.

His reply was that it had always disappeared from northern Europe. It had been brought in time and again, and had never established itself in those countries.

Those of you who are professionals in disease eradication may disagree with me, and you may insist that a certain organization in the United States eradicated fowl pest; but I am inclined to agree with Dr. Kotlan for the simple reason that the disease did disappear from areas in Michigan where no attempt was made by anyone to eradicate it. If so-called sanitation ever cleaned up fowl pest in the dressing stations I saw in Detroit, then we don't know what sanitation is, because those stations were simply filthy.

I am inclined to believe that this disease actually ran its course and disappeared, as it has done in many countries in Europe.

Mr. President, this is all I care to say. I am sure Dr. Beaudette will take up from here and will give you much more valuable information.
COOPERATIVE FEDERAL-STATE POULTRY MEAT INSPECTION

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The Virginia Department of Agriculture, the Virginia Poultry Federation, and certain large commercial and cooperative processors of poultry, have been working for nearly two years in an effort to establish a system of cooperative federal-state inspection on poultry for wholesomeness. We are in agreement that this is desirable, although probably the key reason behind the interest in this venture on the part of each of the groups is somewhat different. The larger processors are ever conscious of costs and it appeals to this group as offering at least the possibility that such an arrangement might eventually lower the costs of this service. From a competitive standpoint this is also desirable. Smaller processors find it difficult to absorb the additional cost of inspection, which often restricts marketing. The Virginia Poultry Federation is an active, aggressive organization, made up of several thousand producers in the state, and its duty is service to this industry. It naturally follows that any program which promises betterment for the industry would have their wholehearted endorsement and support.

From the standpoint of the Department of Agriculture, a part of whose duty is the encouragement and promotion of anything that will serve agricultural interests, this sort of venture offers great possibilities in enlarging and increasing the financial soundness of all phases of the poultry industry.

Up to this point it sounds a little one-sided, because no mention has been made of the consumer or his interest or his health. It is not, however, as one-sided as it may sound, because at this point the main interest of all three of these groups merge and become one. To offer the consumer a high quality product, adequately and intelligently labelled and given all necessary health-safeguards, is the single reason behind this proposal, and on it the whole industry must stand or fall.

I think this one point is worthy of a little repetition. Certainly, there is a feeling in some quarters that the consumer is not being properly considered and that in some of the official agencies presently handling these matters, there is more interest in the health of the industry than the health of those this industry serves with poultry and poultry products. I frankly can find little or no validity to this kind of thinking. Certainly, it is a fact that when veterinarians are dealing with problems having no public health aspects, the health and economy of the industry affected are the primary considerations. But it has been my experience, and it is certainly my belief that when there is a public health hazard or any public health interest in a problem involving animal or poultry diseases, then this public health interest is the primary concern and takes precedence over all others. We invite the cooperation of serious, responsible veterinary, agricultural and public health officials to the solution of this problem. Virginia feels that all of our interests are identical.

I would like to make it abundantly clear that the Department, the Federation, and those of the processing industry in Virginia interested in this matter, will demand that the plants participating in this program in every way meet or exceed
sanitation standards now established or those that may be established in the future. There will be no lowering of standards. None of us will be willing to accept inspection either on-the-line or supervisory, that is anything less than adequate, complete and properly supervised and administered. There are, of course, differences of opinion as to just what constitutes adequate inspection and I am here to offer Virginia's opinions and recommendations. These are based on careful and thorough studies of this whole problem. We freely admit that they are perhaps slanted a little towards the use of lay inspectors, but we are practical people and willing to use the means at hand in preference to engaging in wishful thinking, or hoping for some miracle that might provide us the perfect solution to our problems.

Dr. C. H. Pals, Assistant Chief, Meat Inspection Service, United States Bureau of Animal Industry, in an address before the Conference of Public Health Veterinarians October 10, 1950, said in part: "Nearly 200 veterinarians are employed by the Poultry Inspection Service of the Production and Marketing Administration to inspect dressed poultry for wholesomeness. This service is on a voluntary basis, with the poultry packer reimbursing the Department for the cost of the inspection service. During the fiscal year, 1950 the Federal Poultry Inspection Service inspected a total of 393,484,761 pounds of poultry, of which over 390,000,000 pounds were inspected and certified for wholesomeness and nearly 3,000,000 pounds were condemned as being unfit for human food. It is estimated that less than 10 per cent of the poultry consumed in the United States receives inspection by the Federal Poultry Inspection Service."

At this Association's meeting in 1950 at Phoenix, Mr. W. D. Termohlen, Director of the Poultry Branch of the Production and Marketing Administration, in discussing the poultry inspection program, said in part: "It certainly seems desirable to expend every effort toward working out a practical and not too expensive voluntary program for some type of official inspection of ready-to-cook poultry. The 250,000 retail stores estimated to be selling poultry to consumers would be, in my opinion, far better off if they handled poultry only in ready-to-cook form. The best figures available to us indicate that about 1900 poultry processing plants exist which can handle a carload or more of poultry every week. Around 1400 of these at present have facilities only for dressing. The remaining 500 plants are reported to have facilities for drawing or eviscerating and in this group 125 are said to have facilities for canning poultry. On October 15 (1950), according to the Poultry Inspection Service, there were 145 plants that maintain federal veterinary inspectors." In the past 12 months federal poultry inspection has been expanded to include at present about 186 plants. Twenty-five lay inspectors are now working in this organization and several more are in training.

What are the prospects and the possibilities of any real expansion of this service in the foreseeable future? I imagine most of you here are more or less familiar with the supply of adequately trained veterinarians available to us in the United States. I know of no branch of veterinary medicine, with the possible exception of the armed services right at this time, where there is not a demand for veterinarians considerably in excess of the supply. In my own state we need 20 per cent to 25 per cent increase in rural practitioners. There is a real need for research veterinarians and in my own organization I have two vacant laboratory positions requiring
veterinarians and four vacant field positions. There are vacancies that cannot be filled in the federal service, both in the field and in the meat inspection service. When we come to on-the-line and even supervisory inspection of poultry and poultry products, expansion of this service is not only out of the question, but merely maintaining present coverage is, in my opinion, exceedingly doubtful of accomplishment. As practical officials we must honestly face the fact that meat inspection, poultry inspection and similar duties have little or no appeal to the younger veterinarians coming along in the profession.

In Virginia we believe that the answer is lay inspectors, properly trained certainly, properly supervised of course, but still lay inspectors. So that there will be no misunderstanding, I want to say right here that we contemplate lay inspectors on-the-line, lay inspectors in charge of a plant supervising on-the-line lay inspectors and lay inspectors ultimately supervising districts in which several plants are operating, all of this of course, under an adequately trained supervising veterinarian or veterinarians, depending on the area served and the number of plants in our State.

We are trying to offer the consumer ready-to-cook poultry anywhere in Virginia that he may want to buy poultry. The Federal Meat Inspection Service is employing lay inspectors under supervision with success. Virginia municipalities employ lay meat inspectors with and without veterinary supervision and with complete success in either case. The medical profession has long recognized and accepted the fact that properly trained lay technicians can perform many duties and accept many responsibilities heretofore the sole province of the physician. Veterinarians, whether they be federal, state or public health, will have to recognize this fact in their own profession, and accept it sooner or later, if they are going to fulfill their obligations to the consuming public.

It is very well to stick to generalities in some instances, but in this particular problem I would like to acquaint this group with our specific thinking in Virginia and what we have done. We had five large commercial or cooperative processing plants in Virginia under strictly federal inspection for wholesomeness for some time. This has involved about seven on-the-line veterinary inspectors. At the present time there are about 15 other plants in Virginia that may be listed as large commercial plants, not having any kind of inspection. The Farm Credit Administration distinguishes between a large and a small commercial plant by classifying a small plant as one which dresses a maximum of 400 birds per hour and does not use overhead conveyor lines. I do not wish to draw any firm or fixed line here, but I think this is a reasonably accurate statement. Therefore, if we are going to expand our inspection service to take in a dozen or more large plants and find that lay inspectors are necessary, certainly it is reasonable to assume there will be no chance of doing anything at all for the so-called small commercial plants that exist in Virginia and elsewhere without lay inspectors and lay supervisors.

It is our thought that the present plants having veterinary inspectors can take lay inspector applicants for on-the-line training under the direct supervision of these veterinarians. There they will learn plant sanitation and the enforcement of sanitary requirements. They will learn on-the-line inspection procedure and become familiar with the entire operation of the plant, from the processing standpoint of course. They will learn to recognize the normal, healthy bird.
To teach lay inspectors to be veterinary pathologists is no part of our aim. To
teach them to classify and name all pathological conditions or diseases found is to
us undesirable and unnecessary, but to teach them to recognize diseased conditions
as such, is possible and reasonable. When this is done we feel that the lay inspector
is ready to operate a line on his own from here on, with a supervising veterinarian
constantly available to classify rejected birds. When the lay inspector cannot only
recognize the disease but is able to classify the rejects properly, we think this indi-
vidual is ready for the third step, which is to assume the responsibility of a one
line plant with veterinary supervision twice a week or weekly, as is found to be
necessary. The fourth and last step is for the lay inspector to supervise a multiple
line plant on his own responsibility, or a group of single line plants in a given area.

How long will it take for a lay trainee to become a lay inspector? We do not know
and we frankly do not think anyone else knows. The Virginia Personnel Office has
spent considerable time surveying this problem and has made certain recommenda-
tions involving lay inspectors which I think have merit. We do not know that they
are correct in the time element involved. This remains to be seen, but the fact that
this can be done would not I think meet with too serious opposition. The classes
of positions established in Virginia are:

1. Lay poultry inspector trainee.
2. Lay poultry inspector.
3. Lay poultry inspector supervisor.

A brief description of these three classes would include the following:

First, lay poultry inspector trainee. This is described as an individual who for a
period of from six to eight weeks receives constant on-the-line training from a super-
vising veterinarian or a veterinary training supervisor. Following satisfactory com-
pletion of this phase of training, working tests are administered to determine the
trainee's suitability for assignment. Assignment is then made to a single line in a
multiple line plant where constant veterinary supervision is available for not less
than six months.

Second, lay poultry inspector. Upon completion of the trainee stage, the applicant
is then licensed as an inspector. In this category he is considered qualified to handle
a single line in a multiple line plant or become the responsible inspector in the single
line plant. It is our considered opinion that in this stage, veterinary supervision is
not necessary more often than weekly or semi-weekly.

Third, lay poultry inspector supervisor. Selected inspectors with a minimum of
three years' actual work as such, are in our opinion qualified for further examination
and if successfully passed can be assigned to supervisory positions, which would
include supervision of a multiple line plant or a group of single line plants which
would be classified as a station. The extent of the area would be governed by the
number of plants and the ability of the supervisor to render proper and adequate
weekly or semi-weekly inspection in each.

Beyond this, we do not contemplate the use of lay inspectors at the present time,
but we submit that this is a reasonable and acceptable program in outline and
merits serious consideration from the industry and from regulatory agencies.

Within the Production and Marketing Administration we have a staff of 200-odd
veterinarians that can and should be used as a nucleus to train properly selected
persons as lay inspectors. This is no easy task and it certainly cannot be done overnight. It is, however, a firm foundation on which to build and to build soundly for the future. We should make full and complete use of this asset. When this is done, then these men are the natural area supervisors and administrators of a vastly expanded inspection service.

Administratively it appears to us that we have three possible ways to establish a program of this kind.

1. Strict federal inspection.
2. Strict state inspection.
3. Cooperative federal-state inspection.

Each of these has advantages and each has certain disadvantages. Strict federal inspection has the advantage of providing an absolute uniform system of inspection in all areas, uniformly administered and supervised, which would guarantee uniformity of acceptance on any market and rapid shifts of volume as market conditions may require. It has the disadvantage of being, to some extent, administratively remote and to some extent inflexible. There is the danger, of course, that it will become administratively top heavy, and as with any federally administered program of this nature, it is not geared for rapid expansion. Strict state inspection has the advantage of being closer administratively to the industry in each state. It is considerably more flexible and in our opinion would have a definite advantage in its ability to promote rapid expansion of this service to cover large segments of the industry. The probabilities are that from an administrative standpoint, strict state inspection would be the cheapest of the three. It has disadvantages of course and chiefly among them would be the possibility of eventually establishing 48 different standards of inspection. Under such a set-up, processors would be vulnerable at any time to regulatory whims at the point of consumption of the product which would not be desirable. Cooperative federal-state inspection seems to us to be the most desirable of the three. State administration to keep this as close to the processor and consumer as possible, with federal supervision and control to guarantee uniformity of service and product. The extra cost from the administrative standpoint would be, in our opinion, more than compensated for by the uniformity resulting. We favor this type of agreement and service. We have been working for two years in an attempt to establish it. We have reached agreement on major points of difference, one at a time to the extent that at present there is but one difference between us unsettled, and on this point depends the success or failure of our efforts.

It is the feeling among certain segments of the Poultry Branch of the Production and Marketing Administration that lay inspectors must be supervised by veterinarians at least twice daily. It is Virginia's feeling that properly trained lay inspectors can do an entirely adequate job with weekly or semi-weekly supervision. On this one point we have been unable to agree. It is our contention that if intelligent lay technicians cannot be trained to do this work satisfactorily with weekly or semi-weekly supervision, then they cannot be trained at all. Any inspector who needs twice daily inspection is not an inspector and should never be licensed as such. Such a system would virtually rule out any expansion of this service because it would be denying to all but the larger processors anything but strict veterinary inspection.
We would like to offer a few specific suggestions for consideration.

I. That public health authorities, in conjunction with state and federal officials, draft model regulations providing for the inspection of poultry for wholesomeness. These should include: A—regulations outlining proper and adequate plants, facilities, and equipment; B—detailed regulations covering all phases of inspection itself; C—approved labels which clearly and completely state what has and has not been done to the product.

II. A model ordinance be also drawn to assist governing bodies in establishing inspection where locally desired.

III. That the present staff of veterinarians available to Production and Marketing Administration be used to start training lay inspectors to expand this service.

IV. That serious thought be given to the establishment of academic courses in our land grant colleges for the training of lay inspectors. We have special courses in other specialized fields, why not this one?

Inspection for wholesomeness, both ante-mortem and post mortem, on human food products of animal and poultry origin is the responsibility of the veterinary profession in this country. By training, by experience and by all other standards the veterinarian is the proper person to assume this job. Veterinarians have been slow to relinquish to trained laymen any part of their duties. We feel that this is not only short sighted but a waste of trained personnel. It is our feeling that if this job is to be done it will be done by veterinarians in supervisory capacities and by laymen on-the-line.

We are not offered a choice between veterinary and lay inspection. The choice is between veterinary supervised lay inspection and no inspection at all. We want to establish in Virginia a system of inspection on the principles I have outlined. We want it to be a voluntary service from the processors' standpoint until it has grown over the nation to the extent that most of the processed poultry is inspected and offered to the consumer in ready-to-cook form. When this is accomplished, it is our aim and intention to devote our efforts toward driving uninspected poultry off of the market legally. This must be done, if we are going to preserve any kind of order in the industry, in orderly, well-planned steps and the system here proposed of cooperative federal-state inspection is, in our opinion, the first step. We invite the cooperation of all responsible agencies and individuals to accomplish this end. This is an important and serious matter and we cannot continue to dodge our responsibilities to the consumer. This is a job for the veterinary profession but if the veterinarian does not do this, someone else will.
INFECTIOUS BRONCHITIS

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One of the reasons why this paper might possibly receive some attention is the fact that in the control of infectious bronchitis, a respiratory virus disease of poultry, we at the present time are employing a method which is precisely the opposite of that to which the veterinary profession has been pledged. In effect we have been raised on the principle that we are committed to the prevention and eradication of disease. That is the general principle upon which we practice.

Unfortunately, in the control of infectious bronchitis in poultry we have had to do precisely the opposite; that is, in effect, to propagate the disease. Then the question is asked, why this reversal of form?

In the first place, let me say that infectious bronchitis in many states in the northeast is much more important—indeed, economically worse—to poultrymen than is Newcastle disease.

The second point is that there is no vaccine available at this time for the control of infectious bronchitis. Under those circumstances the poultry man is hard put to it to absorb losses which year after year occur in certain sections of the country. These losses may not of necessity end in mortality of the birds; as a matter of fact, in many instances he would be much better off if mortality was the final outcome. In fact, when laying fowls become infected with infectious bronchitis they take a severe drop in egg production and in a great many instances the recovery of their egg production is not complete. Indeed, in many instances it never goes beyond the 50 per cent level.

To make matters even worse, the eggs that are produced by these laying fowls, in many instances are not marketable. The egg shell is very thin, the eggs are abnormal in size and shape and the interior quality is so poor as to have caused marketing agencies in various northern states to set up a new marketing classification, namely, "Infectious Bronchitis Eggs". Naturally, this product gets the lowest price on the market.

Under such circumstances poultrymen have been unwilling to have their flocks undergo repeated outbreaks of infectious bronchitis at the time when the birds are in full production. As a result of this situation, drastic steps had to be taken in order to prevent these economic losses.

The poultryman, as you can very well see, has to wait until his birds come into production—anywhere from the fifth to the sixth month. Experience has shown that if infectious bronchitis strikes his birds before they come into production, relatively little damage to the birds will be done. If the infection strikes when the birds are in full production, then the flock becomes an economic loss.

The result of these observations has been that if the disease is going to be present, then it is better to have the disease in the flock at the time the birds and the poultrymen can best afford it. With that idea in mind, Dr. Van Roekel of Massachu-
setts and others in northern states started the deliberate inoculation of flocks with infectious bronchitis during the age from seven to fifteen weeks, in order to introduce the disease during an age period when little or no mortality would occur and when egg production has not as yet begun.

If we are going to have the disease, let's have it when we can afford it. Recovery from the infection naturally leaves the flock immune and as a result the egg laying period or cycle is not interrupted by outbreaks of infectious bronchitis.

This practice has been followed in New York State and a system has been evolved which for us has seemingly worked out well. Our idea is to inoculate with egg propagated virus one per cent of every flock; to take this one per cent, introduce them into the rest of the flock and permit the disease to spread naturally. The virus that is used is a natural virus, not modified or attenuated in any way. It is "hot". We want it to be "hot" because we depend upon its contagiousness to infect the other in the flock.

The birds to be inoculated are brought to the laboratory by the poultryman, and the inoculation is done by simply depositing one drop of the virus into the trachea of the few birds the poultryman brings in. The inoculations are done right at the poultryman's car or truck and there is no mixing of birds at the time this operation is done. It is very simple and very rapid.

During the past year 1,128 flocks were inoculated, and these flocks represented about 1,100,000 hens. This does not apply to the entire State; it applies to the area surrounding Ithaca, an area of about six or seven counties. In the entire State approximately 2 million hens were inoculated in this way.

At the time of the inoculation the poultryman is advised that in about two and a half weeks he will receive a questionnaire, with a self-addressed, stamped envelope, asking some five or six questions. We have been very gratified by the response of the poultrymen in replying and sending back the questionnaires. In fact, 72 per cent of the poultrymen returned the questionnaires. And so we have been able to see what effects this inoculation has had upon the birds in the field.

For the most part, about 68 per cent of the flocks are inoculated during the months of March and June. Relatively few are inoculated in the early and latter part of the year.

We were interested to know how long it took the infection to spread from the one per cent of the birds to the others in the flock. During the early part of the year, when the birds are confined, the reports showed that the infection spread to 100 per cent of the birds in three days. As the season progressed and the birds were allowed to go outside on the range, it took a little longer for the infection to get around. During the months of May, June, July and August the infection spread in from four to six days. Later on, as the weather became colder and the birds again were housed, the duration of time that the infection took to spread increased to from four to five days. You can see that the spread of the disease was relatively rapid.

We also were interested to find out whether the disease spread at all, or not. Roughly, 10 per cent of the poultrymen reported that no takes occurred in their flocks. At the outset this might seem to be a rather high figure for failure of infec-
INFECTIOUS BRONCHITIS

In effect, however, it did not mean that the infection did not take. In practically all of these instances it was found that the birds were almost immune by the time they had been submitted for inoculation. As a result, therefore, the inoculation was done by the poultryman as a check test. He knew that they had suffered a respiratory infection prior to inoculation, but he wanted to make sure it was bronchitis and in most instances this previous infection actually had been bronchitis.

Another point we were interested in was the duration of symptoms. How long do these birds cough and sneeze? How long are they visibly sick? For the most part, poultrymen say that inappetence occurred in a period of two or three days, that the symptoms of respiratory distress lasted on an average two to three weeks. A few cases dragged on for another week or so, but in all cases by the end of a month no evidence of respiratory infection was found.

We also were interested in the mortality. It was found that the poultrymen reported, on the group as a whole, about 0.2 per cent mortality. In instances that we investigated it was found that in practically all cases the mortality was due not to the infectious bronchitis inoculation alone, but to some intercurrent disease that was in progress at the time. In most instances it was blackleg and coccidiosis that interfered with the immunization against the bronchitis, and actually, one might say, it was the primary cause of infection. When no intercurrent disease occurred, mortality was zero.

One of the things that we have to caution poultrymen against is this matter of the spread of the disease to birds that are not yet ready for inoculation. That, of course, is a disadvantage of this system of immunization. One hundred and fifty-nine poultry men reported that the disease did spread to the birds they did not want to have contract it. We always caution poultrymen about this, because we have found from experience that the contagiousness of infectious bronchitis is so high that the spread of the disease cannot be avoided on a premise. As a consequence, these poultrymen knew that. They took the chance; and, as I say, 159 out of the 800 or more reported that the disease spread from other lots.

Luckily, however, whether by design or accident, the mortality in the lots of birds that were not supposed to get the infection was relatively low, so that these poultrymen did not mind what losses they had to take. Thirty-nine out of the 800 or more who reported stated that the disease not only spread to their own flocks, which was what they wanted, but that their neighbors' flocks likewise had become infected.

One might think that here might be a cause of difficulty in the neighborhood where a disease is introduced by poultrymen and extends over the line and runs onto other farms. We anticipated this, and before we went into an area with this immunization plan we insisted that 75 per cent of the poultrymen in the area approve the plan, whether they intended to take advantage of it or not. Not until 75 per cent of the poultrymen approved it did we proceed to do the inoculations. We knew that the disease would spread and that it could not be done on an individual flock basis, but must be done on an area or community basis.

As a result we have had very little difficulty with poultrymen whose birds, you might say, accidentally got the disease. As a matter of fact, many of the poultrymen
simply told us that their birds got the disease from a neighbor, and in effect it saved them a trip to the laboratory. There has been very little, if any, ill feeling from this method of immunization.

Furthermore, the natural disease has progressed to the point where there was no difficulty encountered in having poultrymen make up their minds as to whether they wanted this immunization procedure or not. In practically all instances the demand was unanimous for this method of immunization.

Has the scheme worked? It has. In so far as our records are concerned, we no longer record outbreaks of infectious bronchitis in laying flocks in areas where this immunization plan has been in effect.

Is this method the method of choice? I don't think it is. However, until we can get a vaccine that can be applied to individual birds, and until such a vaccine is of such low order of contagiousness as to not spread to other flocks, and until such a vaccine is of such order of antigenicity as to induce a good, solid immunity, this is the only method available to offer the poultrymen the economic protection they want.
REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY

H. Van Rokebel, Amherst, Massachusetts, Chairman; F. R. Beaudette, New Brunswick, New Jersey; W. L. Bendix, Richmond, Virginia; Charles H. Cunningham, East Lansing, Michigan; John P. Delaplane, College Station, Texas; L. C. Heemstra, Washington, D. C.

The development of the poultry industry in this country during the past decade is very impressive. Economically speaking, it has become a three billion dollar industry. One phase of the industry, that is broiler production, has made phenomenal growth. Approximately 100,000,000 broilers were produced in 1939; whereas, it is estimated that 700,000,000 will be grown in 1951. Turkey production also has increased in volume. The outlook reveals that further expansion in broiler and turkey production may be expected. To protect the health of this important segment in our agricultural industry will require increased attention from the livestock sanitarian, practicing veterinarian, laboratory diagnostician, and research worker.

Transmissible diseases of poultry constitute a major problem in profitable poultry production. The status of the more important diseases will be discussed.

SALMONELLA INFECTIONS

A measure of progress in the control and eradication of pullorum disease is the reduced incidence of reactors to the agglutination test. In this respect continued progress has been made, as shown in Table 1, under the National Poultry and Turkey Improvement Plans.

Another and probably more significant measure of progress is the livability of the chicks produced. A compilation of the results of livability surveys conducted in eight states and covering 8,389,572 chicks shows a mortality from all causes for the first three weeks of 198,841 chicks. This represents an average livability of 97.64 per cent. Comparable figures for turkey poults are not available.

The incidence of standard and variant antigenic forms of Salmonella pullorum has been further investigated. Snoeyenbos (13) and associates have form typed 1,679 cultures obtained from 27 states. An incidence of 26.9 per cent variant forms was found with a high of 59.6 per cent in one state and a low of 8.0 per cent in another state. Of 134 cultures obtained from turkeys only 5.9 per cent were typed as variant forms.

While commendable gains are thus being made in the control of pullorum disease, the Committee is not unmindful of the fact that there are other egg-borne bacterial diseases that deserve consideration in a nationwide program.

In this connection, several states have inaugurated modest paratyphoid testing programs of turkey breeder flocks. For the time being, only antigens produced from Salmonella typhimurium are being used and no official recognition is being given to tested flocks.

Fowl typhoid is of actual or potential significance in some areas. Acute outbreaks of the disease should be identified by laboratory methods. The infection should be
eradicated either through the liquidation of affected flocks or through the detection of carriers by the agglutination test.

Gwatkin and Dzenis (6) have compared the antigenicity of 16 strains of Salmonella gallinarum. In 464 cross agglutination tests with antigens produced from these strains there was no variation suggestive of a different antigenic structure.

The North Central States Pullorum Conference, in July 1951, recommended the inclusion of fowl typhoid in the disease control provisions of the National Poultry and Turkey Improvement Plans.

During the past year, McCullough and Eisele (9) have presented further evidence that different members of the Salmonella group are capable of producing human illness.

**Table 1**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Tested Chickens</th>
<th>Reactors Number</th>
<th>Per cent</th>
<th>Number of Turkeys Tested</th>
<th>Reactors Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1946</td>
<td>30,355,224</td>
<td>543,356</td>
<td>1.79</td>
<td>2,061,043</td>
<td>25,019</td>
<td>1.21</td>
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<tr>
<td>1947</td>
<td>30,093,726</td>
<td>354,255</td>
<td>1.18</td>
<td>1,265,037</td>
<td>9,472</td>
<td>.75</td>
</tr>
<tr>
<td>1948</td>
<td>29,320,525</td>
<td>250,553</td>
<td>.86</td>
<td>1,990,073</td>
<td>10,210</td>
<td>.51</td>
</tr>
<tr>
<td>1949</td>
<td>37,237,674</td>
<td>269,115</td>
<td>.72</td>
<td>2,340,576</td>
<td>9,172</td>
<td>.39</td>
</tr>
<tr>
<td>1950</td>
<td>36,618,786</td>
<td>200,155</td>
<td>.65</td>
<td>2,391,630</td>
<td>8,502</td>
<td>.35</td>
</tr>
</tbody>
</table>

* This table furnished by Dr. Heemstra.
† Year beginning July 1.

**Coccidiosis**

The problem of coccidiosis in chickens has been reduced by the wide prophylactic use of the newer compounds such as sulfaquinoxaline, megasol, the arsenicals, and nitrofurazone during the past two years. From time to time failure on the part of these compounds to protect flocks are reported. There is need for thorough study of such failures to determine whether intestinal diseases other than coccidiosis are being revealed or whether it represents actual failure on the part of the compounds in use.

The Committee, as on previous occasions, wishes to reemphasize the need for sound sanitary practices in the control of poultry diseases on poultry farms. The progress made in newer disease control methods the past few years are specific in purpose and not intended to overcome problems resulting from neglect to heed proper sanitation measures.

**Erysipelas in Turkeys**

Erysipelothrix rhusiopathiae infection in turkeys is increasing in incidence. Disease outbreaks are usually observed in turkeys which are approaching market age. Losses may be very severe. Antiseraums or antibiotics have their limitations in controlling outbreaks. Further investigation relative to the origin of infection and control of
TRANSMISSIBLE DISEASES OF POULTRY

this disease is urgent. Turkey erysipelas may be of potential public health significance as has been revealed in laboratory diagnosticians contracting the infection through examination of affected turkeys.

AVIAN LEUKOSIS COMPLEX

The group of neoplastic diseases embraced in the avian leukosis complex continues to exact a higher mortality rate among adult poultry than any other poultry disease. In the United States alone, the annual economic loss attributed to this disease complex has been estimated to be in excess of $60,000,000. Visceral and neural lymphomatosis remain the two most important diseases in this group and more cases involving younger birds are being recorded than heretofore. Ocular lymphomatosis is less often seen than formerly.

Recent experiments by Cottral (1) and Cottral, Burmester, and Waters (2), in which groups of chicks were inoculated with tissue extracts from other newly hatched chicks and embryos 15 and 18 days old, confirm the suspicion often advanced that lymphomatosis is transmitted from dam to offspring through the egg. Furthermore, these experiments indicate that certain normal-appearing hens may be carriers of the agent of visceral lymphomatosis and pass the agent on to their offspring without later showing clinical or gross evidence of the disease themselves.

Incubator exposure studies by Waters and Bywaters (16) indicate that lymphomatosis is transmitted from infected to non-infected chicks in the incubator at hatching time and during the brooding stage. The most dangerous period for contact transmission appears to be during the first 30 days of the life of the chick.

Lucas and Oakberg (8, 10) reported on studies of the so-called normal lymphoid areas found in the various organs of chickens. The lymphoid areas increase in number with advancing age of the chicken and may be related to the activity of the agent of lymphomatosis. The amount of lymphoid tissue in the pancreas appears to bear a relationship to the predisposition of the chicken for developing lymphoid tumors. This point was brought out in studies on surviving populations of grossly normal chickens by relating the number of lymphoid areas found per family and line to the incidence of gross lymphomatosis observed in the sibs that died.

Breeding for resistance to lymphomatosis or raising birds in complete isolation by families are the only two methods known that will result in reduced incidence of the disease. No other more practical control measures have been found.

INFECTIOUS BRONCHITIS

Infectious bronchitis is becoming an increasingly important disease of chickens. According to Van Roekel et al. (15) the incubation period may vary from one to six days with the majority of the affected chickens exhibiting symptoms from one to 11 days. Losses from the disease in laying flocks may approximate one dollar per chicken as the result of decreased egg production and abnormal egg quality. Losses from the disease in broiler flocks may also be significant, especially when the birds approach market age.

Of particular concern are methods of serologic diagnosis. Quantitative in vitro serum neutralization tests by Cunningham (3) and Page (11) using embryonating chicken eggs have shown that the titer of normal chicken serum would not be ex-
pected to exceed a LD_{50} neutralization index of $10^{1.817} \pm 10^{0.337}$ or a maximum of 36 neutralizing doses. Fabricant reported that the titer was never found to exceed 100. Similar observations were reported by Van Roekel, et al. (15). Fabricant, (4) Page, (11) and Van Roekel, et al. (15) studied the antibody response of chickens and reported that for serologic diagnosis of the disease, serum neutralization tests should not be made for at least three weeks following exposure of chickens to the virus. Fabricant concluded that a titer of 100 or greater is diagnostic of infectious bronchitis. Chickens having positive titers were refractory to infection.

In preventing outbreaks of the disease in laying flocks, the birds may be success-fully immunized by artificial exposure to the live virus at 8 to 16 weeks of age. In broiler flocks artificial exposure to the virus at four weeks of age may prove practical and economical in controlling losses from the disease. Artificial exposure to the virus is recommended only in areas where the disease is widespread and eradication is impractical.

**CHRONIC RESPIRATORY DISEASE**

During the past year further reports of the isolation of the chronic respiratory disease agent were made by Fabricant, (5) Johnson, (7) and Van Roekel and Olesiuk. (14) Johnson (7) has reported that the disease is of considerable economic impor-tance to the broiler industry in Virginia. Van Roekel and Olesiuk (14) likewise reported the prevalence of the disease in Massachusetts and that the agent can be identified readily and quite accurately by the inoculation of tracheal exudate sus-pensions into embryos and chickens. Of considerable aid in the diagnosis of the disease were the specific respiratory lesions in embryos caused by the agents of chronic respiratory disease and infectious sinusitis. Furthermore, the two agents behaved similarly in many other respects when inoculated into chickens, turkeys, and mice. Aureomycin, chloromycetin, streptomycin, and terramycin exert an inhibitory effect on the chronic respiratory disease agent but thus far a practical antibiotic treatment for the disease has not been discovered.

Regan, et al. (12) have found with the electron microscope that the particle size of the chronic respiratory disease agent measures 60 to 70 millimicrons. It is appar-ent that a more accurate evaluation of this disease will require the discovery of reliable diagnostic procedures.

A number of investigators are of the opinion that chronic respiratory disease and turkey sinusitis are caused by the same agent. The evidence presented suggests that this might be the case, but thus far the antigenic relationship between the two agents has not been determined. Grumbles (unpublished data) obtained evidence of transmission in chickens through contact with turkeys affected with infectious sinusitis both under field and laboratory conditions. Further research is needed relative to the immunologic aspect of the disease. The use of antibiotics in the con-trol of infectious sinusitis outbreaks has proved beneficial in some instances.

**NEWCASTLE DISEASE**

During the past year numerous investigations concerning Newcastle disease have been reported. One member of our Committee (Dr. F. R. Beaudette) has prepared a review of the papers on Newcastle disease published during the year. This review will be published in the Proceedings of this Association.
Immunization against Newcastle disease has received major emphasis by investigators during the past year. It is evident from investigational and field results that further clarification on the immunologic aspects are necessary to improve methods for the control of the disease.

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A STATISTICIAN LOOKS AT VETERINARY VITAL STATISTICS

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I know we are a little behind schedule, but what I have to say won't take very long and will bring the program right up to schedule.

In speaking of veterinary vital statistics we are really speaking about a subject on which nothing formal exists. I would like to point out that about thirty years ago this Association appointed a committee for what they called morbidity and mortality.

At that time there were brave and high hopes, and after a lot of good words from everybody the committee went to work. All the states agreed that it would be a wonderful thing to have morbidity and mortality statistics.

Thirty years later there are no morbidity or mortality statistics. There is still a lot of high hope and more brave words and more resolutions saying it would be a good thing to have such statistics.

I think it would be interesting to look into the reason or reasons for this rather profound inertia that seems to fall upon the veterinary profession when it comes to the compilation of any sort of statistical material—and I believe you will find that it actually comes down to two components, and these are the two:

One is our attitude toward statistics and mathematics in general. I don't imagine most of you are any different than I am. When one talks about mathematics and statistics I am afraid I approach it with a little bit of awe; I bow a bit, because it seems to be such an esoteric art and esoteric science. It has few practitioners. The practitioners it does have, when they talk to a group, slap a number on a blackboard—and most people won't argue about numbers because they are afraid of them.

The second extreme is the one which we use in self-defense; since we can't manipulate statistics, and since we are not good mathematicians we tend to say, "This is something that a fellow can do in his leisure time. It's the kind of luxury that can be indulged in by people who don't have anything else to do."

I believe the attitude toward statistics, which will reveal something important, is probably somewhere between them. Unfortunately there aren't many veterinarians who have bothered to look into statistics, or who used it as a tool, and therefore anything we have to do with statistics, I am afraid, will have to be left for the time being to professional mathematicians, professional statisticians, who will tell us what to do.

That second remark, about telling us what to do, is the crux of the situation. Statistics, as I intimated, is a tool. You have to know what you want to do with them. You have to know exactly what you would like; then you can tell a statistician, "Do this for me. You're the one who can wield the axe or the saw. You're the one who can put it in shape. Tell me what I've got. I would like to know exactly what there is here." And the statistician can do it for you.

The other reason why we don't have any veterinary statistics is because the vet-
ernarians, as such, in their official work have always tried very hard to imitate physicians and regulatory officials in human medicine. This is an unfortunate, slavish attitude. Our problems are not anything like the physician's problem. Let me give you a small idea of what I mean:

In human medicine we talk about morbidity rates. Morbidity rates are very important because they have been used for ages as a measure of the relative amount of civilization in any one area. You say, "The United States is a good country to live in. It is civilized. We are clean, we are rich, we are healthy. Our mortality rate is only ten per thousand per year."

You think that proves it. India obviously isn't a good country to live in because its mortality rate is around 35 per thousand per year.

Over-all morbidity rate is meaningless. After all, why do we raise animals? We raise animals so that we can kill them, and kill them before they reach their normal period of life. If we didn't do that we wouldn't be in business.

So, it isn't an over-all mortality rate in which we are interested. What we are interested in is a very specific type of mortality rate. We are interested in a mortality rate of specific animals at an age before they reach the market so that the butcher may officially kill them and wipe them out.

When you take that into consideration, it is an entirely different kind of story from what the physician is doing. The physician's mortality rates are pretty good in places like the United States because to bury a person one needs a permit, and you can't get a permit to bury someone unless you have a death certificate. If you have a death certificate, and if on the death certificate you state a cause of death, you can get some very good mortality data. In veterinary medicine we don't have anything approaching that. What we have to do is to use whatever data we can find, at any place we can find it.

Let me assure you, gentlemen, that there are lots of data. Dr. Bendix gave an enormous amount of data on certain chicken diseases. Anybody who is at all interested could take the time to visit rendering plants, and could find out how many animals those people are rendering. They render only animals that die because people didn't want to see them die at that time. If you could possibly have salvaged them and sent them to the butcher, the butcher would have killed them and the rendering plant would not have had them. There is a lot of data there.

We have seventeen veterinary colleges, all of which have ambulatory clinics, and all of which have an enormous amount of data. There is a lot of data there.

The Bureau of Animal Industry has an enormous amount of data which they release once a year; but nobody seems to pay too much attention to that data—I don't know why. They have all sorts of data. The data that arises from the meat inspection floor is data on morbidity of presumably normal animals. They come into the slaughterhouses and certain morbid conditions are found. This material is published once a year. Nobody seems to pay very much attention to it.

What I am suggesting, as far as morbidity and mortality statistics in veterinary medicine are concerned, is that we need someone—it doesn't matter who, just someone most interested, someone who has the technical facilities—to go out and
gather the data that already exists, put it in such form that it will be ready for presentation, and present it.

This form for presentation is probably what personally interests me the most, because just to present a column of data and say, "There were 300,000 parts of carcasses condemned for actinomycosis in one year in the United States," is not particularly meaningful. To stand up and say that out of six million animals that were tested for brucellosis, less than four per cent reacted, is again not particularly meaningful.

These things take on meaning only in terms of very specific problems that people have that they want to solve, only in terms when you are trying to measure either something you are doing or something that is spreading. Therefore, you have to do it against a background of something more important than just gathering statistics.

I had a professor once who said that statistics were like garbage: Once you collected them you had to do something with them, otherwise they became a stinking nuisance.

I believe that to a great extent that is true. Just the mere gathering of statistics for the sake of quantity rather than quality will get us nowhere.

Another reason for our inertia as veterinarians is that we claim we don’t have two things which we think are necessary for morbidity and mortality reporting: We claim we don’t have a system of standard nomenclature, and we claim that we don’t have sufficiently widespread diagnostic laboratories. These are two very serious criticisms of any system of reporting that we might want to set up. It is important or serious only for one reason, namely, if you are looking for a set of very good quality statistics.

For many purposes quality is unimportant, and let me tell you why: Back in the 17th Century in England there was a brewer who made a good beer, who became interested in statistics only because he was interested in geneology. He got rich, and because he got rich he wanted to prove that his family was as good as any of the noble families that existed in England in that day. So he examined his family tree and other people’s family trees, and he gathered a tremendous amount of mortality statistics.

Being a shrewd business man, he realized when he had all of those statistics that he could go into the business of insuring people against death; and so he started the first insurance company. He charged rates depending upon what he found in his mortality statistics. Thus, in the 17th Century we had the first establishment of a successful life insurance company.

There was no germ theory of disease then, no laboratories, no systems of nomenclature or anything else; but in a period of ten years he got sufficiently good mortality statistics to establish a perfectly good, sound, profitable insurance company. That’s something about mortality statistics: It just depends upon what you are interested in.

There were fairly good morbidity statistics that existed in human medicine long before there were any systems of standard nomenclature or laboratories. There is data on smallpox that goes back to the 16th Century—and reliable data, too. There is data on plague that goes back to the 12th, 13th and 14th Centuries. There is
data on diphtheria and on tuberculosis that goes back to—well, just to make sure that I don't step way out of line, let's put it back just to the beginning of the 19th Century. There were no diagnostic laboratories and nothing else then.

If we in the veterinary profession want statistics, they are here. All we have to do is to take them and put them in the form we want them to be in, to solve the problems that we want them to solve, or at least to help us solve them.
REPORT OF THE COMMITTEE ON MORBIDITY AND MORTALITY

C. R. SCHROEDER, Pearl River, New York, Chairman; HERMAN C. AABERG, Chicago, Illinois; D. M. CAMPBELL, Chicago, Illinois; RAYMOND FAGAN, Boston, Massachusetts; R. C. NEWTON, Chicago, Illinois; R. S. ROBINSON, Pierre, South Dakota; A. P. SCHNEIDER, Boise, Idaho; C. E. WICKTOR, Los Angeles, California

Dr. D. M. Campbell, a member of this Committee, made the following statement in the report of the Twenty-Fourth Annual Meeting of the United States Livestock Sanitary Association for 1920: "Since I have repeated one matter given in my report last year, I cannot refrain from reiterating another. During the year I have been impressed more than ever with the need of a central agency for the collection of animal mortality and morbidity statistics and I desire to repeat the recommendation that this Association take steps looking toward the establishment of such an agency either within the Association or elsewhere. An editorial in the current issue of VETERINARY MEDICINE gives in some detail the reasons why such a statistical survey is needed and I will not repeat them here."

Following is the editorial in VETERINARY MEDICINE, Volume 15, No. 12, for December, 1920:

"Notification of Animal Diseases"

"From time to time, we have urged upon veterinarians and upon state and federal officials charged with the enforcement of livestock sanitary laws and regulations, the desirability of a system of reporting certain diseases of the domestic animals.

"In general medicine, the value of reports and statistics pertaining to preventable disease is recognized by all who have had experience in public health work vital to any measure of success in handling such diseases. The following from the United States Public Health Service is conclusive evidence of the importance that that organization attaches to reports on the occurrence of disease.

'No factory management, employees' organizations, or public health agency can control or prevent sickness without knowing when, where and under what conditions sickness actually occurs.

'This knowledge is essential, and not simply for a single day or month or year, but continuously. Eternal vigilance is never more necessary than in the control and prevention of disease, and this oftentimes can be maintained only by the systematic report of sickness. The sole influence of many conditions, harmful or helpful, cannot be recognized and evaluated unless records of ill health are currently available for observation and study in connection with a knowledge of the conditions under which people work and live. So well recognized is this fundamental principle, that the effectiveness of a city health department is judged in large measure by the accuracy and completeness of its morbidity reports. Without dependable and prompt records of what sickness actually occurs, a public health agency is blind.'

"Of the occurrence of disease in our domestic animals, we have some scattering statistics, but these in the main are either so delayed in coming to the surface that they have little, if any, just historical value, or they pertain to such a small part of the livestock population that they will not serve as a guide for control measures."
"A start has been made in the collection of animal morbidity statistics, but only for detached projects of disease control. The value of such statistics for those projects has been amply demonstrated. We refer to tick eradication, accredited tuberculosis-free herds, certain hog cholera control projects and foot-and-mouth disease during the latest outbreak. Collection of such data should be greatly extended under state or federal control or in a co-operative way, and until there is a general statistical service furnishing a constantly available gauge of the animal disease situation, livestock sanitary authorities will work in the dark, unable to undertake effective measures to relieve the animal industry from the burden of losses from preventable diseases. An officer who conducts a campaign efficiently must know the location of the enemy, his strength and his fighting qualities. The odds will favor the enemy in the same proportion that this information is deficient.

"To quote the United States Public Health Service again: 'On the knowledge obtained from this source, we build our public health systems and make a practicable application of preventive medicine by education, sanitation or quarantine, as may be required. The work can be directed intelligently only in proportion to the completeness of the information before the director.'

"The collection of animal morbidity statistics is entirely feasible in most states with little, and perhaps in many of them, no additional legislation. It is in the main a matter of willingness or reluctance of the constituted state livestock sanitary authorities to undertake and vigorously prosecute this great work for the livestock industry of their respective states.

"Just as in the public health service, the reports must be made by practicing physicians and must be collected for the states by the state boards of health, so in the livestock sanitary service, the reports must come from veterinary practitioners and be collected by the state livestock commissions or by the state veterinarians. It has been amply established that the state has the right to make the reporting of disease a condition to the license to practice and to compel practitioners to report disease without additional compensation. Moreover, after a properly conducted educational campaign, compulsion would not be required in most instances any more than it is required to get a good citizen to report it if he sees his neighbor's house on fire.

"There can be no doubt that the livestock sanitary board that has the initiative and aggressiveness to collect animal disease statistics for the whole state, daily or weekly, over a period of sufficient length to obtain the knowledge necessary to construct a practical system of disease control for that state, will receive the support from the veterinary and livestock interests and from the legislature necessary to carry out its program."—D.M.C.

It is interesting to note that in 1920 the Committee on Resolutions of the United States Livestock Sanitary Association at Chicago, Illinois, on December 1, presented the following resolution:

"WHEREAS, it is the sense of the Association that there should be gathered monthly or periodically animal health statistics, same to be published and distributed from the various states;

"Be It Resolved by the United States Livestock Sanitary Association, That we recommend that the livestock sanitary authorities of each state take steps to gather
reliable information concerning the health of livestock in the state with definite information as to any and all existing outbreaks of communicable diseases, and that the information thus gathered be forwarded to the Chief of the Bureau of Animal Industry, United States Department of Agriculture, with the request that the statistics and the information thus gathered be edited and published by the department and distributed to the various state sanitary boards in sufficient quantity so that distribution may be made among those interested in animal health and livestock sanitation in the various states.

"Be It Further Resolved, That the chair appoint a committee of five from the membership of this Association, including the Chief of the Bureau of Animal Industry as chairman, to devise ways and means for the carrying out of this resolution."—J. I. Gibson, Chairman, L. H. Howard, J. H. McNeil.

It is apparent that ways and means for carrying out the resolution did not mature.

Thirty-one years later we find that, whereas the Public Health program for the collection, assembling and distribution of morbidity and mortality data for man has come into being and matured, there has been little change in vital statistics reporting in veterinary medicine, and this committee is still, for the most part, concerned with publicizing the need for morbidity and mortality statistics and especially bringing the subject to the attention of legislators, who it is hoped will concretely support a program with adequate appropriations if given the facts. An editorial "Who Knows the Cost of Animal Diseases?" appeared in the March 1951 issue of the Journal of the American Veterinary Medical Association. The editorial is obviously favorable and concluded with the following two suggestions:

"(1) That there be a conference of persons representative of the fields and agencies who could contribute worth-while material and ideas to the formulation of vital statistics system on animal disease. These would include, but not be limited to, the AVMA Special Committee on Nomenclature; the N.R.C. Committee on Veterinary Services for Farm Animals; the Committee on Morbidity and Mortality Statistics of the U.S.L.S.A.; the Bureau of Animal Industry, Bureau of Agricultural Economics and other appropriate bureaus of the U. S. Department of Agriculture; the Extension Service; the Statistical Laboratory at the Iowa State College Experiment Station; the AVMA Special Committee on Veterinary Services; the appropriate divisions of the U. S. Public Health Service; the appropriate sections or committees of the American Medical Association and the A.P.H.A.; the veterinary deans; the Food and Agricultural Organization and the International Office of Epizootics, etc.

(2) That a fellowship be provided at once through the AVMA Research Council, with any funds that may be made available, for a specific project to collect and to analyze all available information on animal disease statistics, including methods."

In the April 10, 1951 issue of Hoard's Dairyman an editorial appeared, "Working in the Dark", which clearly stated the problem to the livestockmen and concluded with the statement, "Our program of work in protecting our livestock must be based on accurate reliable information. As mature people in a mature country we should not tolerate the continuance of the present complete or partial informational vacuum."

The following note was sent to the deans of all veterinary colleges in the United States, Canada, Mexico and Cuba:
"We would appreciate a brief report from you indicating whether or not any part of the curriculum is concerned with morbidity and mortality, including disease classification, diagnosis and the practice of reporting to a central agency for purposes of recording disease frequency. The Committee on Morbidity and Mortality of the United States Livestock Sanitary Association would like very much to—show—the participation of colleges in a program of collecting, assembling, distributing and interpreting morbidity and mortality data in the 1951 report."

Replies were promptly received and with few exceptions it was stated that, whereas there were no formal courses in vital statistics, the broad subject is presented to all students and they are being made aware of the importance of the program and their moral obligation.

The following letter was sent to all state and territorial veterinarians, together with a reporting form: "The Committee on Morbidity and Mortality of the United States Livestock Sanitary Association is in the process of preparing the annual report for 1951. Since the United States Department of Agriculture Budget Committee has failed to approve the allotment of funds to be used by the United States Bureau of Animal Industry to initiate a program of collecting, assembling and distributing morbidity and mortality data, it seems wise that we start at the state level. Would you be willing to start even in a small way to accumulate mortality data and submit a copy to this Committee?

"Do you now have a form which you send to the practicing veterinarian for purposes of reporting deaths? If you have such a form, we would like a copy. Is the form sent to the practitioner? Monthly or annually?—or is he given a pad of forms to be completed and sent to you, and at what interval? What diseases are reportable in your state? Are your laws strong enough to require prompt reporting? Do you return assembled data to the veterinarian?—and at what interval?—and in what form to appraise him of the incidence or frequency of infectious diseases in his and adjoining sections of the state? Do you acquaint him with approved current preventive practices or accepted forms of treatment for the diseases he is encountering?

"If you can give us answers to some or all of these questions, it is the Committee's feeling that we will assemble such data to incorporate in our report for 1951. This letter is going to every state and territorial veterinarian. Some of you obviously already have an established program. Do you have any suggestions to make? We do invite your participation and we will value your counsel."

There were twenty-eight replies. The combined reports are shown in the table on page 200.

Of the forms returned, many were incomplete. Many indicated that they would return assembled data to the veterinarian if they could convince him to turn in reports. Many had suggestions to offer, most of which proposed simple forms, at least for purposes of initiating a program. Most had a list of reportable diseases and many have excellent forms for the veterinarian to complete to be returned to the state veterinarian. One would gather from the reports that the machinery is there but that it fails to function.

It is the opinion of the Committee as a whole (1) that the diseases reportable in all states should be assembled into a single composite list for purposes of uniformity after discussion and review by those at the State Regulatory Officials Meeting; (2)
1. Do you have 1950 mortality data which we may include in a committee report? .......................... 4 22
2. Do you send a report form to the practicing veterinarian for the purpose of recording reportable diseases? 10 14
3. Do you require the practitioner to report to you?
   a. Weekly........................................ 5
   b. Monthly...................................... 6; 17 10
   c. Quarterly.......................................
   d. Annually...................................... 2
4. Are your laws strong enough to require prompt reporting?.................................................. 13 10
5. Do you return assembled data to the veterinarian for his use?................................. 6 15
6. At what intervals?
   a. Monthly........................................ 5 3
   b. Quarterly.......................................
   c. Semi-annually..................................
   d. Annually....................................... 4 20

that the states should individually be responsible for the assembling of morbidity and mortality data and that reports prepared by the State Livestock Sanitary Inspector be accumulated monthly and delivered to a central agency; (3) that there should be a special central agency for assembling state reports and that either the United States Bureau of Animal Industry or the Bureau of Agricultural Economics, or both, prepare forms and set up procedure for national reporting; (4) that funds be sought through the Agricultural Research and Marketing Act of 1946 for a project to analyze and report field findings; (5) or that an effort be made to secure grants-in-aid to initiate a study program; (6) that a formal publication on nomenclature is not necessary for the initiation of a reporting system; (7) and that the state veterinarian would have the responsibility of abiding by standard nomenclature agreed to between the state veterinarians.

It is the consensus that if a state reporting system materializes the federal program will not be far behind.
SOME ANGLES ON ATROPHIC RHINITIS

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A diagnostic laboratory operating on a statewide scale is an especially good vantage point from which to make observations which are not possible in the average local practice or under the special conditions of a research investigation. The viewpoint of the diagnostic laboratory is in a general way the same as that of the practicing veterinarian. Both get the practical, direct information on animal diseases and a close-up view of positive and negative relationships with a long list of factors which have to be considered. The laboratory has the added advantage of being able to make more examinations from a larger area, and thus has a little broader base on which to build experiences. This advantage is particularly marked in the case of a disease such as atrophic rhinitis where its presence or absence is quite often determined only by autopsy examination.

During the past three years in the course of routine autopsy examinations of swine, so many cases of atrophic rhinitis have been demonstrated and so many of them have been unpredictable on a basis of history and clinical evidence, that we have come to consider it as a disease with very many angles and implications. Some phases are prominent and attract immediate attention. Such phases include the well-known history and symptoms of sneezing, nasal hemorrhage, distortion of the facial bones, the frequent pneumonia, and the tendency to cause either an increase in the time and cost required to produce a certain market grade, or a lowering of the grade and market value.

However, there seem to be many comparatively small, and perhaps even unsuspected angles which do not attract immediate attention. After repeated contacts with these less conspicuous angles, they finally dig their way into our consciousness and we have begun to suspect that the loss and damage which should be charged to atrophic rhinitis has been underestimated, and that the influence of this disease on other swine diseases is a more important factor than has yet been appreciated.

Atrophic rhinitis is a disease of unknowns and many questions can be asked for which we have no really satisfactory answer. For example, the cause of the disease is still unknown. Considerable investigation has been done by various workers on the question of the etiological agent. Schofield and Jones (1) in referring to some bacteriological studies by McKay, state that he isolated Corynebacterium pyogenes from a group of pigs affected with rhinitis and infer that this organism was not present among a smaller group of non-affected pigs. McKay also isolated Pasteurella multocida and Actinomyces necrophorus from 65 of 75 affected swine and believes that these two organisms in combination might be of some etiological significance. This brings up the possibility of multiple etiological agents, and Switzer (2) has recently added to the possible agents that need to be studied further by reporting the occurrence of trichomonads in the nasal cavities of a large percentage of swine affected with atrophic rhinitis.

Probably only a small proportion of the animals that are actually affected can

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be detected by clinical methods. In our experience, very few visibly affected specimens are received for laboratory examination. This is not entirely due to an absence of well-marked cases submitted to the laboratory. At least 10 per cent of the cases have shown almost complete disappearance of the turbinates, but very few of them have shown a recognizable facial distortion. The facial distortion to which we refer does not include the malformations described by Duthie (3) which he considered due to congenital deformity. Hereditary malformations can be easily confused with the distortions of atrophic rhinitis. Positive diagnosis is based on finding a partial or complete disappearance, dissolution, or malformation of the turbinates or ethmoids. A large proportion of the pigs found affected at the laboratory during the past one and one-half years have shown no clinical evidence of the disease just prior to examination.

A recent survey conducted at our laboratory, which included all pigs more than three weeks of age received for diagnostic purposes over a period of only six weeks, showed 59 pigs to be affected with atrophic rhinitis, and 83 to be unaffected. This indicates an incidence of 41.5 per cent. The number of affected pigs was further broken down into those which showed what we classified as slight lesions, those classified as marked lesions, and those which showed complete disappearance of the turbinates. 26 pigs, or 44 per cent, were found to be slightly affected; 26 were markedly affected; and 7 pigs or 12 per cent, were completely affected.

In addition to being a disease of numerous unknowns, atrophic rhinitis is often an insidious and perhaps intermittently active, disease. Most of the case histories indicate that the disease has been present in the herd from at least one to four or five years before its presence was suspected or demonstrated. Many such case histories have involved purebred breeding herds with the disease apparently brought in by a purchased animal. On the other hand, cases in feeder herds are known to have been purchased at sales barns. It is evident that the disease has been spread by movements of affected individuals from one herd to another; sometimes entirely innocently with no knowledge or even suspicion that a serious infectious disease was being disseminated, and at other times under circumstances in which the lack of such knowledge might be doubted.

In addition to the technical findings, we quite often see rather characteristic reactions in the human side of the picture. For example, what is the reaction of the practicing veterinarians when they have a case of atrophic rhinitis to deal with? The response of one very well-informed and successful practitioner in such a situation will illustrate the feeling of discouraged helplessness shown by many. After a laboratory examination of a couple of specimens from the herd of one of his clients who had been a very successful swine producer over a number of years, the practitioner was informed that the pigs were affected with atrophic rhinitis and a Corynebacterium pneumonia. He stared straight ahead a few seconds and then said, "Atrophic rhinitis and Corynebacterium pneumonia. What am I supposed to do about that?" A very similar attitude is quite often shown and expressed by swine owners. However, there is one big difference between these related reactions shown by practitioners and by owners, and that is the point of time at which these reactions are reached. The practitioner isn't helpless until he learns definitely that the condition with which he is dealing is one with the odds stacked very heavily against him.
On the other hand, the owner is very likely to show an attitude of enraged, disgusted and helpless frustration before the specimens from his herd have been examined. He and his veterinarian have been fighting a losing battle against a succession of supposedly minor disease conditions over a period of several weeks or even months without suspecting the presence of atrophic rhinitis, since there had been no clinical evidence of its presence during that time. From a laboratory standpoint, this type of history is practically as significant and characteristic as the history which includes the typical, clinical symptoms of the disease. Specimens from such a herd are almost sure to show some stage of the characteristic dissolution and malformation of the nasal turbinates and ethmoids.

It is rather characteristic in laboratory findings that pigs affected with atrophic rhinitis will also be affected with one or more of almost the entire list of swine diseases. Some of the more common disease conditions found associated with atrophic rhinitis include: abscesses and infections of the brain with bacteria such as Streptococcus and Corynebacterium; pneumonias due to organisms such as Streptococcus, Corynebacterium, Pasteurella, Pseudomonas and Brucella abortus; necrotic colitis; Salmonella infections; and even hog cholera and erysipelas.

A year ago, Doyle (4) pointed out the extreme likelihood that a direct association existed between many cases of pig pneumonia and the bacterial infections which accompany atrophic rhinitis. The frequency with which many of these other disease conditions is associated with atrophic rhinitis can be readily used as clinical evidence of a more indirect relationship between these other diseases and atrophic rhinitis. Since most, if not all, of the cases of atrophic rhinitis probably contract the disease at a very early age, it seems possible that several completely unknown results of the infection will have occurred, or still be in the process of occurring, by the time the pigs reach weaning age. Admittedly, by viewing the problem from this angle, we are entirely in the field of unknowns and can only theorize a little in general terms. Whatever these unknown results may be, they may have more or less influence on what we now mean when we refer to the general health of an animal. They might also have some action on the immunological mechanism or status of the individual animal. Whether or not such theoretical possibilities actually operate, some of the clinical and pathological findings of cases in which atrophic rhinitis can be demonstrated can provide a basis for some interesting speculations and problems for further study.

For example, during the 1949 and 1950 epidemics of so-called cholera breaks, and the resulting discovery of variant virus, many of the cholera cases routinely examined in our laboratory showed the presence of atrophic rhinitis and were found to be infected with such bacteria as Pasteurella, Streptococcus and Corynebacterium. Perhaps a few details from the history and findings of a single recently examined case will serve to better illustrate some of these provocative problems.

The case involved a group of pigs which had been farrowed in March, 1951. The laboratory examination was made on October 10, 1951. The entire group was erysipelas vaccinated with culture and serum when they were 10 days old. They were reported to be a very good looking bunch of pigs until they were about three weeks old. Then many of them began to look rough and unthrifty and developed some diarrhea. Some treatment was given and the diarrhea disappeared—at least tempo-
rarily—but a persistent cough developed. They still looked good enough at seven weeks of age to be considered satisfactory for cholera vaccination with serum and virus. The cholera vaccination did not seem to cause any particular trouble; however, the herd, in general, continued to be unsatisfactory with intermittent losses and many individuals showed evidence of chronic infection. Post mortem examination of the pigs received at the laboratory showed the presence of atrophic rhinitis, a pneumonia of both bacterial and influenza types, and lesions of cholera in the kidney, bladder, lungs, and lymph glands. Aerobic bacteriological examination showed the presence of *Corynebacterium* sp. associated with the pneumonia; however, other organs gave negative bacteriological results. As the practitioner involved in the case said, “What are we going to do with this herd?” It seemed that the underlying condition fundamentally responsible for disease problems in the herd could possibly have been atrophic rhinitis, and an attempt to eliminate the atrophic rhinitis was suggested.

Our present efforts in this direction are along lines of strict sanitary measures developed by European workers several years ago in order to save valuable blood lines. The measures are based on segregation and elimination of affected litters as clinical evidence of the infection develops. The results of a necessarily long-range program of this type are often very discouraging, and many breeders have preferred to go out of business rather than undertake the long-range program.

State diagnostic laboratories operate on the basis of being of as much help as possible to the individual owner and the livestock industry in general. However, when the swine owner asks where he can get replacements that are free of atrophic rhinitis, the only answer we have—which is, “I do not know,” is just another discouraging note in the overall picture of atrophic rhinitis.

**REFERENCES**

EDEMA DISEASE OF SWINE

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Edema disease is an acute and usually fatal disease of young swine. It is marked by a sudden onset and rapid clinical course in which a locomotory disturbance is a prominent physical symptom and the accumulation of abnormal amounts of fluid in some of the tissue spaces and body cavities is a characteristic post mortem finding.

Edema disease is not a new disease of swine in this country. It has occurred for 20 or more years. It appears that the only new thing about the disease is the name, edema disease. It has been described and recorded under such names as edema of the stomach, gut edema, intestinal edema, visceral edema, peri-renal edema, cholecystic edema, ascites, hydropericardium and pulmonary edema. Some cases of this disease have been diagnosed as plant poisoning and others as food poisoning.

In June 1933, W. L. Boyd and the writer observed their first cases of what is now known as edema disease. The entry in the records of the veterinary diagnosis laboratory at the University of Minnesota shows that two pigs between 11 and 12 weeks of age were examined and diagnosed as edema of the stomach. The entry reads — "stomach wall heavy, due to edema, also in walls of large intestine. Large amounts of serous exudate (2 liters) in abdominal cavity." A section from the stomach wall showed the mucosa and muscle coats to be widely separated by an inflammatory edema. The disturbance was thought to have resulted from the ingestion of a poisonous substance. It was recorded in the case history that four young pigs were lost by death within a period of eight days. The course of the illness is said to have been very short. The pigs were grazing a pasture when the outbreak occurred and they were also receiving a supplemental diet consisting of corn, oats, and barley and also some skim milk.

One or two typical cases of edema disease have been seen in these laboratories each year between 1932 and 1948. In 1948 five cases are recorded, in 1949 seven cases, in 1950 twelve cases and thirteen cases for the first ten months of 1951. In connection with our investigations of the diseases in swine as they occur on the farm under natural or field conditions, edema disease was encountered more often during the past two years than at any previous time. Each year since 1948 more inquiries as to the nature and cause of edema disease have been received from practicing veterinarians than in former years. Tobola (1), a veterinarian practicing in the southwest part of Minnesota, reports having observed "gut edema" in more than 60 different droves in 1950. Quin (2) says he has seen the "gut edema syndrome" from time to time for the past two decades. The indications are that the prevalence of edema disease is increasing which is an admonition that much needs to be learned of its nature, cause, and methods of control.

The first more or less complete description of the condition now known as edema disease in swine is the report of Shanks (3) in Ireland in 1938. He reported on the

1 Paper No. 2779 Scientific Journal Series, Minnesota Agricultural Experiment Station.
occurrence and nature of "an unusual condition affecting the digestive organs of the pig." Shanks tells of having observed the disease in pigs from 20 or more different farms. In 1950, according to Lamont, Luke, and Gordon (4) "gut edema" has become one of the most important diseases of swine in Ireland.

Edema disease is a disease of young swine. From our observations and experience it occurred in pigs ranging from 6 to 20 weeks of age. The majority of cases occurred in pigs that varied between 8 and 16 weeks.

For the most part the disease occurred more frequently in some certain months than in others. For example, approximately 10 per cent of the cases occurred in May, 40 per cent in June, 20 per cent in July, and 7 per cent in October. The remainder are distributed about equally in the remaining calendar months. The reason for what appears to be an increased prevalence of the disease in some particular month or months is because these are the times when the largest proportion of the pigs born in Minnesota are of susceptible age. The period from March 15 through June 15 is the period when most of the spring crop of pigs is farrowed and the autumn crop is usually farrowed in August and early in September.

No sex or breed differences in resistance or susceptibility were found. No singular circumstance with reference to food, water, and shelter could be considered significant from the standpoint of its cause since it was found to occur under many different conditions.

**PHYSICAL SYMPTOMS**

Symptoms that suggest a disturbed locomotory function are usually displayed by pigs affected with edema disease. In the very early stages of a typical case they move forward with an unsteady gait. The hind parts of the body sway from side to side. Even when standing the hind parts often sway far enough to the side so that in order for them to maintain a standing position they must take one or two quick steps in the same direction. A little later in the course a staggering gait is manifested. When moving forward the strides are short and quick and the pigs veer to one side for a few paces and then veer to the opposite side. The next stage is marked by a stiff and stilty gait in which there is a minimal amount of flexion of the joints. The last stage in the locomotory syndrome is extreme weakness (paresis) in which the pigs are unable to rise to their feet and they often lie on their side and "paddle" with their legs. All of the dysfunctional locomotory stages may not occur. In some cases the disease terminates with the so-called first stage and in others it may be the second stage.

A physical symptom that occurs in most cases is a swelling of the eyelids or a subcutaneous swelling over the dorsal surfaces of the nose and forehead. Swellings beneath the skin in the region at the base of the ear are not uncommon. Also subcutaneous swellings on the ventral surface of the thorax and abdomen sometimes occur.

It is not uncommon for pigs in the more advanced stages of the disease to display signs of stupor. They lie on the sternum with the head extended and usually make no effort to resist being handled. In fact even vigorous handling or jostling is oftentimes not sufficient to cause the pig to squeal. In this connection, the tone of the
squeal is usually pitched much lower than is characteristic for normal pigs. This is due to edema of the larynx.

The body temperature in edema disease is not elevated.

The incidence of edema disease within the drove or herd, from the standpoint of morbidity, is variable. In our series this varied between 4 and 40 per cent in droves that contained 40 or more pigs of susceptible age. Less than 10 per cent of the pigs were affected in approximately 50 per cent of the herds in which the disease occurred. The incidence ranged between 10 and 20 per cent in about 40 per cent of the herds and in 10 per cent of the herds the incidence was between 20 and 30 per cent of the susceptible pigs. The average number in a herd that developed clinical signs of edema disease was of the order of 14 per cent. The loss by death among the pigs affected by the disease is usually high. As a rule, in our series, about 90 per cent of the affected pigs came to a fatal ending.

From the standpoint of the occurrence and duration of edema disease in a drove it has been observed that the outbreak has its beginning and its ending within a comparatively short space of time. Generally speaking, within a period of 7 to 10 days, the disease would have come and gone.

**POST MORTEM FINDINGS**

The post mortem picture in this disease is one of edema. The edematous lesion may be restricted to one organ of the body or it may be more generalized and involve several different organs or parts simultaneously.

Edema in the subcutaneous tissues is not uncommon and especially in the region of the nose, forehead, base of the ear, ventral surface of the body and eyelids.

The peritoneal cavity usually contains an excess amount of fluid which oftentimes coagulates to form a gelatinous mass or masses. The colic mesentry and ligments are often distended with semi-gelatinous material. Similar masses of coagulated gelatinous material sometimes surround the kidneys. The pleural cavity and also the pericardial cavity may contain abnormal amounts of clear fluid, which upon exposure to the air, may coagulate into a semi-gelatinous mass.

The stomach is the site of a very typical and characteristic lesion in a large number of cases. The particular lesion is the great amount of edematous material that accumulates between the mucosal and muscle coats of the stomach wall in the cardiac gland region. The mucosal and muscle coats may be separated as much as an inch or more by a glistening and slightly pinkish colored semi-gelatinous material. When edema is present in such great amount it is not likely that it would be overlooked. It is advisable to always incise the stomach along the greater curvature since an opening in this plane affords an excellent opportunity to inspect it for this lesion. When only very small amounts of the edematous material is present its detection may be difficult. The surface of the gastric mucosa does not show changes which can be considered peculiar to this disease.

The walls of the large intestine (large colon in particular) and less frequently the walls of the ileal portion of the small intestine are involved by edema in a manner similar to that described for the stomach. The walls of the gall bladder and of the cystic and bile ducts are sites where edema sometimes occurs.
Large amounts of extravasated fluid in the lungs—edema—is the chief post mortem finding in some cases. The lungs in these cases are heavy and many of the lobules are distended. Considerable amounts of fluid escape when the lung is incised. Inspection of the larynx often reveals much fluid beneath the mucous membrane. The gastro-hepatic and mesenteric lymph nodes are sometimes enlarged and soft and when incised, the cut surfaces bulge and exude an abnormal amount of fluid.

The brain and spinal cord are sometimes involved. In some of our cases considerable amounts of fluid escaped from the subdural spaces when opened at the foramen magnum. In some instances the ventricular system of the brain, the fourth ventricle in particular, was distended by the fluid. The brain system and cord in several of our cases was “heavy” and gave the impression of being “water logged”. The disturbed locomotory symptoms and the stupor and comatose symptoms displayed by many of the pigs affected by edema disease are probably referable to the edematous changes in the central nervous system.

Before leaving the matter of the post mortem findings, it is important to point out that one might search the cadaver very carefully for any gross sign of this disease but fail to discover one. In other words, affected pigs may succumb from edema disease without showing any significant gross lesions. The case history and physical symptoms may be the only significant factors suggestive of edema disease.

ETIOLOGY

When it comes to the matter of the etiology of edema disease in swine one could dismiss a discussion of it with the short and simple statement: cause unknown. However, if dismissed in that manner it might be construed that no special effort was ever made to discover a cause. Quite to the contrary. The fact is that Timoney (5) and Luke and Gordon (6) in Ireland, Terpstra (7) in Holland and Flatla (8) in Norway have carried on some rather comprehensive studies directed toward its cause. Their work thus far emphasizes some of the factors which are not directly concerned from an etiological standpoint. For example, the bacteriological examinations of various tissues from typical cases of edema disease have failed consistently to yield microorganisms. Likewise they have failed to reproduce the disease by feeding susceptible pigs the edematous organs from affected swine. Moreover the various body tissues and fluids were minced and extracted in physiologic saline solution and introduced intracerebrally, intraperitoneally, intranasally and intravenously into susceptible pigs without causing the disease. Susceptible pigs were placed in close contact with typical cases of edema disease but in no instance was the disease transmitted. The dietary regime of the pigs on farms where the disease occurred was critically examined, but it was concluded that the diet did not appear to be the cause.

Timoney (5) has done much work on the causative factors in this disease and leans to the view that the disease is a toxemia. The toxic factor, he believes, is either produced in the intestinal canal or was present in the feedstuff and released in the bowel. In support of this view he reports producing an acute intoxication syndrome in approximately 20 per cent of the test animals when injected with large proportions (10 cubic centimeters) of the supernate of centrifuged “saline extracted” in-
testinal contents. The injections were made directly into the blood stream. While these results are considered encouraging, nevertheless Timoney recognizes the importance of further and more convincing work along these lines before reaching definite conclusions as to the specific cause.

From the writer's experience it can be reported that all attempts to isolate a bacterial agent from typical cases of edema disease have failed. An inspection of the feedstuffs together with an inquiry into the feeding practices in herds where the disease occurred has failed to give a reasonable clue as to the cause. Furthermore, our attempts to reproduce the disease by injecting the supernate of centrifuged saline extracted intestinal contents from typical cases of edema disease have also failed thus far. It is only fair to state that our attempts to reproduce the disease by this means have been limited to eleven animals. Conclusions are not warranted. However, the injections did cause the pigs to manifest a generalized hyperemia and in seven, a very noticeable respiratory embarrassment. These usually occurred within a few minutes following the injection and the pigs appeared normal in from 14 to 16 hours.

A situation which has become an important part of the clinical history in 13 of our outbreaks is that an immunization treatment with hog cholera anti-serum and hog cholera virus had been administered from 1 to 42 days prior to the occurrence of edema disease. In seven of the outbreaks edema disease had its onset from 5 to 7 days following the serum-virus treatment, in one outbreak the onset occurred on the first day following the treatment and in another it did not occur until 42 days after the vaccination. Four outbreaks of edema disease had their onset in the fourth week following the vaccination. The loss from edema disease, while not strictly determined in all instances, varied in the different herds. This ranged from 3 to 23 per cent with the majority ranging between 7 and 10 per cent.

It was difficult in many of these cases to convince the owner that there was no special relationship between the serum-virus injection and the development of edema disease. Some very strained and tense owner-veterinarian and producer relationships evolved around the cause and effect of the post-vaccinal circumstances that were being experienced. In every instance it was possible for us to cite other outbreaks of edema disease which in no way had any direct connection with the serum-virus method of protecting swine against hog cholera. The majority of the outbreaks with which we have had greater or lesser contact occurred in herds in which hog cholera or hog cholera immunization by the serum-virus method was not a part of the picture. Moreover, hog cholera is not known to occur in Ireland where edema disease is very prevalent and widespread.

**TREATMENT AND CONTROL**

No satisfactory therapeutic measures for this disease have been developed. According to Luke and Gordon (6) a wide variety of palliative and supposedly direct and specific remedial procedures have been tried but without success. They report the use of penicillin and various sulfonamides, of antihistamin preparations, of adrenalin, of Clostridium welchii antiserum and of purgatives but in no instance could the treatment be evaluated as having produced significantly beneficial results.
CONCLUSIONS

1. There exists in this country a disease syndrome in swine that is characterized by the accumulation of abnormal amounts of fluid in some of the tissue space and/or body cavities.

2. Fluids may accumulate in various organs and parts of the body and are not restricted to the alimentary tract.

3. The condition appears to be a disease entity for which the term edema disease is proposed.

4. Edema disease is a disease of young pigs, occurring chiefly in pigs between the ages of 8 and 16 weeks.

5. An outbreak of edema disease usually has a sudden onset and it abates just about as suddenly. An interval of from 7 to 10 days usually occurs between the time of its appearance and disappearance in the herd.

6. For the most part, less than 15 per cent of the susceptible pigs in a herd will contract the disease.

7. The specific cause is unknown but there is much evidence to indicate that edema disease is not a contagious disease.

8. No satisfactory therapeutic or preventive measures are available.

LITERATURE CITED


7. TERPSTRA, J. T. Cited by Timoney.

8. FLATLA, J. L. Cited by Timoney.
REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

J. D. Ray, Omaha, Nebraska, Chairman; Frank Breed, Lincoln, Nebraska; J. S. Campbell, Little Rock, Arkansas; T. J. Cunha, Gainesville, Florida; R. Fenstermacher, St. Paul, Minnesota; H. U. Garrett, Des Moines, Iowa

The 1951 pig crop is scheduled to be the second largest on record. Transmissible diseases of swine are of major importance at all times but especially so when such stepped-up production is in effect. To obtain an overall picture of this disease situation, your Committee communicated with livestock sanitary officials of the 48 states and 46 of them replied furnishing reports on current conditions. These reports are submitted in summary.

HOG CHOLERA

Hog cholera is still the No. 1 disease of swine. During 1949 and 1950 the so-called variant hog-cholera virus caused considerable concern. However, this condition has not been reported as an important field problem in 1951. At the spring meeting of the Southwestern Iowa Veterinary Medical Association, April 3rd, 1951, at Council Bluffs, Iowa, Dr. H. W. Schoening, Chief, Pathological Division, United States Bureau of Animal Industry, presented a report on "Variations (Variant) of Hog-Cholera Virus". This informative paper was published in the May 1951 issue of the Journal of the American Veterinary Medical Association and merits your attention.

The incidence of hog cholera has remained unchanged or decreased in 37 states during the year. It is significant that five of the major hog producing states showed a decrease. Only nine states reported an increase in hog cholera outbreaks and seven of these were eastern or far-western states. None of the nine has a heavy hog population.

Nine states (two in the Midwest) reported an increase in postvaccination troubles this year. All others experienced no increase, or less trouble than usual.

SWINE Erysipelas

Swine erysipelas is becoming more widespread. It was prevalent in 22 states the past year and 17 of these experienced an increase. It is significant that five of the 17 were in the major hog raising area. Only four states reported a decrease.

The simultaneous use of anti-swine-erysipelas serum and Erysipelothrix rhuisiopathiae vaccine is permitted procedure in 24 states. The vaccine can be a dangerous product to both animals and man and it is a fragile product when not handled properly. Therefore, this committee commends the Virus-Serum Control Division of the United States Bureau of Animal Industry and the several state livestock sanitary officials who have so effectively controlled the distribution of this product for the good of the swine industry during the past several years, and we recommend that this Association actively support the continuation of controlled distribution of Erysipelothrix rhuisiopathiae vaccine through veterinarians.
The enteritis complex is a primary problem affecting swine production. With no attempt to differentiate between the types, enteritis was a problem in 29 states this year, including all major hog producing states. An increased incidence was evident in 16 states. Swine dysentery (vibrio infection) has caused considerable concern in some areas. The problem of relapses or recurrence of the disease in a herd when placed back on feed after treatment, makes the condition difficult to cope with. Often these animals are sold during the interim of apparent good health, thus spreading the trouble.

EDEMA DISEASE OF SWINE

This has become a devastating disease in several foreign countries and has attracted attention in the United States in recent years. It was reported as a problem in 10 states this year and seven of these were in the major swine producing area. Edema disease of swine was deemed of sufficient importance by your Committee to have it discussed in detail elsewhere on the program of this meeting.

ATROPHIC RHINITIS

Atrophic rhinitis has been recognized as an important transmissible disease of swine for some time and its spread has been significant in the Midwest in recent years. This year it has been recognized in 20 states and seven of these are in the major swine producing territory. It was considered a problem in 8 states. A more detailed discussion of this disease is scheduled elsewhere on this program.

TRANSMISSIBLE GASTROENTERITIS

This disease continues to take an appalling toll of baby pigs and causes considerable economic loss in older swine. It is extremely infectious and easily transferred from one premise to another by persons or equipment. It was listed as a problem in 18 states which included all major swine producing states. An increased incidence this year was noted in seven states.

INFLUENZA

Influenza has not been widespread this year. However, seven states—three of them major hog producing states—considered it a problem. We call your attention to the possibility of severe outbreaks of this disease occurring during the summer with considerable mortality.

EPIERYTHROZOONOSIS

Apparently this condition is not being recognized in many areas but is considered as significant in others. Two states indicated it is spreading and 4 made a questionable reply about its increased incidence.

BRUCELLOSIS

The discussion of this infection has been left to the Committee on Brucellosis. However, we want to emphasize the importance of this disease and the need for better control in swine.
The results of considerable research on transmissible diseases of swine have been released during the year. However, the expenditures for this type of work have been negligible compared to the monetary value of the swine industry and the staggering losses it experiences annually.

During the year, the Associated Serum Producers, Inc., announced the allocation of a long term grant in aid to the Veterinary Research Institute of Iowa State College, Ames, Iowa. This will be used for the study of hog cholera.

The Committee feels that there is insufficient research in progress on transmissible diseases of swine and recommends that the Association go on record favoring, and where possible promoting, increased research in this field.
LABORATORY STUDIES AND DATA ON MODIFIED LIVE HOG CHOLERA VACCINE

HILARY KOPROWSKI, M.D., TERENCE R. JAMES, AND HERALD R. COX, Sc.D.

From the Section of Viral and Rickettsial Research, Lederle Laboratories Division, American Cyanamid Company, Pearl River, New York

The ideal vaccine is one which will induce a state of resistance equalling that engendered by a natural attack of the disease. In both human and veterinary preventive medicine this goal has been approached by the discovery or development of strains of virus which are both safe and effective when used as living virus vaccines in susceptible individuals. The need for an immunizing strain of this type for hog cholera has long been recognized and efforts to develop such a strain were instituted in this laboratory early in 1946. The attempt to develop a modified antigenic strain of hog cholera virus was made through adaptation of this specific virus to hosts other than swine. Following many fruitless efforts to adapt the virus to other animal species, the virus was injected into rabbits and successfully propagated for several series of passages. The virus is now considered to be adapted to rabbits and a preliminary report on this subject has been published (1). The present communication describes the laboratory investigations concerning modification of the virus and the preliminary results of its use for immunization purposes.

MATERIALS AND METHODS

Viruses strains: The Lederle production stock strain of hog cholera virus adapted to rabbits according to a method described previously (1) was used throughout the experiments for vaccination purposes. For challenge purposes, two strains of virus were employed: the original Lederle virulent stock strain and the so-called “variant” 1949 strain received from the Bureau of Animal Industry, United States Department of Agriculture. The challenge virus strains were stored at -60°C. in the form of defibrinated blood obtained from an infected pig five to seven days after inoculation with the virus.

Animals: White rabbits of the “New Zealand” strain were used throughout the work. The animals weighed 6 to 10 pounds and were usually kept in individual cages. The inoculum for the rabbits consisted of either a 10 per cent suspension of hog cholera infected rabbit spleen, or a 10 per cent dilution of infected rabbit blood. The volume of inoculum was always 2 ml. injected into the marginal ear vein. In order to avoid occasional deaths among the animals due to a thrombosis following inoculation, a 1:50 dilution of heparin was incorporated in the spleen inoculum.

Pigs of various breeds were bought from local farmers whose premises were known to be free of hog cholera and who employed no hog cholera immunizing agents. Pigs were obtained immediately after weaning and care was taken to ascertain that none of the animals was exposed to hog cholera previously and that none was sick prior to purchase. Upon arrival in this laboratory, pigs were kept in strict quarantine for two weeks or more, and in the absence of any signs of illness,
MODIFIED LIVE HOG CHOLERA VACCINE

were released for experimental work. Inoculated pigs were kept in individual pens under strict isolation, in order to exclude any possibility of cross infection.

Pigs were inoculated either subcutaneously in the axilla or intramuscularly in the groin region and rectal temperatures were taken twice daily.

*Harvesting of infectious material:* Three to five days after inoculation, rabbits were exsanguinated under deep ether anesthesia and careful autopsy was performed on each animal. Either spleen alone, or spleen, liver and kidney were removed. If any macroscopic signs of abnormality were noticed at the autopsy, the carcass of the respective animals was discarded.

At the early passage levels, spleen tissue was used exclusively both for passage in rabbits and for verification of infectivity by the inoculum in swine. Later, either spleen tissue or blood was used as inoculum for rabbits, but liver, spleen, kidneys and blood were homogenized and employed as inoculum for swine.

If only a small amount of harvested material was available, it was ground with sterile distilled water in a Ten Broeck grinder. If a larger amount was obtainable, either a Waring blender or an Eppenbach colloidal mill was used for homogenization.

Material employed for inoculation of rabbits (except defibrinated blood) was always centrifuged for 15 minutes at 1500 rpm and the supernatant used as inoculum. Rabbit tissue used for preparation of the vaccine was uncentrifuged, but was filtered through two layers of gauze.

The inoculum employed for swine was prepared from virus in either a fresh, frozen (at −60°C), or desiccated state. In the latter case aliquots of the infectious material were distributed in ampoules or vials and desiccated from the frozen state either in Vendon dryers or in D.P.I. chambers. The dried material was stored at 4°C.

*Challenge of pigs immunized with rabbit passage material:* All animals surviving inoculation with virus stemming from different rabbit passage levels were challenged two to four weeks later with virulent hog cholera virus. An inoculum of 1 ml. of a 1:1000 dilution of infected porcine blood was used. This dilution contained at least 10,000 lethal doses of the virus as determined by titration.

**EXPERIMENTAL**

*Modification of the virus:* Table 1 summarizes the history of the modified strain of hog cholera virus through serial passages in rabbits. It may be observed that actual signs of attenuation were first noticed at the 80th rabbit passage level, yet it could not be assumed that the virus had lost its lethal properties before the 207th rabbit passage level when 100 per cent of the inoculated swine survived. Modification of the virus was further confirmed by the results of inoculation of animals with the 245th and 284th rabbit passages of the virus. It may be of interest to note that two pigs infected with material representing the 11th rabbit passage survived the inoculation. Yet under no circumstances could this be considered as evidence of modification of the virus since material originating from the very next rabbit passage was lethal for infected animals, and pigs infected even with the 30th and with the 50th rabbit passages all died exhibiting clinical signs of hog cholera. Thus, it was not until the 80th rabbit passage of the virus that attenuation could be demonstrated.

The results of the challenge inoculation, shown in the last column of Table 1, indicate that with one possible exception, pigs surviving inoculation with the 80th
rabbit passaged material and beyond, were solidly immune to challenge with virulent hog cholera virus.

These results were encouraging enough to justify the preparation of large amounts of desiccated material representing passages higher than the 245th rabbit passage and to employ such material for field trials.

**Table 1**

*Effect of Serial Rabbit Passage on Swine Virulence*

<table>
<thead>
<tr>
<th>Rabbit Passage</th>
<th>Mortality Ratio</th>
<th>Challenge Tests* of Surviving Swine Mortality Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>2/2</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>0/2</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1/1</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>6/6</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>4/4</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>3/5</td>
<td>0/2</td>
</tr>
<tr>
<td>90</td>
<td>2/5</td>
<td>0/1</td>
</tr>
<tr>
<td>97</td>
<td>3/7</td>
<td>1/4</td>
</tr>
<tr>
<td>129</td>
<td>2/8</td>
<td>0/6</td>
</tr>
<tr>
<td>185</td>
<td>6/25</td>
<td>0/17</td>
</tr>
<tr>
<td>145</td>
<td>1/4</td>
<td>0/2</td>
</tr>
<tr>
<td>207</td>
<td>0/11</td>
<td>0/11</td>
</tr>
<tr>
<td>245</td>
<td>0/18</td>
<td>0/18</td>
</tr>
<tr>
<td>284</td>
<td>0/12</td>
<td>0/12</td>
</tr>
</tbody>
</table>

* 1 ml. of 10,000 or more LD₅₀ used for challenge inoculation.

**Table 2**

*Results of Titration of Desiccated Vaccine*

<table>
<thead>
<tr>
<th>Rabbit Passage</th>
<th>Storage Time</th>
<th>Mortality Ratio of Pigs Challenged After Immunization with Dilutions of Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>261</td>
<td>None</td>
<td>1:160 1:640 1:2560 1:10240</td>
</tr>
<tr>
<td>274</td>
<td>None</td>
<td>0/2 0/2 1/2 2/2</td>
</tr>
<tr>
<td></td>
<td>4 mos.</td>
<td>0/2 0/2 2/2 2/2</td>
</tr>
<tr>
<td></td>
<td>2½ mos.</td>
<td>0/1 0/2 0/2</td>
</tr>
</tbody>
</table>

It was first necessary, however, to measure the immunogenic potency of the leporine strain of the virus in order to determine the dosage to be employed in the field trial vaccination program.

**Titration of the vaccine:** In Table 2 are summarized the results of swine titrations of desiccated material representing the 261st and the 274th rabbit passage levels of the virus. It may be observed that the minimum protective titer of the vaccine seemed to range between 1:640 and 1:2560 dilution. Storage at 4°C. seemed to have little or no effect upon the viability of the desiccated product.
Preliminary field trial results: Following the apparent good results of these experiments, a field trial was organized at Letchworth Village, Thiells, New York. The results of this trial are summarized in Table 3 and it may be observed that pigs which were vaccinated two weeks after weaning withstood challenge inoculation, regardless of the dilution of vaccine employed. At the same time, 100 per cent mortality was observed among the nonvaccinated controls.

The results of these experiments also seem to indicate that vaccines representing the 240th and 284th rabbit passage levels were equally effective.

Onset of immunity following vaccination: Since living virus was employed as an immunizing agent in these experiments, it was of interest and importance to determine the length of the interval between vaccination and the appearance of resistance of the pigs to challenge with virulent hog cholera virus. The results of these experiments are summarized in Table 4. It may be seen that in the first experiment

**Table 3**

<table>
<thead>
<tr>
<th>Rabbit Passage</th>
<th>Dilution of Rabbit Tissue</th>
<th>Volume Ml.</th>
<th>Vaccinated</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>240</td>
<td>1:50</td>
<td>1</td>
<td>0/6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:50</td>
<td>2</td>
<td>0/6</td>
<td>2/2</td>
</tr>
<tr>
<td></td>
<td>1:100</td>
<td>2</td>
<td>0/9</td>
<td></td>
</tr>
<tr>
<td>261</td>
<td>1:25</td>
<td>1</td>
<td>0/28</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:25</td>
<td>2</td>
<td>0/7</td>
<td>3/3</td>
</tr>
<tr>
<td>274</td>
<td>1:50</td>
<td>1</td>
<td>0/6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1:50</td>
<td>2</td>
<td>0/6</td>
<td>2/2</td>
</tr>
<tr>
<td></td>
<td>1:100</td>
<td>2</td>
<td>0/11</td>
<td></td>
</tr>
<tr>
<td>284</td>
<td>1:50</td>
<td>2</td>
<td>0/10</td>
<td>2/2</td>
</tr>
</tbody>
</table>

a 1:50 dilution of infected rabbit tissue representing the 245th passage of hog cholera virus seemed to induce resistance in vaccinated animals some time between the second and fourth day after inoculation. This resistance persisted throughout the observation period.

In the second experiment, a 1:25 dilution of the same preparation was used and partial resistance seemed to be conferred as early as the first day after vaccination. The results of the third experiment in this series suggested that the onset of resistance may to a certain degree be related to the concentration of virus employed for vaccination purposes. It may be noted that the majority of pigs immunized with a 1:25 dilution of the vaccine resisted challenge with virulent virus as early as the third day after inoculation, whereas pigs immunized with 1:50 dilution of the same vaccine became resistant a day later, on the fourth day after vaccination. In the last experiment in this series, the vaccinated animals were not injected with virulent virus.

1 Dr. D. B. H. Dalrymple of the Bureau of State Institution Farms, State Office Building, Albany, New York, kindly gave permission to vaccinate the animals at Letchworth Village.
virus, but were left exposed to nonimmune pigs, sick after inoculation with virulent hog cholera virus. These results again appeared to confirm evidence obtained earlier that the onset of resistance after vaccination with rabbit origin vaccine (ROVAC) takes place within three or four days after immunization.

An experiment conducted along the same lines, but performed on a larger scale, was conducted by Dr. Max Harvey (2) and the results again indicated that most of the immunized animals were resistant to challenge inoculation on the fifth to seventh day after vaccination.

Duration of immunity: The duration of immunity following vaccination with rabbit adapted hog cholera virus was studied by immunizing two groups of pigs with a 1:100 dilution of vaccine representing the 240th and 274th rabbit passages. Following vaccination, these animals were housed on premises which were free from hog cholera virus, in order to avoid the possibility that exposure to virulent virus may have a booster effect upon the immunity induced by vaccination. The results of the challenge inoculation, summarized in Table 5, indicate that solid immunity was observed in all four animals challenged four months after inoculation and likewise in the two groups of 12 animals challenged six and twelve months after vaccination; in contrast, 100 per cent mortality was observed in a large group of nonvaccinated challenge controls.

The remaining animals in these groups will be challenged one and two years after their respective vaccinations, and the complete studies on duration of immunity following vaccination with ROVAC will be published elsewhere.

Immunization against variant virus: Although so far no immunologic differences have been observed among the numerous strains of hog cholera virus which have been isolated in the past, during the Summers of 1949 and 1950 large losses occurred in swine vaccinated with hog cholera antiserum and virulent virus. Following thorough laboratory investigation, these losses were ascribed to a "variant" form of the virus (3). It was found that swine, solidly immune following serum virus vaccination, were not detected by this variant. However, it seemed to be of interest to determine the ability of rabbit origin vaccine to protect against challenge with the so-called variant strain of hog cholera virus. The results of two such experiments are summarized in Table 6. In these experiments pigs were vaccinated with a 1:50 dilution of material representing the 275th and 276th rabbit passage of the virus, respectively. Three weeks after vaccination, these animals were divided into two groups and challenged with the 1949 variant and with the Lederle stock virus. In this case 1 cc. of undiluted infected blood was used for challenge. In contrast to the 100 per cent mortality among the nonvaccinated controls, vaccinated pigs seemed to be equally resistant to challenge with either the variant or the Lederle stock virus.

These results were further confirmed by experiments conducted by Dr. C. N. Dale of the Bureau of Animal Industry, Office of Serum Control. As shown in Table 7, out of 9 pigs vaccinated with ROVAC only one succumbed to challenge with the variant 1950 strain of hog cholera virus. Out of 10 pigs immunized with ROVAC and challenged by contact exposure, again only one succumbed. In contrast, none of the pigs immunized with crystal violet vaccine survived challenge by exposure to virulent virus (see CV in the table). One of 5 pigs, immune after convalescing from hog
**TABLE 4**

Relation between Time Interval after Vaccination with Rovac and Resistance of Pigs to Challenge with Virulent Hog Cholera Virus

<table>
<thead>
<tr>
<th>Lot No.</th>
<th>Rabbit Passage Dilution of Rabbit Tissue</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
<tr>
<td>245</td>
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<td>1/1</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-14</td>
<td></td>
<td>2/10</td>
<td>2/10</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>-14</td>
<td></td>
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<td>2/10</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Controls</td>
<td></td>
<td>0/10</td>
<td>0/10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/7†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 1 ml. of $10^{-3}$ dilution of infected blood used for challenge purposes.
† Challenged by contact with sick pigs.
‡ 2 ml. of undiluted infected blood used for challenge purposes.

**TABLE 5**

Duration of Immunity Following Vaccination with Rovac

<table>
<thead>
<tr>
<th>TIME INTERVAL AFTER VACCINATION (MONTHS)</th>
<th>VACCINE EMPLOYED</th>
<th>MORTALITY RATIO OF PIGS CHALLENGED WITH VIRULENT VIBUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rabbit Passage</td>
<td>Dilution</td>
</tr>
<tr>
<td>4</td>
<td>240</td>
<td>1:100</td>
</tr>
<tr>
<td></td>
<td>274</td>
<td>1:100</td>
</tr>
<tr>
<td>6</td>
<td>240</td>
<td>1:100</td>
</tr>
<tr>
<td></td>
<td>274</td>
<td>1:100</td>
</tr>
<tr>
<td>12</td>
<td>240</td>
<td>1:100</td>
</tr>
<tr>
<td></td>
<td>274</td>
<td>1:100</td>
</tr>
</tbody>
</table>
cholera, succumbed to challenge inoculation, whereas out of the 20 nonvaccinated controls all died as a result of challenge.

The results of similar types of experiments are summarized in Table 8, but in these a commonly used, regular virulent strain of hog cholera challenge virus was employed. These results closely parallel those observed in Table 7, except that in

<table>
<thead>
<tr>
<th>EXP.</th>
<th>VACCINE</th>
<th>RESULTS OF CHALLENGE* OF PIGS WITH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lot No.</td>
<td>Rabbit Passage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7-3004-16</td>
<td>275</td>
</tr>
<tr>
<td>B</td>
<td>7-3004-18</td>
<td>276</td>
</tr>
</tbody>
</table>

* 1 ml. of undiluted infected blood used for challenge purposes.
† U. S. B.A.I. 1949 Variant SN-1.

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>TYPE OF CHALLENGE</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Rovac...</td>
<td>Injection</td>
<td>7</td>
</tr>
<tr>
<td>Rovac...</td>
<td>Contact</td>
<td>3</td>
</tr>
<tr>
<td>C V......</td>
<td>Contact</td>
<td>0</td>
</tr>
<tr>
<td>Cholera Immune...</td>
<td>Contact</td>
<td>4</td>
</tr>
<tr>
<td>None......</td>
<td>Contact</td>
<td>0</td>
</tr>
<tr>
<td>None......</td>
<td>Injection</td>
<td>0</td>
</tr>
</tbody>
</table>

* Data obtained by Dr. C. N. Dale of B.A.I., U. S. Dept. Agriculture.

this case the crystal violet vaccine seemed to confer immunity against the challenge virus.

Vaccination following use of antiserum: In view of the modified nature of the rabbit adapted strain of hog cholera virus, it became of interest to investigate the possibilities of vaccinating pigs with this product, following passive immunization induced by the administration of antiserum. An experiment was therefore performed in which groups of normal pigs weighing 50 to 80 pounds were injected with 30 ml. of anti-hog cholera serum. Groups of ten animals were individually immunized 7, 14 and 21 days after administration of the serum, with 1:33 dilution of the leporine strain of vaccine, representing the 263rd rabbit passage. 28, 35 and 42 days after
administration of the serum, and 21, days after vaccination with ROVAC, respectively, ten animals in each group were challenged with a 1:1000 dilution of defibrinated blood infected with the virulent Lederle stock strain of virus. In addition, ten animals which received antiserum, but not ROVAC, were challenged along

**TABLE 8**

*Effect of Vaccination with Rovac upon Challenge of Pigs with Regular Virulent Hog Cholera Virus*

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>TYPE OF CHALLENGE</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Rovac</td>
<td>Injection</td>
<td>7</td>
</tr>
<tr>
<td>Rovac</td>
<td>Contact</td>
<td>9</td>
</tr>
<tr>
<td>C V.</td>
<td>Injection</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>Injection</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>Contact</td>
<td>0</td>
</tr>
</tbody>
</table>

* Data obtained by Dr. C. N. Dale of B.A.I., U. S. Dept. of Agriculture.

**TABLE 9**

*Time Interval between Administration of Anti-hog Cholera Serum and Vaccination with Rovac*

<table>
<thead>
<tr>
<th>EXP. NO.</th>
<th>RABBIT PASSAGE</th>
<th>DILUTION</th>
<th>INTERVAL BETWEEN ADMINISTRATION OF</th>
<th>RESULTS OF CHALLENGE WITH VIRULENT VIRUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anti-serum and ROVAC (Days)</td>
<td>Antiserum and ROVAC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anti-serum and Challenge Inoculation (Days)</td>
<td>Attack* Rate</td>
</tr>
<tr>
<td>1</td>
<td>263</td>
<td>1:33</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>301</td>
<td>1:33</td>
<td>14</td>
<td>35</td>
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<td></td>
<td>21</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Simul.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>0/10</td>
</tr>
</tbody>
</table>

* As evidenced by prolonged febrile response and signs of illness.

with six animals which received neither. The results of this experiment (Exp. 1) are summarized in Table 9. It may be observed that 28 days after administration of serum, the level of passive immunity induced by treatment with antiserum alone was high enough to protect two out of three challenged animals. However, the presence of antibodies due to the administration of antiserum seemed to decline rapidly from then on, since those animals which received antiserum alone when challenged
and 42 days later with virulent virus, seemed to be as susceptible to virulent virus as untreated controls. In contrast, of those pigs which were treated with antisera followed by ROVAC vaccination 7, 14 and 21 days later, only one of 30 died when challenged with virulent virus.

These results led to another series of experiments in which ROVAC was injected simultaneously with, and 1, 4 and 7 days after the administration of antiserum. Thirty-five days after the inoculation with antiserum, all animals which received antiserum and ROVAC and 20 animals which received antiserum alone were challenged with virulent hog cholera virus. The results of this experiment (see Exp. 2 in Table 9) indicate that only two out of the 20 pigs which received antiserum alone failed to show signs of illness after inoculation with virulent virus. The survival of these animals, as well as of the twelve animals which recovered after a prolonged sickness, was due in all probability to the persistence of homologous antibodies passively acquired 35 days previously. In contrast, none of the animals which received antiserum and ROVAC either simultaneously, or after a 1, 4 or 7 day interval showed any signs of illness following challenge with virulent virus. These results suggest the surprising possibility that the simultaneous administration of antiserum and ROVAC does not seem to affect the immunogenic potency of the latter. It is obvious that data bearing on this important point are as yet too meager to permit specific conclusions; therefore, there are in progress additional experimental procedures designed with particular emphasis on the duration of immunity following the simultaneous administration of antiserum and ROVAC.

COMMENT

Studies on the immunogenic potentialities of the leporine strain of modified hog cholera virus were not motivated by the lack of a vaccine for immunization against hog cholera, since this is a disease against which several immunizing procedures were employed in the past and are still used at the present time. The most commonly used method is that of simultaneous inoculation of virus and potent immune sera initiated by Dorset et al. (4) in the year 1908. The success of this type of vaccination, however, was obviously dependent upon many factors and the use of this method was not without risk, since foci of infection were created in hog cholera free territories and virulent virus lingered on premises on which such vaccination procedure was practiced. Although it is beyond the scope of the present paper to discuss in detail the drawbacks of the simultaneous immunization procedure, it might be pointed out that in this method there exists a danger of contaminating the virus with other swine pathogens. In addition, leukopenia is usually produced, and dormant infections may be aggravated by this immunization procedure (5).

So far as the other immunization procedures are concerned, substantial immunity is not induced by crystal violet vaccine or Boynton tissue vaccine until two or three weeks after vaccination. Immunity induced by these methods was of such short duration as to warrant biennial vaccination. Moreover, as indicated in the experimental section of this paper, vaccination with crystal violet vaccine does not seem to confer immunity against the so-called variant strain of hog cholera virus.

The Lederle leporine strain of modified hog cholera virus seemed to be free of these limitations and objections. It was found to be non-pathogenic, was not ob-
served to gain virulence by passage from hog to hog, and being of leporine origin, was obviously devoid of organisms pathogenic for swine.

The virus is stable after desiccation and may be distributed in this form in the field. It was found to induce protection as early as the third to fourth day after inoculation, and although such a type of resistance seemed to be due to interference phenomena rather than to the presence of antibodies, it blends smoothly into the period of active immunity.

Immunity following vaccination with ROVAC was found to be solid at twelve months, the longest period tested to date. Further information on duration of immunity will become available when animals vaccinated with ROVAC will be challenged two years or later after immunization.

The results of field trials performed in more than 10,000 animals and summarized by Harvey et al. (2), parallel those obtained in the laboratory. The virus was found to be completely modified and at the same time to be highly immunogenic.

It is obvious that the laboratory alone cannot give the answers to all of the pertinent questions to be considered in mass vaccination programs, in which ROVAC will be employed in the future. Emphasis should be placed on the fact that only through additional information gained in the field can confirmation be obtained of the excellent results secured in the laboratory with this modified strain of hog cholera virus. Vaccination performed by different investigators under different conditions in different geographical areas will obviously add more valuable information to that already obtained in preliminary field trials. If this modified strain of hog cholera virus is found to confer life time immunity upon vaccinated animals, it should play an important role in the control of the disease, and possibly in the not too distant future, reach its ultimate goal—the eradication of hog cholera.

REFERENCES
FIELD TRIAL STUDIES WITH ROVAC


Lederle Laboratories Division, American Cyanamid Company, Pearl River, New York

To give support to the research program presented in the preceding paper (Laboratory Studies on Rovac, H. Koprowski, T. R. James, H. R. Cox), extensive, carefully supervised field trials were instituted to determine the safety and efficacy of Rovac in actual use. To have significance, such field trials must involve large numbers of animals of various breeds and ages, under many types of hog-raising conditions, in various sections of the country.

PROCEDURE

Preliminary Arrangements

Permission to conduct trials was obtained from the Serum-Virus Control Division of the United States Bureau of Animal Industry and from the regulatory officers of the states in which trials were to be conducted. Local veterinary practitioners collaborated, and were given all available information on Rovac. All vaccinations were performed by a veterinarian of our clinical research staff, under the direct observation of the local practitioner. It was agreed that intercurrent disease would be treated in the approved manner, and be reported promptly.

Swine producers were contacted through the practicing veterinarians and a complete description of the product and trial procedure was given to them. A contract was drawn up between the producer and the company as protection for the grower.

Animals

Pigs used in the trials were average farm animals. No effort was made to select only the best. Routine feeding practices were not changed either before or after vaccination. On some of the farms, there were histories of virus breaks in previous years following serum and virus vaccination.

For the most part, the herds to be vaccinated were given a careful physical examination for purposes of record. Temperatures of randomly selected animals were recorded. Obviously nutritionally deficient, parasitized, or sick animals were excluded from the trials. To prove susceptibility, an average of 3 per cent of each herd to be vaccinated was taken to an isolated area and challenged with virulent whole blood virus.

A total of 74 herds, located in Missouri, Virginia, New Jersey, and New York, consisting of 10,147 pigs of various breeds, ranging in weight between 20 and 225

1 (Rabbit Origin Vaccine)—U.S.B.A.I. true product name—Hog Cholera Vaccine, Modified Live Virus.

2 The authors wish to express their sincere appreciation to state veterinarians, practicing veterinarians, and hog producers, whose cooperation have made these field trials possible.
pounds, were vaccinated between October 1950 and June 1951. The physical condition of the pigs was classified as follows: 253 excellent to very good, 5,525 good, 2,264 fair, and 2,105 poor to very poor. The pigs in the last classification would normally have been considered poor risks for any active immunization procedure. Three herds, totaling 336 pigs, had previously been declared unsatisfactory for serum-virus vaccination by the local veterinarian.

Vaccination

In keeping with the purpose of field trials, all vaccination procedures, including preparation of the product for injection, followed the proposed package recommendations.

The vaccine, in the dried state, was transported in an insulated container which could be conveniently carried in a car. This container held a can of ice to insure maintenance of proper temperature.

Reconstitution of the vaccine was accomplished by transfer of the distilled water diluent to the dry material by means of a boiling-water-sterilized syringe and needle through the intact rubber stoppers.

All animals received an intramuscular injection of 2 cc. of Rovac in the medial aspect of the ham, using an 18-gauge, 1½" needle. This location was chosen for convenience, and to avoid the deposition of vaccine in fat to assure dissemination and multiplication of the vaccine. Reconstituted vaccines containing tissue concentrations of 1:25, 1:50, or 1:100 were used. The purpose of this procedure was to determine the optimum tissue concentration to induce immunity without adverse reactions. There was no indication that a more dense tissue concentration caused unfavorable reactions. On the basis of the findings, and for manufacturing convenience, the vaccine marketed contains a 1:33 concentration of tissue when reconstituted.

All animals were identified by tagging the right ear. No changes in herd management were made before or after vaccination. To determine immunity, approximately 3 per cent of the vaccinated pigs selected at random were removed at intervals between 14 days and three months after vaccination. They were transported to a quarantine area and challenged with a subcutaneous injection of 2 cc. of virulent whole blood virus. The herds were closely observed by the local veterinarian. Figure 1 is the form used to record the details of the trial in each herd vaccinated.

Susceptibility and Immunity Tests

Susceptibility and immunity challenge tests were performed in an area approved by the state veterinarian and the United States Bureau of Animal Industry, and were carried out under the supervision of the United States Bureau of Animal Industry.

Susceptibility Challenge: To determine the susceptibility of the herds being vaccinated, a single 2 cc. dose of United States Bureau of Animal Industry-selected virulent whole blood virus was injected subcutaneously into the test animals. Herds were considered susceptible when the animals inoculated sickened and died within a specified period to meet the requirements of the United States Bureau of Animal Industry.
Immunity Challenge: To determine immunity after vaccination, pigs received 2 cc. of virulent whole blood virus as in the susceptibility tests. All pigs were observed for 14 days from the date of challenge. Daily recorded observations included temperatures, general physical appearance, and adverse reactions.

RESULTS

During the conduct of the trials, there were no deaths shown to be caused by hog cholera virus in the vaccinated herds exposed to natural field conditions, regardless of the physical condition of the animals at the time of vaccination. The observation period varied from four to ten months after vaccination.

FIG. 1

<table>
<thead>
<tr>
<th>Date weaned</th>
<th>Owner's name</th>
<th>Date inoc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of birth</td>
<td>Location</td>
<td>Lot no. vac.</td>
</tr>
<tr>
<td>No. of pigs</td>
<td>Dosage</td>
<td>No. challenged</td>
</tr>
<tr>
<td>No. of litters</td>
<td>Veterinarian</td>
<td>Date of challenge</td>
</tr>
</tbody>
</table>

TAG NO. INC. RANDOM PRE-INOC. TEMPERATURES

<table>
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<tr>
<th>From</th>
<th>To</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
</table>

General remarks

Condition
Premises
Diet
Previous history of disease
Approximate weight
Results of vac.
Veterinarian's comments

During the period of approximately ten months, in which 10,147 pigs were vaccinated, there was a mortality from all causes except laboratory challenge of 0.42 per cent. This is considerably better than the usual field experience from all causes. Causes of death are listed in Table 1.

A total of 335 nonvaccinated pigs were given 2 cc. of virulent whole blood virus to prove susceptibility. Of these, 329 died, representing a mortality rate of 98.2 per cent. The six surviving pigs were from groups of susceptible animals where the majority challenged died of hog cholera. The herds were therefore considered susceptible.

A total of 852 vaccinated pigs were challenged from 14 days to three months after vaccination, the majority by subcutaneous injection of 2 cc. whole blood virus and the balance by contact with cholera-sick pigs. Of these, 812 survived; 22 died of hog cholera, which represents a survival rate of 97.5 per cent. Eighteen died of other diseases.
An additional 725 vaccinated animals were exposed to hog cholera virus by contact with pigs vaccinated with serum and virus. There were no reported losses among these animals.

**RAPID ESTABLISHMENT OF PROTECTION**

Trials were instituted to determine the interval following vaccination necessary for the establishment of protection. Vaccination procedures followed were the same as those in the routine field trials.

A herd of 326 pigs was vaccinated with Rovac in the manner previously described. A test on seven pigs showed the herd to be susceptible. Groups of five vaccinated pigs were selected at random on the third, fourth, fifth, and sixth days following vaccination, and were challenged by contact with pigs in varying stages of hog cholera. Two pigs exposed on the third day died of hog cholera within nine days; all five exposed on the fourth day survived; one of five exposed on the fifth day, and two exposed on the sixth day died 20 days after challenge. Results of this test are summarized in Table 2.

In another experiment consisting of 42 pigs, 30 were vaccinated. Groups of ten were challenged by the intramuscular injection of 2 cc. of virulent whole blood virus on the third, fifth, and seventh days after vaccination. One of those challenged on the third day after vaccination died on the eighth day following challenge, but its death was due to traumatic pericarditis. All other animals survived. The 12 remaining unvaccinated pigs were challenged to determine susceptibility of the herd and died of hog cholera. Table 2 shows the results of these tests.

In the third experiment, a total of 220 unvaccinated pigs from one herd were used...
**Table 2**

Results of Challenge 3, 4, 5, 6, and 7 Days Following Vaccination with Rovac

<table>
<thead>
<tr>
<th>NO. OF PIGS</th>
<th>VACCINATED WITH 2 CC. BOVAC</th>
<th>CHALLENGE TEST</th>
<th>SUSCEPT. TEST</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passage No.</td>
<td>Date</td>
<td>Method</td>
<td>Days after Vac.</td>
<td>D/T†</td>
</tr>
<tr>
<td>326</td>
<td>261 5/24/51</td>
<td>Contact</td>
<td>3 2/5</td>
<td>7/7</td>
</tr>
<tr>
<td></td>
<td>274 5/27/51</td>
<td></td>
<td>5 1/5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5/28/51</td>
<td></td>
<td>6 2/5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5/29/51</td>
<td></td>
<td>2 cc. whole</td>
<td>3 1/10</td>
</tr>
<tr>
<td></td>
<td>5/30/51</td>
<td></td>
<td>6/26/51</td>
<td>2/10</td>
</tr>
<tr>
<td></td>
<td>6/28/51</td>
<td>blood</td>
<td>6/30/51</td>
<td>7 0/10</td>
</tr>
<tr>
<td></td>
<td>6/30/51</td>
<td>virus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I.M.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>274 6/23/51</td>
<td></td>
<td>5 7</td>
<td></td>
</tr>
</tbody>
</table>

* Rabbit passage.
† Deaths/Total.

**Table 3**

Results of Challenge of 60–90 lb. Pigs in Good Condition 5 and 7 days Following Vaccination with Rovac

<table>
<thead>
<tr>
<th>DAYS AFTER VACCINATION</th>
<th>VACCINATED WITH 2 CC. BOVAC</th>
<th>CHALLENGE TEST—7/28/51 2 CC. WHOLE BLOOD VIRUS</th>
<th>5-day D/T‡</th>
<th>7-day D/T‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lot number¹</td>
<td>2/10</td>
<td>0/10</td>
<td>0/10</td>
</tr>
<tr>
<td>5</td>
<td>134</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>134</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>132</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>132</td>
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<td></td>
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<tr>
<td>5</td>
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</tr>
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<td>7</td>
<td>240</td>
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<td>5</td>
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</tr>
<tr>
<td>7</td>
<td>902005</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                        | 12/90                         |                                               |             | 8/90       |

Susceptibility test, 5 and 7 days, each—20/20.
¹ Production lot ² Subcutaneous ³ Deaths/Total.
for challenge tests five and seven days following vaccination. Forty of these pigs were challenged with virulent virus to prove susceptibility and all died of hog cholera. The remaining 180 pigs were divided into groups of ten and vaccinated in the routine manner. At either five or seven days after vaccination, the vaccinated animals were challenged by the subcutaneous inoculation of 2 cc. of virulent whole blood virus. Twelve of the 90 pigs (13 per cent) challenged on the fifth day after vaccination died of hog cholera. Eight of the 90 pigs (9 per cent) challenged on the seventh day died of hog cholera. Table 3 shows the results of this test.

COMMENT AND SUMMARY

Field trials using Rovac, a rabbit-adapted, modified live virus, hog cholera vaccine, vacuum-dried, are described, involving 74 herds, consisting of 10,147 pigs.

At the time of vaccination, approximately three per cent of each herd, totaling 335 pigs, taken at random, proved the herds to be susceptible to hog cholera following the subcutaneous inoculation of 2 cc. virulent whole blood virus.

A single immunizing dose of 2 cc. of a one to four per cent tissue suspension of Rovac was administered into the muscle tissue of the medial aspect of the ham.

Over an observation period of four to ten months, there have been no deaths from hog cholera in those animals exposed to natural field conditions. No serious adverse reactions following vaccination occurred in these trials.

In some herds, only part of the animals on the premises were vaccinated. The remaining susceptible pigs showed no unfavorable reactions attributable to contact with the vaccinates.

A representative number of animals from each herd, totaling 852 pigs, were challenged 14 days to three months after vaccination by subcutaneous injection of 2 cc. virulent whole blood virus or by contact with pigs dying of hog cholera. Of these pigs, 97.5 per cent survived.

Complete protection was established five to seven days after vaccination, to a massive artificial challenge, but evidence showed that three days after vaccination good resistance to the hog cholera virus may be present.

The evidence showed that the vaccine, while being antigenic, is not pathogenic, and will not perpetuate hog cholera virus on the premises.

The field trials described in this report indicate that Rovac is a good and practical product for active immunization of susceptible swine against hog cholera. In the course of these trials, animals of all breeds, in various sections of the country, maintained under variable conditions, have been vaccinated. In no case was there any deviation from the usual feeding practices. There were no deaths attributed to hog cholera under normal field exposure, even though the general physical condition of many of the pigs vaccinated could be considered poor. Of the total of 852 vaccinated pigs artificially challenged from 14 days to three months after vaccination with 2 cc. of virulent whole blood virus, 18 died of intercurrent disease. Twenty-two succumbed to hog cholera, a 97.5 per cent survival rate.
TISSUE CULTURE MODIFIED LIVE VIRUS HOG CHOLERA VACCINE

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The interest shown in new hog cholera vaccines is certainly proof of the importance of continuous effort in development of better immunizing agents for preventing this very important disease. It justifies the belief that even though we may not all agree on the relative value of vaccination methods we have had long experience with, we could probably agree that none have been ideal from all standpoints. Surely we could also agree that such an ideal vaccine for prevention of hog cholera should possess the following characteristics:

1. It should produce a rapid and enduring immunity.
2. It should be safe for all classes of pigs raised under all conditions.
3. It should not spread disease.

This, of course, is a large order in the development of any immunizing agent for any disease and particularly is it a problem as applied to hog cholera since the virus of that disease has such strict requirements for growth and such a devastating effect when not controlled. At any rate, realization of the shortcomings of available methods in measuring up to this ideal immunizing agent has been the impetus which has stimulated a great amount of effort by many research groups to develop something a little closer to that ideal or perfect vaccine.

Many of you are aware of Dr. Boynton's dissatisfaction with any method of immunizing against hog cholera which utilized virulent hog cholera virus and of his past work for many years in attempting to accomplish hog cholera immunity without virulent virus. We have been privileged to work with him for many years in the development, commercial production and distribution of one of the products for immunization against hog cholera which does not necessitate the use of virulent virus or for that matter any disease-producing potential. His efforts beyond that point have been continuous in searching for better methods of propagating the virus or any means by which a more satisfactory hog cholera immunizing agent might be produced.

In 1945 he started his work with attempting tissue culture propagation of hog cholera virus utilizing a nutrient solution to which ultrafiltrate of swine serum and a small amount of sterile live bone marrow tissue from a susceptible pig were added. Our research group has been fortunate in being able to cooperate with him in this work from its beginning. Dr. Boynton's original goal was to find a means of cultivating hog cholera virus outside the living animal under well-controlled conditions to prevent the possibility of concurrently propagating other pathogens known or unknown to the normal host, the pig. He also realized the advantages of tissue culture hog cholera virus for purposes of studying the virus itself. His starting virus was commercial virulent virus and was passaged in this medium with minor variations by weekly passage from culture to culture with, of course, some interruptions to the present date. Each passage was checked on two or more pigs to determine whether or not virus was being carried from passage to passage. He published in
October 1946 (1) the results of his work to that time indicating that he had carried virus through 24 passages, and on virus titration a concentration of virus of $10^9$ was demonstrated.

By further passage of the virus to the 52nd generation it was found that the virulence of the virus had been reduced and that fact was reported by him in October of 1948 (2). This modification in virulence of the virus by tissue culture passage was an unexpected rather than a planned result since the modification in virulence occurred in the presence of normal host tissue. However, it did present new avenues of approach to the development of a new immunizing agent. We wanted then to determine just how safe and immunogenic this modified virus was. To determine this we planned to inject approximately 100 pigs with a selected culture of the modified live virus alone using animals from several different sources. The original plan was to use ten pigs from each of ten different farms to test the safety and immunizing ability of the virus in pigs of varied quality produced under different conditions. In all cases pigs of from 60 to 90 pounds were to be used.

The 59th tissue culture passage was selected for this test on the basis of its behavior on the routine screening test to determine its safety and immunizing ability. In the experiment actually 94 pigs were injected. They represented animals from seven different ranches and 83 or 88.3 per cent of the animals survived both the vaccination and subsequent challenge to virulent virus injected 14 to 28 days after vaccination. It was interesting to note that the 11 pigs that did not survive the test died as a result of the vaccine reaction, but all those surviving vaccination were solidly immune to virulent challenge. The 11 pigs that succumbed to vaccination were in two of the seven groups tested. These dead animals at autopsy showed evidence that existing dormant infections had been aggravated and our interpretation of the over-all result was that the vaccine reaction was a bit too severe for those groups carrying inapparent or dormant infections.

Further passages of the virus in tissue culture were made and at the 84th passage it appeared as judged on routine screening test by pig inoculation that the virulence of the virus had been further reduced. It was then decided to subject the 84th passage to a test similar to that used in testing passage 59. In this test 108 pigs in 12 groups were subjected to vaccination, and all survivors were then challenged 10 to 21 days after vaccination. The animals used in this experiment originated from eight different ranches, and some groups were purposely selected as poor subjects for immunization. A definite attempt was made to include both good and bad groups. All groups in the total were not on test at the same time; in fact, the test on each group was started as suitable pigs were available over a period of almost ten months. In this test 82.4 per cent of the pigs survived both vaccination and challenge. Only one pig died after vaccination, but 18 died after challenge with virulent virus. Since the significant loss occurred after the groups were challenged with virulent virus, the data were more closely examined in an attempt to explain this result. It was determined that the losses following challenge occurred only in pigs which had been vaccinated with fluid virus stored five to six months at 5°C. or when frozen virus was used after eight months' storage. The data indicated, therefore, that the poor result was due to instability of the fluid culture rather than an immunizing deficiency of the viable virus itself. Subsequent stability trials helped to bear out
the fact that virus in fluid form could not be relied upon to be viable after six months at 5°C.

This problem of stabilizing the tissue culture virus to maintain its viability on long storage was one we realized might have to be handled by vacuum drying and the results of this experiment emphasized the desirability of settling that question. This stability problem has since been adequately handled by preservation of the tissue culture modified virus by vacuum drying. The dessicated tissue culture virus is remarkably stable when properly packaged under high vacuum.

Recently data have been collected on two separate passages of tissue culture virus which were vacuum dried and then each tested on a small group of animals to determine that the viability of the virus had been properly preserved through drying. This information was obtained by indirect titration—that is, injection of tenfold dilutions of the dried material after reconstitution and then challenging the animals injected with each dilution two weeks later to determine the highest dilution that still immunized pigs. Both reconstituted dried vaccines were shown to contain viable virus in dilutions which indicated that no more than one log loss in virus had resulted from the drying.

The 150th passage dried and tested in this way was reconstituted, and a total of 60 pigs in six groups of ten animals each were injected with the reconstituted modified virus. These animals originated from five ranches. Fifty-five or 91.6 per cent of the 60 animals vaccinated survived both vaccination and subsequent challenge with virulent virus. Four of the five animals that died following vaccination originated from one source. There were 20 animals from this ranch included in the test. Since the first group of ten from this source reacted more severely than the groups from other ranches on test of this vaccine, a second group from this source was tested in an attempt to reproduce this unfavorable reaction. The second group reacted somewhat less severely in that one animal died as compared to three in the first group, but in terms of the number of animals that showed clinical symptoms the two groups reacted rather comparably.

Vacuum-dried passage 152 was reconstituted and used to vaccinate 56 animals. There were four groups of animals in this total of 56, and they originated from four ranches. Fifty-five or 98.2 per cent of these 56 animals survived both vaccination and subsequent challenge with virulent virus. The one animal that died was not observed sick until the 12th day after vaccination with the modified live virus. This animal was dead the following day, and at autopsy was found to have an occluded ureter. In fact, the posterior portion of the left ureter was entirely closed apparently as a result of a congenital anomaly. This animal apparently succumbed to uremic poisoning, and the anterior portion of the ureter and the pelvis of the corresponding kidney were very drastically distended with urine. Were it not for the death of this one animal which we believe to have no bearing on the performance of the vaccine, this laboratory trial would have been 100 per cent.

Dr. Boynton’s original hog cholera tissue culture virus series has now been continually grown outside the normal swine host for nearly six years and has been run through 180 passages. The work has encompassed the use of 900 pigs in the laboratory evaluation of the material during its development. The usual response to vaccination with the virus at its present point of modification in virulence is a
rise in temperature for one or more days with an occasional animal showing clinical illness followed by prompt recovery. These laboratory trials have indicated that tissue culture modified hog cholera virus can be utilized as a safe and effective vaccine. The field testing of tissue culture modified live virus as an immunizing agent using the modified live virus both with and without serum simultaneously is in its preliminary phase, and the results to date are promising.

A license has not been applied for as yet in view of the meager field information so far available.

REFERENCES

A HOG CHOLERA VACCINE PREPARED FROM A RABBIT-MODIFIED SWINE-PROPAGATED LIVE VIRUS

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R. L. WILLIAMSON, D.V.M.

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A hog cholera vaccine prepared from a rabbit-modified, swine propagated, live virus has been developed. It is designed to overcome the objection of the possible dissemination of virulent virus during immunization against hog cholera. The use of virulent virus in the simultaneous method of vaccination has always presented a problem in the eradication of hog cholera. After variable results with inactivated virus vaccines research workers directed their efforts toward modifying the virulence of the virus. In attempts to grow hog cholera virus outside the natural host Tenbroeck (1) and others (2, 3) reported cultivation of the virus in chick embryos and tissue cultures containing minced swine tissue. Baker (4), using the Tenbroeck strain of virus, adapted it to serial passage in rabbits. Independently Koprowski, James and Cox (5) propagated hog cholera virus by serial passage in rabbits subsequent to a technic of alternating passage between swine and rabbits. Baker reported modification of the virulence of one strain of virus on continued serial rabbit passage. This strain obtained from Tenbroeck was designated as strain A in the Baker publication. This rabbit-modified strain A was made available to interested commercial laboratories through the kindness of Dr. James A. Baker.

In the Fort Dodge Laboratories, this rabbit-modified virus was propagated in swine in a manner which maintained its modification and high antigenicity. In addition, the yield of virus per gram of swine tissue was much higher than in rabbit tissue. In the commercial production of this rabbit-modified, swine-propagated virus it is vacuum-dried, tested for safety, potency and purity, labeled and marketed under a special United States veterinary license as Hog Cholera Vaccine, Modified Live Virus (M.L.V.), Porcine Origin, Vacuum-Dried. A sterile diluent is supplied for restoring the vaccine for use. For the sake of brevity and to differentiate from the other modified live virus hog cholera vaccines, Fort Dodge vaccine will be referred to as M.L.V. The history of this vaccine is summarized in Figure 1.

Under experimental conditions M.L.V. used alone may produce a transient fever and moderate degree of leucopenia after injection into cholera susceptible swine. Healthy pigs usually continue to eat and show no obvious clinical signs during this reaction period. However, in swine carrying latent infections undesirable reactions may develop. For this reason 15 cc of anti-hog cholera serum is recommended for routine simultaneous use with 2 cc of M.L.V. The serum reduces both the extent and duration of the fever and leucopenia and in addition provides immediate passive resistance to virulent hog cholera virus. The advantages of immediate passive protection to hog cholera obtained by the simultaneous method of vaccination developed by Dorset and his co-workers (6) are well known. This immediate passive resistance has also been demonstrated experimentally in pigs vaccinated with 2 cc of M.L.V. and 15 cc of anti-hog cholera serum. Groups of such vaccinated pigs were challenged with 2 cc of virulent virus at 48 hour intervals from one hour to 14 days after vaccination. All remained well during a two week obser-
HOG CHOLERA VACCINE

vation period following challenge. Unvaccinated control pigs of the same lot developed cholera after challenge.

Following laboratory studies of the method of vaccination using 2 cc of M.L.V. and 15 cc of anti-hog cholera serum a plan for field testing the vaccine was devised, and Bureau of Animal Industry representatives were invited to observe the results. The tests were carried out under farm conditions by a number of Iowa practicing veterinarians. At the beginning of each farm experiment, at least three unvaccinated control pigs from each herd were sent to the serum plant and inoculated with 2 cc of virulent virus as a check on the susceptibility of the experimental group to cholera. The balance of the herd was vaccinated simultaneously with 2 cc of M.L.V. and 15 cc of anti-hog cholera serum. No evidence of undesirable postvaccination reaction attributable to the vaccine occurred in the 6,578 pigs in this field study. In one of the 43 herds, a dead pig was found on the morning of vaccination. Two pigs died on the sixth day after vaccination. Autopsy of both animals showed

<table>
<thead>
<tr>
<th>Hog cholera virus</th>
<th>Virulent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chick embryo plus swine testicle</td>
<td></td>
</tr>
<tr>
<td>Tissue culture plus swine testicle</td>
<td></td>
</tr>
<tr>
<td>Swine spleen (Strain A)</td>
<td></td>
</tr>
<tr>
<td>Virulence Modified, Antigenicity Retained</td>
<td></td>
</tr>
<tr>
<td>Serial passage in rabbit spleen (Baker)</td>
<td></td>
</tr>
<tr>
<td>Passage in rabbit spleen, propagation in swine (M.L.V., Fort Dodge)</td>
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</tr>
</tbody>
</table>

Fig. 1. History of M.L.V.

anemia and evidence suggestive of anaplasmosis-like infection. At the time of marketing, at least three hogs from each herd were injected with 2 cc of virulent virus to determine resistance to hog cholera. These results are summarized in Table 1. It will be noted from the table that 96.8 per cent of the 126 pigs challenged at market weight survived.

In order to obtain information on the duration of immunity following vaccination with M.L.V. and serum, gilts were retained as breeding stock on a number of these farms. To date 24 of these sows have been challenged with virulent virus at the time of their disposal to the packer from 11½ to 18 months after vaccination. The results are summarized in Table 2. Twenty-three, or 95.8 per cent of the 24 sows, survived the challenge. Three of the 23, or 12.5 per cent, developed fever and were slow following challenge but showed complete recovery by the 18th day.

One of the requirements of the United States Bureau of Animal Industry concerning the use of this vaccine is that reports on its use in the field must be submitted to the Bureau by the veterinarian administering the product within 60 to 90 days following vaccination.

Analysis of the results shown on these field reports should provide additional
information as to the use of M.L.V. under varied conditions of swine management in widely separated areas of the United States.

For the present, M.L.V. is recommended for use in a 2 cc dose with a 15 cc dose of Fort Dodge Anti-Hog Cholera Serum. Ten days to two weeks after weaning is

TABLE 1
Summary of Results of Simultaneous Vaccination of Pigs on Iowa Farms with 2 cc. Hog Cholera Vaccine-Modified Live Virus (M.L.V.) and 15 cc. Anti-Hog Cholera Serum (Fort Dodge)

<table>
<thead>
<tr>
<th>Vaccine Serial Number</th>
<th>Number of Herds</th>
<th>Number of Pigs</th>
<th>Number of Herds Challenged</th>
<th>Number of Pigs Challenged</th>
<th>Deaths From All Causes in Challenged Pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>13</td>
<td>1898</td>
<td>13</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>50-B</td>
<td>4</td>
<td>532</td>
<td>4</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>51-D</td>
<td>13*</td>
<td>2353</td>
<td>13</td>
<td>39</td>
<td>1</td>
</tr>
<tr>
<td>52-B</td>
<td>3</td>
<td>436</td>
<td>3</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>53-A</td>
<td>2</td>
<td>373</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>54-A</td>
<td>5</td>
<td>763</td>
<td>5</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>56-A</td>
<td>3</td>
<td>228</td>
<td>3</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Totals</td>
<td>43</td>
<td>6578</td>
<td>42</td>
<td>126</td>
<td>4</td>
</tr>
</tbody>
</table>

* In one herd of this group, a dead pig was found in the herd on the morning of vaccination. Two pigs died on the sixth day after vaccination. Autopsy of both animals showed anemia and evidence suggestive of anaplasmosis-like infection.

TABLE 2
Results of Challenge with 2 cc Virulent Virus at 11½ to 18 Months after Vaccination

| Hogs challenged                                    | 24 |
| Remained well                                      | 20 |
| Reaction with recovery                             | 3  |
| Deaths*                                            | 1  |
| Survival                                           | 95.8% |

* Bloody enteritis.

suggested as the ideal age for vaccination. However, these dosages have been used satisfactorily on a limited number of pigs five weeks of age or older which were still nursing, and also, on a limited number of adult swine. Larger doses of serum may be used safely if in the experience and judgment of the veterinarian they are indicated. Additional data on the use of M.L.V. on suckling pigs, in sales barns and in garbage feeding lots will be available upon completion of work now in progress.
It is expected that the use of M.L.V. in place of virulent virus will prove to be a step forward in the control of hog cholera provided it is combined with sound principles and practices of sanitation, swine management, nutrition and the control of other swine diseases and parasites.

**SUMMARY**

A hog cholera vaccine prepared from a modified, swine-propagated, live virus for use in a 2 cc dose with 15 cc of anti-hog cholera serum in the vaccination of swine against hog cholera has been described.

The results of field vaccination tests on 6,578 pigs are reported. No evidence of undesirable postvaccination reactions attributable to the vaccine occurred. Of 126 hogs vaccinated by this method as pigs 96.8% survived a challenge inoculation of 2 cc of virulent hog cholera virus at market age which in this study was three months or longer after vaccination.

Of 24 sows challenged from 11½ to 18 months after vaccination 95.8 per cent survived.

This rabbit-modified, swine-propagated, hog cholera virus vaccine (M.L.V.) has been licensed for sale by the Department of Agriculture and additional data on its use under field conditions is being submitted to the Bureau of Animal Industry.

**REFERENCES**

REPORT OF THE NATIONAL COMMITTEE ON ERADICATION OF
HOG CHOLERA


At the onset, your Committee wishes to emphasize it believes eradication of hog cholera is possible—but not so long as mass production and field use of virulent hog cholera virus is permitted. This statement is in accordance with the National Research Council Report. We further suggest that as soon as nonvirulent cholera immunizing agents have been fully approved by a majority of the Bureau of Animal Industry and representatives of the swine industry and our livestock sanitary officials and have demonstrated, through actual farm use, that they are thoroughly effective vaccines, steps should be taken to cease renewal of licenses for production of virulent hog cholera virus. In this interim any state should be permitted to limit or forbid the use of virulent field virus if it sees fit to do so. Your Committee suggests that until field use of virulent hog cholera virus can be eliminated, the following measures bearing on better control of hog cholera should be approved and activated.

RECOMMENDED INTERIM PROCEDURES

A. Legislation

1. It is recognized that virulent live hog cholera virus is employed in immunization procedures and moved interstate in an indiscriminate manner. Wherever such products are employed potential centers of infection are established. If, therefore, hog cholera is to be controlled or eradicated, the distribution and use of virulent live hog cholera virus must be under control. To accomplish this, the Committee recommends the consideration, adoption and activation of Amendment 15 to B.A.I. Order 276 as originally promulgated by Secretary of Agriculture Claude R. Wickard in 1940.

It is suggested that those states having inadequate legislation governing the control and use of the virulent live hog cholera virus be encouraged to suggest legislation to provide such adequate control; that the Bureau of Animal Industry give all possible guidance and cooperation to respective state livestock sanitary authorities in suggesting revisions of existent laws and regulations governing
ERADICATION OF HOG CHOLERA

prevention and control of hog cholera; and further, that the United States Livestock Sanitary Association endorse and urge consideration for revision of existent laws and regulations where such action is indicated. (Model legislation may be provided by committees of the United States Livestock Sanitary Association.)

B. Sanitary Recommendations

1. It is recommended that on premises where hog cholera exists (either as a natural field infection or as a result of vaccination over-reaction), closed quarantines shall be instituted and shall be subject to release by the chief livestock sanitary official.

2. All veterinarians or other persons having hogs under their control or supervision and knowledge of or reasonable suspicion of hog cholera, shall render an immediate report to the state livestock sanitary official, setting forth the name and location of the premises.

3. No garbage not sterilized by heating, except that originating on the premises where it is fed, shall be fed to swine. Owners of swine should be advised to avoid feeding uncooked home garbage because of the danger of spreading hog cholera.

4. All carcasses of swine which have died of hog cholera shall be disposed of by licensed rendering plants, burning under quarantine supervision or deep burial with lime.

C. Recommendations for Use of Immunizing Agents

1. It is recommended that all swine of any age (except suckling pigs nursing sows vaccinated against cholera prior to farrowing) transported for the purpose of sale, barter, exchange or exhibition, except for immediate slaughter, production of biologics and experimentation, shall meet one of the following requirements:

   (a) They shall be accompanied by an official certificate of vaccination with the serum-virus method more than 30 days prior to sale, or

   (b) Vaccination with non-virulent vaccine within the immunizing limits of the product.

2. It is suggested that the same requirements shall apply to the transportation of swine sold on the premises of the owner after such sale as to swine transported for sale, barter, trade or exhibitions.

3. It is further recommended that when feasible to recognized government officials, state and national, the licenses of all plants to produce virulent hog cholera virus for field use shall be terminated. At the time of termination of license to produce virulent virus for field usage, provisions should be made to permit production of hog cholera virus for purposes of anti-serum and vaccine production.

4. Widespread field use of non-virulent hog cholera vaccines should be encouraged as an adjunct to official control programs. However, provisions for adequate supplies of existing products until there is satisfactory proof of the value of the new vaccines should be made.

D. Research Recommendations

Your Committee suggests that all segments of the swine industry concur in sponsoring adequately financed research bearing on all phases of the epidemiology
of hog cholera. Such research should include comprehensive and conclusive laboratory and field testing of vaccines and other types of immunizing agents by an independent research institute or institutes. In order to implement this suggestion, it is recommended the R.M.A. livestock advisory committee be urged to plan or cause to be planned, projects and adequate funds to carry on this important work.

E. Revision of Procedures

It is suggested by this Committee, that as new information becomes available and new products are licensed, the interim procedures suggested herein should be modified to meet the situation. Furthermore, the sanitation measures recommended should be completely modified at the time virulent virus usage in the field is discontinued.

RECOMMENDATIONS FOR PUBLIC RELATIONS

Inasmuch as more than sufficient scientific knowledge is already available, your Committee has proceeded on the thesis that one of its assignments was to outline an educational and public relations procedure for the total eradication of hog cholera, assuming that the technical, legal and organizational means for such eradication are now available or will be at some future date and that the public support for such eradication can be generated and mobilized.

Stated in the most simple terms, the problem is one of disseminating as widely as possible among producers, handlers, distributors, processors and perhaps even consumers, the basic facts about hog cholera and its eradication, to wit:

- The nature of the disease
- Losses and evils
- Possible methods of eradication
- Benefits and advantages of such eradication

While these are the essential and simple elements of the problem, we are not unmindful of the magnitude of the educational and public relations job. It has been pointed out, hog cholera is the one and only disease with which we have practiced the reverse philosophy of living with it rather than striving to eliminate it, as we have with all others which have threatened our livestock population. Hence, if we are now to eradicate cholera, we are setting for ourselves the task of reversing our thinking, our toleration, our national and state policy and our action with respect to the disease.

Furthermore, we must do so without the advantage of a public health appeal, as was so potent in the case of tuberculosis eradication. There is, of course, the appeal of a higher quality and a more stabilized supply of pork and pork products in a hog cholera eradication campaign, but these benefits cannot be dramatized in terms of babies, mothers and protection of the home.

Public support and action on hog cholera eradication must be mobilized on the basis of the shameful economic loss now being suffered by farmers and the nation, on the staggering cost of trying to control the disease while still temporizing and tolerating, on the anxiety latent in the hearts and minds of farmers as a result of the threat which hog cholera constantly holds over our heads, on the pride of
producers in a good husbandry, and on the economic benefits which will accrue to the entire livestock industry in the form of reduced costs, the elimination of waste and losses and the production of a higher quality product.

While this poses a gigantic task, we are encouraged by the credo of Dr. B. T. Simms, Chief of the United States Bureau of Animal Industry and a member of the general committee, that "Animal disease control and eradication are a condition of the mind." The clear inference and challenge of this statement is that, with the proper technical, legal and organizational means at hand, the United States can eradicate hog cholera if farmers, producers, and all other interests of the industry are made so minded through an effective educational program.

To this end, your Committee recommends that a Public Relations Committee on the eradication of hog cholera be set up by the United States Livestock Sanitary Association to organize and coordinate materials, manpower and methods at the national level. This might preferably be a subcommittee of a larger committee, but in any event, its work should be closely integrated and coordinated with the activities of other United States Livestock Sanitary Association committees concerned with the eradication of hog cholera.

It is further recommended that the state livestock sanitary officials in each and all of the states appoint a public relations committee on hog cholera eradication to cooperate with the national committee and to organize, coordinate and localize the educational phases of the campaign at the state level.

The organization of such committees is further recommended on the county level, at least in the important commercial hog producing counties of the nation.

It is recommended that the membership of these committees at the national, state and county levels include representatives of such groups as the Extension Service, veterinarians, swine breed associations, commercial hog producers, farm organizations, livestock haulers, packers, farm press, daily and weekly press, radio and any others with an interest in the problem.

The basic materials with which these committees will work in furthering the educational and public relations program are the new facts on hog cholera eradication as developed by state and federal agencies, private industry and farmers and producers themselves, supplemented, of course, by the basic knowledge on hog cholera. There also will be important material issuing out of the work of the various committees concerned with various phases of the problem.

As a means of unifying and coordinating available subject matter on the problem of hog cholera and of bringing all of it to bear in the most effective manner on the campaign, the Committee recommends that a group of competent authorities be appointed to assemble and publish under the sponsorship of the United States Livestock Sanitary Association, a popular type booklet of facts about hog cholera, its control and eventual eradication. Such a booklet might take the form of the one on "WHAT IS KNOWN ABOUT BRUCELLOSIS."

As of today, such a booklet might not be able to spell out all the details of a campaign to eradicate hog cholera, but it should, among other things, present the pros and cons of eradication in the most effective manner possible in order to expedite the campaign once it is under way.

It is further recommended that the United States Department of Agriculture,
the Federal Extension Service, the state experiment stations and state extension services be asked to review their current bulletins, circulars and other publications dealing with hog cholera to the end that these may be updated and modernized wherever necessary in order to make them more effective instruments in the eventual eradication of the disease.

It is the feeling of the Committee that much of current public information being put out on cholera, its control and eradication, is ineffective because of faulty distribution or because it is not getting into the proper hands. We, therefore, recommend that one of the functions of the subcommittee on Public Relations to be set up by the United States Livestock Sanitary Association be to serve as a clearing house for all current press material and publications on hog cholera and that the committee do everything possible to see that meritorious and helpful material receive proper distribution and careful attention wherever it might be used to advantage in furthering the campaign.

As a source of helpful and effective material especially during the early stages of the campaign, the Committee recommends that the proper authorities consider launching the eradication effort in a pilot-test area. At one time this was, and may still be, the considered judgment and the suggestion of the United States Bureau of Animal Industry. Such an area could be an effective “laboratory” for ridding the campaign procedure of troublesome bugs before the nationwide program is launched. More important, if such an area were properly organized and handled, it could serve as an invaluable source of pictures, as well as article and press material, which could be used to good advantage in presenting to the remainder of the country the procedures, the problems and the benefits of eradication.
DISCUSSION OF THE REPORT OF THE NATIONAL COMMITTEE ON THE ERADICATION OF HOG CHOLERA

[Dr. Hutchings read his prepared paper.]

PRESIDENT MOLLIN: Our program calls for discussion of this report, and it seems to me it opens up quite a field. We could well spend a few minutes on it if there are any questions from the floor.

DR. H. F. WILKINS: It occurs to me that we are overlooking a bet, that is, all regulatory officials, in permitting the sale of infected and exposed hogs for slaughtering purposes. It would appear to me that all exposed hog herds should be quarantined and not be permitted to go to slaughter until they have recovered possibly from serum treatment so that we would not have in our commercial channels pork infected with the virus of hog cholera.

I realize that this is a departure from a procedure that has been established for many years, but I believe we all will admit that it is one of the most fertile means by which hog cholera has been spread throughout this country.

DR. HUTCHINGS: The Committee definitely considered that point, sir, although I doubt if we considered every point that might be brought up.

The first recommendation under “Sanitary Recommendations” is as follows, and I shall repeat it: “It is recommended that on premises where hog cholera exists, either as a natural field infection or as a result of vaccination overreaction, closed quarantine shall be instituted and shall be subject to release by the chief livestock sanitary official.”

PRESIDENT MOLLIN: I might say that in my own experience in Nebraska, where we handle a lot of hogs, we have found sometimes some farmer would detect a break in his hogs, and he might know there was hog cholera in the neighborhood, so he would sell us all the pigs that looked as though they were all right, and by the time we got them they would begin to get sick. It would be an awfully hard thing to enforce, Dr. Wilkins. I know that from my own experience.

Are there any other questions? There are some new ideas in this report. I am interested in it personally because of my past experience. I thought we would have a little more discussion as the the proposal for a committee, as suggested, and the publicity to accompany it. I guess everybody is satisfied.

DR. AB QUIN: I would like to know how many in the room would approve the Committee’s report.

PRESIDENT MOLLIN: No matter what the convention does about it, it has to be approved by the Executive Committee.

DR. QUIN: I would like to have that information for the benefit of the Committee. They have done a lot of hard work on it.

PRESIDENT MOLLIN: Do you mean how many would approve the general recommendations in the report?

DR. QUIN: Yes; how many in the room would do that?
President Mollin: Let's have a showing of hands of those in the room who would approve the recommendations in this report. There is a very good showing of hands, Dr. Quin.

Secretary Hendershott: How many are opposed to it?

[One]
Interest in brucellosis eradication continues to increase. Immediately after the Annual Meeting of this Association held in Phoenix, Arizona last year, the Third Inter-American Congress on Brucellosis assembled in Washington, D.C. Previous meetings of this group were held in Argentina in 1948 and in Mexico in 1949. Leading scientists from the Americas and some from Europe joined the recognized authorities on this subject in the United States for a five-day meeting. The report of this Congress can be obtained through the Editorial Section of the Pan American Sanitary Bureau in Washington, D.C.

The National Brucellosis Committee, comprised of representatives of 27 national organizations from the agricultural, livestock and food processing industries, and the educational, scientific, and medical professions, has continued to support brucellosis eradication in a very effective way. This Committee, recognizing the necessity for education and that the demand for service should originate at the farm or ranch level, has recommended the setting up of state, county, and where considered necessary, township brucellosis committees. It is suggested by the National Brucellosis Committee that the recommendations of the United States Livestock Sanitary Association for brucellosis eradication in domestic animals, which were approved by the Bureau of Animal Industry, be used as a guide in discussions by these committees.

Extension Service is participating more than in the past in organizing these committees, and in the educational work being done by them. Professor C. G. Bradt, Extension Animal Husbandman of New York, who has worked very closely with state and federal officials in connection with tuberculosis and brucellosis eradication projects for the past 20 years, has been granted leave to make a study of the brucellosis eradication projects as they are now being conducted in a number of the states. It is felt Professor Bradt's observations and recommendations will be very helpful.

States in which brucellosis committees have been set up have apparently made more rapid progress than those which have no such committees. During a recent trip to several midwestern and western States where brucellosis committees have not yet been set up and where action is now being taken to organize these committees, I was informed the livestock producers and all other interested groups have responded exceptionally well. In one state the brucellosis committee, made up mostly of producers, set up a program which was presented to the legislature with a request that the laws of the state be amended so as to permit the program as outlined by the committee to be placed in operation. The committee also requested an appropriation. Both received almost unanimous approval by the state legislature. The appropriation was the largest ever made in any state. One of the

1 Dr. Kuttler is In Charge of the Brucellosis and Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture.
motivating factors in this state for such a brucellosis eradication program was the adoption of a milk ordinance by the Chicago Health Department which provides that milk may be sold there after January 1, 1955 only if produced from herds classified by state and federal livestock sanitary officials as brucellosis free. An ordinance has been adopted in Washington, D. C. which provides that within two years after adoption, August 3, 1950, all milk and cream produced for sale or shipped into the District of Columbia must be from herds following one of the plans approved by the United States Bureau of Animal Industry for the control and eradication of brucellosis, and after July 1, 1952 all milk sold for fluid consumption in North Carolina must come from brucellosis-free herds.

The new United States Public Health Standard Ordinance and Code will be ready in 1952. Provisions of this code as it pertains to brucellosis are that within a period not to exceed three years after adoption all herds producing milk for pasteurization must be operating on Plan A or B for brucellosis eradication, and the ordinance looks toward requiring that all herds supplying milk be free from brucellosis. The restrictions for herds producing milk not for pasteurization are more stringent.

It is interesting to note that in eight of the states, most or all of which have state and country brucellosis committees, the total appropriation for brucellosis eradication exceeds appropriations made for this purpose by all the other states combined. In fact, the appropriation in these eight states is 62 per cent of the total funds appropriated in all of the states.

The new motion picture, "The Triple Threat of Brucellosis" prepared by the United States Department of Agriculture and released since our last meeting, has been very favorably received in this country. An award of second prize was made this year for "The Triple Threat of Brucellosis" at the Motion Pictures Festival at the International Exhibit of Cinematographic Art, held at Venice, Italy. This film tells in a most accurate and interesting way the story of brucellosis from the time it was discovered as a serious disease among British soldiers on the Island of Malta. There have been 107 copies printed for use in this country and 2 copies have been sent abroad. This film has also been televised with very satisfactory results. Special copies for this purpose can be secured by writing the Bureau of Animal Industry, Washington 25, D. C. There is also a copy in the Visual Aids office in each of the states. The federal veterinarian in charge of each Bureau of Animal Industry station also has a copy and in a number of states the State Department of Agriculture Motion Picture Service has purchased copies to be used along with other educational films. "The Triple Threat of Brucellosis" is a 16 mm. color film with sound and requires 30 minutes running time. It is suitable for agricultural groups, clubs, schools, etc.

The demand for the booklet prepared by the United States Livestock Sanitary Association, "What is Known About Brucellosis," has continued. Perhaps the most complete exhibit ever prepared on brucellosis was on display by the United States Army at the 1951 Annual Meeting of the American Veterinary Medical Association held at Milwaukee, Wisconsin August 20–24. Colonel Frank A. Todd accumulated the data for this exhibit which will no doubt be used at meetings of medical and veterinary medical associations as well as other groups all over the country. All who have an opportunity should see this exhibit.
The farm press and radio have presented during the last year the most accurate information on this subject of any year since the campaign was begun on a national scale in 1934. Reprints of one of the most complete series of articles yet published on brucellosis by a farm paper will be purchased by the Bureau of Animal Industry and made available to those who wish to study the problem as it has been treated in the press.

I am sure we can all find encouragement in the improved uniformity of thinking and progress made during the past year on the brucellosis eradication project. However, as expressed by our good friend, Bill Knox, Secretary of the National Brucellosis Committee, “Time is no longer on our side. It is up to us to do the job now.”

It is felt sufficient time has lapsed to warrant a report on the degree of compliance by the different states with recommendations of the Association which were made at the December meeting in 1947. The recommendation of the Association that the Secretary of Agriculture be authorized to promulgate regulations pertaining to interstate shipment of cattle affected with brucellosis was provided for by the 82nd Congress, which adjourned October 19, 1951.

There are now 24 states with laws or regulations which will permit the livestock authorities of the state to require the test of all cattle in a given area after a majority of the owners have voluntarily placed their herds under supervision. Identification of cattle at the time they are tested is required in all states. Branding of cattle which react to the test is required in 42 states. Permanent identification of calves when vaccinated is required in practically all states. Adult vaccination is recognized in 31 states. In 24 states, only the animals which react are placed under quarantine and in 14 states the entire herd is placed under quarantine when reactors are found. In the remaining states there is no quarantine. In 24 states the quarantine is enforced. In 15 states reactors held are accounted for with the same degree of care that is taken with regard to animals slaughtered immediately after having been found to be reactors to the test. Indemnity is now paid for reactors to the test for brucellosis in 24 states. A negative test is required in 15 states for all cattle moved except for immediate slaughter or those excepted by regulations. In 8 states the owner is required to pay for services rendered in connection with the brucellosis eradication program. In 40 states the state or federal government pays for services in this connection. In 12 states non-veterinary personnel participate in the project. In the same number of states consideration is being given to using non-veterinary personnel. In 25 states there is a state brucellosis committee. In 14 states county brucellosis committees have been organized or are being organized. In 10 states the milk ring test is being used extensively. In 3 states this is the only test used in the initial survey. Herds that show evidence of infection based on the milk ring test are given the blood serum test.

The greatest single obstacle continues to be a shortage of veterinary personnel. In many states there are not more than one-fifth as many full time employed veterinarians assigned to the brucellosis eradication project as compared to the number which were assigned in the early years of the campaign. In this connection I quote from an observation made by our Secretary, Dr. R. A. Hendershott, on March 22, 1949, at the meeting of a group called together to consider formation of the National Brucellosis Committee: “There are in round numbers approximately 40 million
breeding cows and ten million heifer calves in this country. We shall have to come
a lot nearer incorporating all of these animals in the brucellosis eradication project
than we have in the past if we are to reach our goal. In most sections one man can
take care of ten to 15 thousand cattle so far as the brucellosis eradication project
is concerned, provided he spends his full time on the work and the proper educational
and organizational work is done prior to his undertaking the task. This would re-
quire the employment of at least 4,000 men. There are, as near as I can estimate
at the present time, less than 1,000 Bureau and state veterinarians engaged in this
project on a full time basis. It will require in addition to veterinarians, a rather
large number of administrative and clerical personnel."

The use of the milk ring test has been greatly expanded and offers one of our
best solutions to the manpower problem.

There were 5,640,836 cattle tested by the blood serum method during the past
fiscal year as compared to 5,974,721 tested in 1950. There were 2,542,333 calves
vaccinated as compared to 2,065,063 vaccinated the previous year. There were
133,898 adults vaccinated as compared to 150,056 vaccinated the previous year.
The percentage of infection as calculated for herds under supervision has been
reduced from 3.5 in 1950 to 3.1 in 1951.

The recommendations of this Association for brucellosis eradication in domestic
animals, which have been approved by the Bureau of Animal Industry, have been
accepted in 43 of the states as minimum requirements. Memorandums of under-
standing between state livestock sanitary officials and the Bureau have been pre-
pared on the basis of these recommendations. Due to a reduction in funds available
to the Bureau for brucellosis eradication, it will be more essential than ever to
adhere closely to the policy of making allotments of federal funds to the states
contingent upon the ability of the state to conduct the brucellosis eradication pro-
ject as outlined in the recommendations of this Association.

SUMMARY

Education, which is conceded by all to be most vital to the success of the brucel-
losis eradication project, has made satisfactory progress from every angle during
the past year. Agreements reached by those in positions of leadership in all phases
of the livestock industry assure that the project will be prosecuted to a successful
conclusion.
REPORT OF COMMITTEE ON BRUCELLOSIS


During the past 36 years the United States Livestock Sanitary Association annually appointed a Committee on Brucellosis. The responsibilities were to secure and present, for the benefit of the livestock industry, factual information relative to the disease as well as offer recommendations for its control and eradication.

The efforts of these committees have not been in vain, as statistics from the United States Bureau of Animal Industry indicate a general reduction in the incidence of the disease. Further, the efforts of certain states are most gratifying and commendable as three of our states have now attained the enviable "Modified Certified Brucellosis-Free" status.

Unfortunately the disease does not confine itself to the bovine species alone. Therefore it cannot be totally eradicated until intensified and coordinated efforts are made toward its control and eradication in all affected species or carriers.

In review of the literature and past reports it appears primary consideration has been given to the disease in cattle. Research indicates additional consideration must be given to brucellosis in swine and goats and possibly other species implicated in transmission, if final and complete eradication is to be attained.

TESTS AND RESEARCH

Reports of the efficiency and economy of the milk test indicate it might well be recognized and employed on a wider scale in area control work. In addition, it would appear quite practical to employ this test in certified herds as an adjunct to annual blood tests. Such tests could be made quarterly, and because of the economy might well be applied monthly.

The more recently developed capillary-tube test appears deserving of more extensive field trials. Its use in combination with the milk test and serum agglutination test seems justifiable to determine its comparable efficiency. Since the capillary-tube test can be applied to homogenized milk, it would appear justifiable to apply it to goat milk to ascertain its efficiency as an adjunct test in the control of the disease in this species.

Since the spread of brucellosis is basically accomplished by the infected or carrier animals, consideration might well be given by the individual states for improvement or modification of laws or regulations to adequately control the movement of known infected animals.

Although the contributions of research have materially aided brucellosis control,
continued and intensified action is still indicated relative to immunizing agents and diagnostic methods.

Since a limited amount of work has been carried on in swine brucellosis, each state should be encouraged to initiate or intensify its efforts toward control on the national level. Perhaps subcommittees on swine and goat brucellosis are indicated for the National Brucellosis Committee, the Committee of the United States Livestock Sanitary Association and the new national organization, Livestock Conservation Inc. Such committees could well study reports of the past and attempt to clarify or correct certain contradictory language now existing in past reports on swine brucellosis.

Appreciation is extended to the National Brucellosis Committee for effort in attempting to attain unification and coordination of brucellosis control from the national level.

The farm press is to be commended for its efforts in bringing factual information of the disease to the general public. Such efforts are to be indeed encouraged for it is through these efforts to improve basic understanding that the way will be paved for greater accomplishment in the future.

**PRIORITY FOR FUNDS**

With greatly expanded brucellosis control and eradication programs, funds are often limited to accomplish desired objectives. It is recommended that available funds be used in the following order of priority:

1. State-wide milk and blood testing of all dairy herds.
2. Informative blood testing.
3. Calfhood vaccination.
4. Indemnities.

**STATUS OF HERD**

Where possible, it is recommended that health papers on individual animals indicate the brucellosis status of the herd of origin. This recommendation applies to cattle and swine.

**STANDARD MILK ORDINANCE**

The new United States Public Health Standard Ordinance and code is reported to be issued in 1952. It is scheduled to require that within a period not to exceed three years after adoption all herds producing milk for pasteurization must be operating on Plan A or B for brucellosis eradication. The three-year time interval is too short. It does not allow for sufficient time to initiate and effect more intensive and extensive programs promulgated through education and state legislation. A five-year period for compliance is recommended.

The Secretary of the United States Livestock Sanitary Association is requested to advise the United States Public Health Service immediately of the foregoing recommendation.

**RANGE AND SEMI-RANGE AREAS**

It is recommended that the incoming chairman of the Committee on Brucellosis be instructed to appoint a subcommittee of ranchers and regulatory officials to
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draw up rules and regulations for specific application to range and semi-range areas. The report of the subcommittee will be submitted to the chairman of the Committee on Brucellosis prior to the 1952 Annual Meeting of the United States Livestock Sanitary Association. We further recommend that the recommendations of the United States Livestock Sanitary Association for Brucellosis Eradication in Domestic Animals as of 1949 for state legislation be readopted except for Section 8, which should be entirely replaced by the following:

Sec. 8A. Requirements for identifying all animals which have been officially vaccinated:
(a) All vaccinated adult animals shall either be tattooed “AV” in the right ear or branded “AV” on the right jaw.
(b) All vaccinated calves shall either be tattooed “V” in the right ear or branded “V” on the right jaw.
(b-1) If the tattoo is used, then the “V” shall be preceded by a numeral indicating in which quarter of the year the vaccination was done. The “V” shall be followed by the last number in the year in which the vaccination was done.
(b-2) If the brand is used, then the “V” shall be applied in four different positions—one each year over a four year period to indicate in which year the vaccination was done. The fifth year will repeat the first year, and so on indefinitely. In 1951 the “V” shall be placed with the open end up; in 1952 the “V” shall be placed with the open end facing right; and so on clockwise indefinitely.

Sec. 8B. Each state should use all available channels to obtain for its Livestock Sanitary Official the sole right to use the “V” brand on the right jaw.

PROPOSED REVISION TO UNIFORM METHODS AND RULES FOR THE ESTABLISHMENT AND MAINTENANCE OF CERTIFIED BRUCELLOSIS-FREE HERDS OF CATTLE AND MODIFIED CERTIFIED AREAS

Part I

Individual Certified Herd Plan

Sec. 1: A “herd” shall be defined as including all animals over six months of age except steers, spayed heifers and officially vaccinated animals not more than 24 months of age.

Sec. 2: Herds may be placed under supervision for certification as brucellosis-free upon complying with provisions governing the testing requirements of the respective state-federal cooperative program.

Sec. 3: herd tests shall be made at intervals of not more than 60 days until all evidence of infection has been eliminated. A herd may be certified as brucellosis-free when it has passed at least three consecutive tests, with the first clean test and the certifying test not less than 12 months apart. It is provided that where there is no evidence of infection on the first test a herd may be certified as brucellosis-free when it has passed one additional clean test conducted not earlier than six months from the date of the first. Where the milk test is employed herds may
be certified as brucellosis-free with a minimum of three satisfactory milk tests conducted at not less than 90-day intervals and followed by a clean blood test.

Sec. 4: Animals under 30 months of age vaccinated as calves shall not be required to be negative to test. Vaccinated animals over 30 months of age, showing titer, may be retained in certified herds if a retest of such vaccinates in not less than 30 days shows the titers to be stabilized or receding at not more than incomplete at 1:100.

Sec. 5: Certified brucellosis-free herd certificates which shall be valid for one year unless revoked, may be issued by cooperating state and federal officials.

Sec. 6: Herd certification may be extended for a period of one year upon evidence of a negative herd blood test.

Sec. 7: If the retest of a certified herd, or of animals from such a herd, reveals one reactor, the entire herd shall be retested, and may be recertified on the results of two negative tests conducted not less than 60 days apart, the first such test at least 30 days after the date of the test on which the reactor was disclosed.

Sec. 8: If the retest of a certified herd or of animals from such a herd reveals more than one reactor, the herd shall be tested as under Sec. 3.

Sec. 9: In those cases where the certified status of a herd has been cancelled only because of the presence of overage vaccinates showing continuing reactions of 1:100 or higher, the status may be restored upon evidence of one clean herd retest applied not earlier than 60 days following removal of such reactors.

Sec. 10: If the retest of a certified herd discloses suspects but no reactors, only the suspicious animals need be retested. If all suspects are available for retest and are negative, the herd test may then be considered negative. If the retest does not include all suspicious animals, or if one or more reactors result, the herd shall be classed as infected and tested as under sections 7 and 8.

Sec. 11: Animals in herds where infection has been disclosed will be restricted in movement to the premises, except under permit, until the herd has passed a clean retest not less than 30 days following the test on which reactors were last revealed.

Sec. 12: Additions:
1. To certified herds.
   (a) From herds with equal status.
   (b) From once clean herds, (1) vaccinated animals up to 24 months of age on certificate of vaccination—over 24 months, if negative; or (2) non-vaccinated animals on evidence of negative retest not less than 60 days from date of negative herd test.

2. To once clean herds:
   (a) From herds with equal or superior status.
   (b) From other herds, (1) vaccinated animals up to 24 months of age on certificate of vaccination—over 24 months, if negative, or (2) non-vaccinated animals if tested negative, then segregated and retested negative in not less than 60 days.

Sec. 13: Additions introduced from herds without equal status, under qualifying conditions of Subsections (b), Sec. 12, shall not receive new herd status for sales purpose until they have been members at least 30 days and included in complete herd retest.
Sec. 14: Premises shall be cleaned and disinfected under supervision or proper direction, following removal of reacting animals.

Part II

Modified Certified Area Plan

The provisions of the individual certified herd plan that relate to testing, cleaning and disinfection shall apply to the modified certified area plan. The extent of the area shall be determined by the cooperating state and federal agencies. When an area has been designated and the required percentage of herds and cattle included under any of the plans, the area shall be placed under quarantine and the following rules apply:

Sec. 15: Cattle from officially certified brucellosis-free herds, and cattle from negative herds in modified certified brucellosis-free areas, when officially blood tested with negative results within one year of the date of shipment, may enter other modified certified areas without being retested for brucellosis. All such cattle shall be individually identified and shall be accompanied by approved certificates of health indicating herd and animal status.

Sec. 16: Cattle from herds under federal-state supervision for the control of brucellosis in which all animals in the herd over six months of age (except animals officially vaccinated as calves and under 30 months of age) were negative to the official blood agglutination test for brucellosis within 90 days of the date of entry and the individual animals to be moved were negative to an official retest at least 30 days from the date of the previous herd test and within 30 days before entry, may enter a modified certified brucellosis-free area or an area in the process of such certification without further restriction.

Sec. 17: Heifers under 24 months of age officially vaccinated as calves when six to eight months of age and coming from (a) negative herds in modified certified areas, (b) individually certified brucellosis-free herds, or (c) herds under federal-state supervision which have passed a test as under Section 16, may enter a modified certified brucellosis-free area or an area in the process of certification without further test when individually identified by mark, brand, tattoo or other acceptable identification and approved by the proper sanitary official of the state of origin.

Sec. 18: Breeding cattle not over 24 months of age, officially vaccinated as calves when six to 8 months of age, which do not qualify under Sec. 17, may enter a modified certified brucellosis-free area providing they do not show blood agglutination reactions higher than incomplete in dilution of 1:100 and the animals are maintained in quarantine until they have passed a negative blood test.

Sec. 19: All other male or female cattle over 6 months of age, except steers, spayed heifers and cattle intended for immediate slaughter, shall be required to pass a negative officially recognized blood agglutination test for brucellosis within 30 days prior to the date of entry, and shall be maintained in quarantine separate from other cattle and retested in not less than 30 nor more than 60 days after the date of entry. If passed, they shall be released from quarantine.

Sec. 20, a-1: If as a result of a blood test of all cattle within an area the number of reactors (exclusive of officially vaccinated animals under 30 months of age) does
not exceed one per cent and the herd infection does not exceed five per cent, the area may be declared modified certified brucellosis-free for a period of two years, provided that infected herds shall be quarantined until they have passed at least two consecutive tests not less than 60 days apart.

Sec. 20, a-2: An area may be declared modified certified brucellosis-free by the application of semi-annual milk tests and blood testing of herds reacting to the milk test. All non-milk tested herds must be blood tested. To be declared modified certified brucellosis-free an area must have two milk tests not less than six months apart. All herds reacting to the milk test and all non-milk tested herds must be blood tested. The number of reactors (exclusive of officially vaccinated animals under 30 months of age) must not exceed one per cent and the herd infection must not exceed five per cent. Infected herds shall be quarantined until they have passed at least two consecutive blood tests not less than 60 days apart. This certification shall be indefinite if semi-annual milk tests are applied and milk reactor herds are blood tested. Twenty per cent of non-milk tested herds shall be blood tested bi-annually. Continuance of certification will depend on the disease incidence not exceeding the maximum stated above.

(b) If, as the result of testing under 20 (a) the number of reacting animals exceeds one per cent, but is not more than two per cent and a retest of the infected herds applied within 120 days discloses infection not exceeding one per cent of the total cattle population and five per cent of the herds, the area may then be certified. (c) If the test of an area as under 20 (a) results in more than three per cent reactors, or if a retest of infected herds as under 20 (b) does not qualify the area for certification, it shall be necessary to make a complete area retest.

Sec. 21: At the expiration of the two-year period, (20 a-1) areas may be recertified for another two-year period when the results of a retest of all herds in which infection was reported at the time of the previous certifying test or since, together with the results of a retest of 20 per cent of other representative herds, reflects a rate of infection which does not exceed one per cent of the cattle or five per cent of the herds so tested. The number of herds required for retest shall be computed from the last area test and shall not include the same 20 per cent previously tested for this same purpose.

Sec. 22: If retesting as conducted under Section 21 or 20 a-2 reveals an infection rate of more than one per cent of the animals tested, but not more than two per cent, retests may be applied to the infected herds during the following 120 day period, and if the reactors revealed on any such retest do not exceed one per cent of the total animals under retest, and five per cent of the herds, the area may be recertified.

Sec. 23: Any area not qualifying for recertification under Sections 20 a-2–21 or 22 shall be subject to retest of all cattle as under Section 20 (a).

Sec. 24: It will be permissible in modified certified brucellosis-free areas to have not to exceed one per cent of the total number of herds in the area maintained as infected herds under the provisions of the uniform program which govern the handling of such herds. The cattle contained in these herds shall be included in the total number of reactors when determining the percentage of infection as provided under Sections 19, 20 and 21 of these rules.
At the present time the Division of Virus-Serum Control of the Bureau of Animal Industry lists 99 biologicals that are licensed. This includes two new products which were licensed during the course of the year:

1. Anti-canine distemper serum and anti-infectious canine hepatitis serum,
2. Hog cholera vaccine modified live virus.

The latter includes two products or vaccines. One vaccine is of rabbit origin and the other is of swine origin. The final evaluation of the two types of modified, live virus, hog cholera vaccines under field conditions remains to be accomplished. The final solution of the hog cholera problem will rest upon more basic information pertaining to hog cholera as a disease and on a better understanding of the virus, both of which are inadequate at present. The need for extensive research in various avenues of this area seems imperative. Unlike the spasmodic investigations of the past, future research on hog cholera should be characterized by continuity and work of a more basic nature to form the foundation for subsequent application or developmental research.

The evaluation of developments with reference to new vaccines by journalists in the lay press, and the almost complete absence of technical presentations in the veterinary publications, constitutes an unhealthy situation. Professional standards are jeopardized when journalistic efforts are substituted for the critical testing and evaluation of medical problems by those who are specifically trained and experienced in field and laboratory research.

The far-reaching effects of recent developments and actions during the past year pertaining to hog cholera are of a grave nature. These demand clear thinking and careful adjudication which must be unbiased, scientifically sound and devoid of merchandising goals.

Nearly every competent student of the hog cholera problem will readily concede that the simultaneous serum and virus method of protecting swine against hog cholera is not a perfect procedure but it must also be recognized that this procedure has made possible the development of the large swine industry during the past four decades. Before blithely casting this aside for something untried, a great deal of caution should be exercised.

Geographical considerations and densities of swine populations are important factors that will affect the control of hog cholera. The efforts of the late A. K. Atherton in Maryland to control hog cholera by quarantine and prohibition of the use of virus are recalled. His plan has merits in that area, but it is questionable whether these procedures are applicable in the Corn Belt with its dense swine population and traffic in feeder pigs and movements of animals through sales barns.

The fact remains that little is known regarding the virus of hog cholera and it
must be the object of intensive research. It is reasonable to conjecture that the failures in the simultaneous method of immunization are based upon the same unknowns that characterize the failures in the recently introduced methods.

**ANTIBIOTICS AND FERMENTATION RESIDUES**

In the 1950 report of this Committee attention was called to the unsatisfactory situation that prevailed with reference to a product then labelled APF. The Committee pointed out the necessity of specifying on the label the actual quantities of the specific antibiotic, B₁₂ and other factors contained in the product. It is encouraging to report that during the past year the feed industry and others concerned have faced this situation realistically by abolishing the term APF and designating the amounts of antibiotic and B₁₂ in products derived from residues of antibiotic fermentation.

While these products have merit in some herds or flocks and in certain feeding programs in the young animal, they should not be used promiscuously with the expectation that their use will permit discarding the basic principles of sanitation, sound nutrition and management. Competent investigators in this field urge caution in the wide scale use of antibiotics on nutritional grounds. Some researchers have shown that when healthy swine are fed good rations, the addition of antibiotics to the feed does not result in increased gains or improved feed efficiency. Excessively rapid gains are not always associated with normal body constitution.

**CONTROL OF NOSTRUMS AND MISBRANDING OF MEDICINAL AGENTS**

Relatively few people fully appreciate the work of the Food and Drug Administration in protecting the livestock owner from exploitations by vendors of nostrums and agents for which extravagant claims are made. More than 16 violations in the veterinary field were prosecuted by the Department during the past fiscal year.

Recent developments have given us agents that are of some value in the control of enteritis, rendering obsolete products containing sodium hydroxide or other alkaline agents to which are added small amounts of aromatics or potent drugs in quantities insufficient for therapeutic action. When veterinarians continue to dispense materials of this kind even at the request of the client, often this is used as a defense by the nostrum vendor when prosecution is attempted. It is believed that this situation now is greatly improved but will bear watching with changes in the economic situation.

However, at the present time, a new problem has developed which involves the sale of trace mineral mixtures which are purported to prevent and treat mastitis and brucellosis of cattle and other diseases of swine and cattle. While such claims are made upon promotional grounds without factual basis, actions against the interstate shipment of material so misbranded is difficult to stop even in the face of the prevailing unfavorable opinion of investigators dealing with these and other diseases. Definitely controlled experiments are needed as evidence to halt this new development in the field of nostrum vending. Therefore, it is urged that the workers who have experimental data and who have reported it informally at various con-
ferences record their findings in the literature to support the efforts of our control and regulatory officials.

Avian Infectious Bronchitis Immunization

The absence of a safe immunizing product for infectious bronchitis has created a serious problem in the poultry disease situation and in the field of sanitation and disease control. In an attempt to avoid the serious effects of infectious bronchitis in the laying flock some owners have urged and even demanded the use of live virulent virus on young birds in the hope that the damage caused by the virus would be less serious at an early age and produce protection for the birds in later life. In some cases where this was tried it caused losses up to 15 per cent among young birds and the infection spread to the adult birds, whereas in other cases favorable results are claimed. Legal implications sometimes arise when the disease appears in a neighboring flock. In order to bring this up for discussion the Committee has arranged for a paper on this subject, the title of which was not available until after the program was issued.
REPORT OF THE COMMITTEE ON PUBLIC RELATIONS


This Committee does not think it achieved enough to justify a formal report. Instead, I shall employ this opportunity to make a few general remarks on the problems of the Committee on Public Relations of this Association that may possibly be of benefit to future committees.

Under present conditions your Committee is stymied at the start. Our meetings are usually held in large cities, where the readers of the local press are overwhelmingly metropolitan dwellers. Only a small percentage of any of our programs is of the slightest interest to this class of readers. (Note, I said "interest" not "importance"). Hence, whenever the papers are briefed in popular style, metropolitan newspapers find our releases of little interest. No doubt one factor in this is the quality of the briefing, but the Committee is handicapped here. Few copies of the papers which will be presented on our programs are received by the Secretary more than 10 days before the meeting, despite his earnest pleas for copies much earlier. Worse still, one-half of our papers are not sent to him in advance at all, but first show up when the authors bring them to our meetings. It takes considerable time and a great deal of work to brief scientific papers. Even with those received by the Secretary a few days before the meeting the Committee can do little and, of course, it can do almost nothing with those not received until the meeting begins.

This meeting and the recent meetings in Phoenix, Columbus and Denver have been well treated from a news point of view by the local press. A story about the meeting was carried each day by the Star and Times and I am informed The Stockyards Journal will have quite a lengthy story on the meeting. But, these stories, and they are good ones, are by reporters assigned to the meeting by these publications. The Committee on Public Relations did not get them published.

The point I am leading up to is this—news stories about our meetings will be published whether or not we have a Public Relations Committee and little other than news items will be used by the local daily press or the wire services regardless of how hard the Committee works or how efficient it may be.

I think this is as it should be. The daily press is not the medium through which this Association should attempt to conduct a public educational program. Our work and the research which is reported at our meetings is of primary interest to and adapted to the understanding of just two groups of the public, livestock raisers and the veterinary profession. The media through which they can be reached are the agricultural press, particularly the livestock press and the veterinary press.

Your Committee has invited editors of the leading livestock journals to attend this meeting and a number of them are here. The veterinary editors being members of the Association of course attend all of our meetings.
Now that they are here, what do we tell them? "We are glad you are here, but none of our papers will be released for publication until they appear in our annual report. You are at liberty to abstract them or publish articles of your own based upon them, but we haven't any copies to give you for that purpose."

The situation is absurd and will so remain as long as the Association elects to hide its light, not under a bushel, but in an annual report. Our annual reports reach but a small circle beyond our membership. Experience has shown that neither the veterinary press nor the farm press will publish these papers and reports after they appear in the annual report, which is several months after the meeting at which they are presented. Fewer than 10 per cent of them will be abstracted after the lapse of that period.

It is my belief if these papers and committee reports were released for publication when presented, that by judicious allotment the Committee on Public Relations could obtain immediate publication of one-half of them or more in the veterinary press thus giving them a circulation among 10,000 to 15,000 veterinarians, the men in the final analysis who must do the job of disease control and eradication. Do you want to keep the veterinary profession of this country informed as to your plans for disease control and eradication and as to the problem and research pertaining thereto?

The editors of agricultural publications have told me that our programs are a source of a great deal of material of interest and educational value to their readers and that if they could be supplied with copies of our papers and committee reports at the meeting or in advance of it, such material could and would be used as a basis or background for stories and editorials for many issues, thus placing it before millions of livestock owners whose informed cooperation is essential to success in disease control and eradication.

The whole matter seems to me to resolve itself into the question as to whether this Association does or does not want to promote educational programs in confirmation with its programs for disease control and eradication.

Mr. President, I move that this report be received and referred to the Executive Committee and since under present custom a Committee on Public Relations is a wholly futile committee that it be discontinued until such time as the rules are changed to permit it to function.
Anaplasmosis, originally confined within the area formerly infested by the Texas fever tick, *Margaropus annulatus*, has since spread to other states. It is not uniformly prevalent over the whole of these states but rather occurs in certain districts. It seems that these districts are gradually becoming larger and increasing in number, even within the original tick-infested area as carrier animals are being carried from place to place and find vectors at hand in the new area to spread the disease. Since the mortality frequently runs as high as 80 per cent, it is readily understandable that the livestock owner has a vital interest in finding an effective treatment for the disease. Likewise the manufacturer of an effective therapeutic agent would have an interest in the problem. According to available information there is no effective therapeutic agent known at this time, but the search for one is continuing daily.

The evaluation of a therapeutic agent against anaplasmosis must be based upon certain criteria which can best be understood by a study of the behavior of the disease, especially the relation of the clinical behavior of the disease to the appearance and number of anaplasma bodies and the degree of blood destruction. In the field when transmitted by vectors other than man, the disease occurs in either a single animal in a herd or in two or more animals within a comparatively short time, usually within a week or ten days. Usually only animals two years of age or older are affected. It is evident from field observation that such an outbreak of the disease must take its origin from a carrier animal in the herd or in a neighboring herd. Now it often happens that some 25 to 35 days following such an outbreak another outbreak occurs which may involve even a larger number of animals than the original one. This, however, depends upon the number of susceptible animals in the herd and the vector population. This second occurrence, because of the length of the period of incubation and the larger number of animals often involved, has been interpreted as proof that the disease was transmitted from the acute case or cases of the first outbreak, and that anaplasmosis is more readily transmitted by vectors from acute cases than from carrier animals.

The amount of blood of a carrier animal that must be inoculated into a susceptible animal by the bite of the vector to produce an acute case of anaplasmosis is, at most, so small that it probably involves not more than a few hundred red blood cells. It is in the field under natural conditions that one will be called upon to combat the disease and therefore experimental cases for the evaluation of therapeutic agents should be produced with a highly virulent strain under as near natural conditions as possible, especially as regards the age of the animal, the season of the year and the quantity of the inoculum used. Thus the writer has found in the course of immunization of hundreds of young cattle against piroplasmosis and anaplasmosis that in animals less than one year old the death rate is practically nil; in
cattle, 15 months of age the mortality approaches 2 per cent and comparatively few cases in the higher brackets of this age limit require symptomatic treatment (1, 2). In still older animals, this mortality increases rapidly with advancing age as will be seen below.

It is the disease in these older animals that the veterinarian will be called upon to combat, and it is for this type of animal that we must develop a therapeutic agent. Furthermore, the disease with few exceptions occurs during the hot summer days which is an added burden to the already fevering body and tends to increase mortality. An exception as referred to occurred on a ranch in the Edwards Plateau area of Texas on which the author diagnosed anaplasmosis clinically, at autopsy, microscopically and by blood inoculation in late January and early February in two consecutive years. *Dermacentor albipictus*, a tick which has been shown capable of transmitting anaplasmosis, were quite prevalent on this ranch and some were on the animals involved.

The period of incubation, that period elapsing between the time of inoculation or infection of the animal and time of the first detectable response of the host, that is a rise in body temperature, cannot be accurately established in field cases. In experimental inoculation of the animal with virulent blood, however, this period of incubation can be determined definitely by the daily use of the clinical thermometer except in exceptional cases. Two such exceptional cases have been recently observed by the writers in which two Jersey cows showed no rise in body temperature while a daily examination of the blood revealed a typical daily increase in the number of red cells showing anaplasma bodies, in one to 20 per cent and in the other to 35 per cent. In the former cow, the hematocrit value dropped to 14, and in the latter to 8 before death. Neither cow went off feed. At necropsy, changes typical for anaplasmosis were found.

Lotze (3) has published some data on variables and constants in experimental bovine anaplasmosis which, according to his viewpoint, may be used as criteria in the evaluation of therapeutic agents against the disease. In his data he shows that massive doses of virulent blood greatly shortened or even eliminated the period of incubation and that the severity of the resulting infection tended to be somewhat in keeping with the quantity of infected blood used. In the field such massive doses do not come in question, hence with these points in mind the writer checked his own data accumulated over many years on a large number of animals to determine whether the quantity of inoculum used in his own tests in the evaluation of therapeutic agents had any influence upon the outcome of the test.

Only a few groups of animals will be presented here. The animals in each group are comparable first, from the standpoint of age and breed (beef) and because the members of each group were raised together. Table 1 shows two groups of animals, each inoculated with one milliliter of blood from the same donor and Table 2 shows two groups similarly inoculated from a different donor. Both donors were, however, harboring the Texas fever tick, *Margaropus annulatus*, and were running in the same pasture. It is noted that there is practically no difference in the period of incubation as defined above nor in the length of the fever period even though in one group the animals are two years of age. None of the animals died. Table 3 shows three groups of animals inoculated from a third donor, not harboring ticks, and
obtained far removed from the first two donors, but this time 2 ml. of blood were injected. In these three groups the period of incubation is slightly more variable but is still around 30 days or above on the average while the duration of the fever period is slightly shorter but not significantly so. All of the above cattle were in-

**Table 1**

*Period of Incubation and Duration of Fever Period of Anaplasmosis in Two Groups of Young Cattle When Inoculated with 1 ml. of Blood from a Carrier Animal. Source of Blood: Jersey Steer Harboring *Margaropus annulatus*

<table>
<thead>
<tr>
<th>NO. OF ANIMALS IN GROUP</th>
<th>AGE (MO.)</th>
<th>PERIOD OF INCUBATION (DAYS)</th>
<th>AVERAGE (DAYS)</th>
<th>DURATION OF FEVER PERIOD (DAYS)</th>
<th>AVERAGE (DAYS)</th>
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<td>8</td>
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<td>27-35</td>
<td>32</td>
<td>6-13</td>
<td>9</td>
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<tr>
<td>7</td>
<td>12</td>
<td>28-33</td>
<td>30.6</td>
<td>6-10</td>
<td>9</td>
</tr>
</tbody>
</table>

**Table 2**

*Period of Incubation and Duration of Fever Period of Anaplasmosis in Two Groups of Young Cattle When Inoculated with 1 ml. of Blood from a Carrier Animal. Source of Blood: Boyett Cow Harboring *Margaropus annulatus*

<table>
<thead>
<tr>
<th>NO. OF ANIMALS IN GROUP</th>
<th>AGE (MO.)</th>
<th>PERIOD OF INCUBATION (DAYS)</th>
<th>AVERAGE (DAYS)</th>
<th>DURATION OF FEVER PERIOD (DAYS)</th>
<th>AVERAGE (DAYS)</th>
</tr>
</thead>
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<td>12</td>
<td>28-34</td>
<td>31</td>
<td>6-14</td>
<td>10</td>
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<tr>
<td>10</td>
<td>12</td>
<td>27-35</td>
<td>31.3</td>
<td>4-15</td>
<td>9</td>
</tr>
</tbody>
</table>

**Table 3**

*Period of Incubation and Duration of Fever Period of Anaplasmosis in Three Groups of Young Cattle When Inoculated with 2 ml. of Blood from a Carrier Animal. Source of Blood: Cow 114, Raised in Tick-free Area but Inoculated with Blood from Cow Freed of *Margaropus annulatus* 12 Months Before Blood was Drawn*

<table>
<thead>
<tr>
<th>NO. OF ANIMALS IN GROUP</th>
<th>AGE (MO.)</th>
<th>PERIOD OF INCUBATION (DAYS)</th>
<th>AVERAGE (DAYS)</th>
<th>DURATION OF FEVER PERIOD (DAYS)</th>
<th>AVERAGE (DAYS)</th>
</tr>
</thead>
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<td>29.4</td>
<td>4-11</td>
<td>7.4</td>
</tr>
<tr>
<td>29</td>
<td>18-24</td>
<td>31-42</td>
<td>37.5</td>
<td>2-18</td>
<td>7.1</td>
</tr>
<tr>
<td>17</td>
<td>21-24</td>
<td>29-39</td>
<td>33.6</td>
<td>4-14</td>
<td>8.5</td>
</tr>
</tbody>
</table>

oculated in the winter or early spring. Since all of the above animals were undergoing premunization at the Texas Experiment Station for private owners, hematocrit readings were not taken. A difference attributable to the donor or amount of inoculum or strain of infection cannot be detected in these groups. Yet, on the basis of field observations it is generally believed, and it is so expressed by Lotze (loc. cit.), that there is a difference in the virulence of strains of *Anaplasma marginale*. 
An opportunity again to observe such a difference was afforded the authors several years ago while evaluating a certain drug. The Jersey cows used in this experiment were comparable as to age and condition. In the course of the experiment, 11 such cows were inoculated and all were treated alike. Two donors were available for the inoculation, one a local animal, known to us as Brindy strain, and the other from the Gulf Coast and known to us as Hughes strain. At the conclusion of these tests, when the experimental animals were arranged according to donors, it was found that four had been inoculated from the local donor and seven from the Gulf Coast donor. It was also found that one of the four animals inoculated from the local donor died while six of the seven inoculated from the other donor died. This clearly points up the need of using a tested strain of high virulence for evaluating any therapeutic agent. Had only the local strain been used, the agent would have been found to have a high therapeutic value, but in the light of the results obtained with the Hughes strain, it was shown to be worthless.

Table 4 gives some additional data on the behavior of the disease in Jersey cows when inoculated with 5 ml. of blood containing the Hughes strain. The cases listed in the table were all comparable as to age and condition and were chosen from a larger number of trials solely for the reason that the data to be presented were more complete for these individuals. Most of them, but not all, were treated at the height of the disease with one drug or another, none of which seemed to have any influence upon the course of the disease. The animals have been arranged first according to survival or death of the animal, and second, according to the lowest hematocrit value observed. In the case of those animals which died, the final determination of the hematocrit value varied from a few hours to probably 18 hours before death. The period of incubation was figured to the first day of fever in which 102.6°F. was considered as the lowest degree of fever, provided it was followed on the next day or on the day after that, by a higher rise in body temperature. It will be noted that the period of incubation is somewhat shorter in some of the Jersey cows than in the group of younger animals of the beef breed shown above which may be partly due to the larger dose of inoculum or to the greater virulence of the strain or perhaps to a reduced resistance of older animals, or difference in breed. Thus far only one comparable animal (Jersey cow) has been inoculated with 3 ml. of this strain in a comparative test to determine whether this quantity of inoculum with this particular strain produces a different clinical outcome than did the 5 ml. dose. No significant difference in the outcome was noted in this instance. The dose of 5 ml. having once been chosen to make certain that the inoculation would be effective in each case, was used in all other animals in the tests under consideration here. In the writers' experience 1 ml. of blood from a carrier animal injected subcutaneously has been ample to transmit the disease to susceptible bovines.

It is self-evident, except in very exceptional cases, that the first clinical symptom observable by the alert owner would be a loss of appetite and the resultant shrinkage of the animal. It is, therefore, of the greatest importance to know the stage of the disease and the condition of the animal at this point because that is the time when the therapist first enters the picture. It is the earliest time at which any therapeutic agent would be used. In our case the therapist could only have saved those animals that died, for those that recovered did not need his help. Let us more closely
Data not recorded for this cow.
† This cow did not go off feed.
‡ R: recovered.
§ Anaplasma bodies were found on only the first day of a 7-day period immediately preceding death. They were again found in the spleen following autopsy. On the remaining days only very small suspicious-looking bodies could be found.
examine, therefore, those animals that died as listed in Table 4 to get an idea how quickly the therapeutic agent must act in order to save the cow when it is administered with due haste once the disease becomes clinically manifest.

In these considerations it is assumed that the alert owner saw the cow every day and determined that something was wrong with the cow on the first day she showed grossly recognizable symptoms, which would be the day the cow went off feed and looked gaunt to him; or perhaps she was standing apart from the herd with her head lowered and ears hanging down or in driving her with the herd she was hanging back a little and tired easily or she looked a little icteric or was breathing a little fast. All of these symptoms are only recognizable when the disease has reached that stage where the cow loses her appetite. By this time, many things have happened to the sick animal. Prior to this time the animal has been fevering but even the keenest observer would not be able to tell this without the use of a clinical thermometer except perhaps in dairy cows in production. The table shows that, in the animals here under consideration, this fever lasted for one to four days with an average of only 2.38 days, which was one day less than in those animals that recovered. It also shows that in seven of the 16 animals for which this observation is recorded the fever had subsided at the time the animal went off feed. Indeed, the body temperature may even be approaching subnormal, for a subnormal body temperature was recorded in our experiments in 11 out of 21 comparable animals before death from anaplasmosis. A subnormal temperature following the fever period was recorded in only one out of 11 comparable animals in the group (Jersey cows) that recovered. Our records show that in 25 animals of beef breeds between 12 and 16 months of age which died from anaplasmosis following artificial inoculation, the body temperature shortly before death was subnormal in only one case, had returned to normal in ten cases while 14 died while they were still fevering. This is in sharp contrast to the results obtained in the above mature Jersey cows which had all returned to normal or subnormal before death occurred.

It will be noted that the period of incubation ranges from 15 to 36 days with an average of 26 days. In the majority of these animals this period averages 2.8 days longer than this average. In the latter cases it is near but still slightly shorter than the period of incubation observed in the younger beef animals of Tables 1, 2, and 3. The greatest difference in the clinical manifestations of the disease between young animals of the beef breeds and mature Jersey cows lies in the duration of the fever period. In the young beef animals this period ranged from two to eighteen days with an average of all the comparable groups ranging from seven to ten days while in the Jersey cows this period ranged from one to five days with an average of 3.37 days for the cows that recovered and from one to four days with an average of 2.38 days for the cows that died. In the Jersey cows a similar relationship exists in the time between the first day of fever and the time the lowest hematocrit value occurred. This time varied from one to six days with an average of 3.37 days for the cows that recovered and from none to five days with an average of 2.7 days for the cows that died.

Another important factor in the progress of the disease is the percentage of red blood cells infected by *A. marginale*. In the cows that recovered these bodies appeared in the red blood cell from three to seven days before the first day of fever,
while in those that died it varied from zero to eight days. In the beginning, only a few infected cells will be found which increase from day to day until the peak is reached. Here it may remain for a few days with little variation after which it drops off rapidly in case the animal recovers. The presence of the anaplasma bodies, of course, means a destruction of the red blood cells and thus, as the number of infected cells increases, the ascending curve of infected red blood cells approaches and often finally crosses the continuously descending curve of the hematocrit value. In the cows that died, the rapidly descending curve of the hematocrit value showed a uniform pattern; however, the descending portion, unfortunately for the patient, either was incomplete or did not develop.

This relationship can best be seen from Table 5 or Graph 1. In this table the course of the disease is divided into the period of fever and the period of anorexia as observed in the cows that died. These two periods, with few exceptions, are present in every case of anaplasmosis. The fact that in the field the fever period is not ascertained as such makes this statement no less true. It is not intended to convey the idea that the period of fever and the period of anorexia are two distinct periods as to time. While this is true in some cases, in others they run concurrently or overlap partly. Table 4 shows that in 50 per cent of the cows that died and for which this information is recorded, the period of anorexia began on the day the body temperature had returned to normal or later. In these cases the period of anorexia truly followed the period of fever. The period of anorexia as revealed in this table shows that the crisis is already at hand and illustrates the difficulty faced by the therapist when trying to save such an animal and the quick-acting qualities and high effectiveness required on the therapeutic agent.

This table reveals that, with one exception and possibly two, from 50 to 88 per cent of the red blood cells had already been destroyed on the day the owner could have recognized the first signs of illness in the animal. It also shows that the animal survived thereafter for one to four days or an average of only 2.42 days. This can only mean that for any therapeutic agent to be successful in the treatment of anaplasmosis it must be quick-acting and produce a high percentage of kill of the parasite within a very short time. This action would be reflected by an immediate and measurable cessation of the destruction of the red blood cells following its administration and a sharp reduction in the percentage of red blood cells still parasitized. If these two criteria are not fulfilled, the therapeutic agent used is of little if any value in the treatment of anaplasmosis. Therapeutic agents with such qualities have been found against malaria in man and piroplasmosis in animals and thus encourage us to continue the search for one against anaplasmosis.

To guard against the possibility of a disease-producing agent other than A. marginale clouding the picture in our case, a constant watch was kept for such during the many microscopical blood examinations but none was ever observed. Furthermore, the blood of the donor animal (Hughes strain) was filtered through a Seitz filter and inoculated into a susceptible cow with negative results. It may be mentioned in passing that this latter test was undertaken because of the difficulty frequently experienced in finding anaplasmata in the blood even during the fever period. In such cases these were either absent or appeared as tiny specks near the margin of the erythrocytes, and were then recorded as suspicious-looking bodies
EXPERIMENTAL BOVINE ANAPLASMOSIS 267

(note cow 162). Since the same batch of Giemsa stain of German manufacture was used throughout, and since this same batch of stain, both before and after, has shown excellent staining qualities and since the regular staining procedure was

always rigidly adhered to, and since this observation has been made with other batches of Giemsa stain, we have no reason to believe that our observations were not correct. This often leaves one in doubt as to the actual percentage of erythrocytes infected.

It was with this background that a number of chemotherapeutic agents were tested on anaplasmosis, one of which, Trifloryl, is presented herewith.

**Table 5**

Clinical and Hematological Data of Jersey Cows That Died from Anaplasmosis Following Artificial Inoculation with Hughes Strain of Anaplasma marginale

<table>
<thead>
<tr>
<th>ANIMAL NO.</th>
<th>DURATION (DAYS)</th>
<th>PERIOD OF FEVER</th>
<th>PERIOD OF ANOREXIA</th>
<th>SURVIVAL AFTER LOSS OF APPETITE (DAYS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hematocrit Value</td>
<td>Percentage of Infected RBC</td>
<td>Percentage of RBC</td>
<td>Hematocrit Value</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>First day of period</td>
<td>First day of period</td>
<td>Highest</td>
</tr>
<tr>
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<td>25</td>
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</tr>
<tr>
<td>4837</td>
<td>1</td>
<td>—</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>169</td>
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<td>28</td>
<td>18</td>
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* Anaplasma bodies were found on only the first day of a 7-day period immediately preceding death. They were again found in the spleen following autopsy. On the remaining days only very small suspicious-looking bodies could be found.
Trifloryl\(^1\) is the chemical \(4'(4\text{-diethylamino}-1\text{-methylbutylamino})-7\text{-trifluoromethylquinoline}\) with the following structural formula:

\[
\begin{align*}
\text{NH} & \quad \text{CH} & \quad \text{CH}_2\text{CH}_2\text{CH}_3\text{N} (\text{C}_2\text{H}_5)_2 \\
\text{F}_2\text{C} & \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 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hematocrit value recorded during the critical period of the disease. The lower row of curves is that of the control animals with the corresponding treated animals above. Nine of the ten animals treated with Trifloryl and three of the five controls died.

An analysis of the data shows that of the 13 animals which died, one showed no fever at all when 102.4°F is considered the maximum normal morning temperature of a cow; two died during the fever period; seven died after the temperature had returned to normal, considering 100°F the lowest normal morning temperature of a cow, and two died while the temperature was below normal. It will also be noted that of the animals that died besides the animal showing no fever, two fevered for one day, four fevered for two days, four fevered for three days, and two fevered for four days, one of these irregularly. Of the three cows that recovered, one fevered for three, one for four, and one for six days.

In the attempted therapeutic treatment of any disease, the survival period of
the untreated animal after symptoms become manifest is of utmost importance to the effectiveness of the treatment. The shorter this survival period, the more effective the therapeutic agent must be. In the case of anaplasmosis we must depend upon clinical symptoms other than fever for the recognition of the disease in the field. Of the recognizable symptoms, loss of appetite is the first to become manifest, followed by weakness. In the case of range cattle which are not under daily observation the loss of appetite may be overlooked for the time being and the presence of the disease is then not recognized until weakness of the animal is observed. This is truly the advanced stage of the disease, and a therapeutic agent to be effective or to have time to act must be quickly administered. It is of interest, therefore, to check our cases on this point. The record shows that time elapsed between the appearance of the first visibly recognizable symptom, namely loss of appetite, and death was in one case less than one day; in five cases, one day; in four cases, two days; in one case, three days; and in two cases more than three days. Thus the average time was less than two days, a time almost too short for any therapeutic agent to save the animal. It is of interest to note that in eight treated animals and four controls that were checked on the percentage of red cells already destroyed at the time that loss of appetite was observed, the following figures were obtained:

Treated animals: 48.5, 60, 64.5, 65.6, 70, 74, 80 (this animal recovered) and 87 per cent.

Controls: 36.4 (recovered), 40 (recovered), 69.5, and 73 per cent.

These figures highlight the urgent need for a therapeutic agent that shows immediate strong therapeutic action.

There is no indication in these data that the administration of Trifloryl in doses as high as 10 gm. per day per cow had any influence upon either the course of the fever or the percentage of red blood cells showing anaplasma bodies, nor did it halt the destruction of the red blood cells or reduce the mortality.

REFERENCES

REPORT OF THE ADVISORY COMMITTEE ON ANAPLASMOSIS

H. SCHMIDT, College Station, Texas, Chairman; R. S. Sugg, Auburn, Alabama; D. H. Ricks, Oklahoma City, Oklahoma; V. D. Chadwick, Jackson, Mississippi; D. A. Sanders, Gainsville, Florida; Ray W. Willoughby, San Angelo, Texas; L. T. Giltner, Washington, D. C.; Loren C. Bamert, Ione, California; Dorman Turner, Burns, Oregon

In areas where anaplasmosis is present, it ranks at the top of the list of animal diseases in concern it gives the stockmen, especially because of its insidious character and high mortality. From Mississippi and Oregon come reports of its spread to new areas. In these new areas it is especially dangerous because the livestock owners are not acquainted with the disease and hence do not recognize it and do not know its insidious character. A campaign of educational lectures by qualified persons would be helpful in such areas.

The key to the problem of the control and eventual complete elimination of anaplasmosis from our herds still is the carrier animal. The detection of all carrier animals still is awaiting a simple, reliable test, easily applicable. It must, either alone or in conjunction with some other test or tests, also easily applicable, detect every carrier in the herd, for to leave only a single carrier invites disaster in the future. Some laudable progress has been made in the development of the complement fixation test, but at present it still leaves too many carriers undetected. More work on it is needed and more information on its shortcomings should be made available. If a plan of eventual complete eradication of the disease is to succeed, such a test must be found. In the meantime, livestock owners in areas where the disease is prevalent are either taking their annual losses or are resorting to premunition.

Prior committees have already pointed out that the research workers in animal diseases at the experiment stations of the southern states where the disease is more prevalent, set up an ambitious program for the study of this disease on a regional basis. Anticipated funds were to come from federal funds assigned to state experiment stations for research, but thus far no appropriations have been made. This seriously impedes progress of the work in such states because other available funds are barely large enough to keep interest in the problem alive. More rapid progress is not anticipated until larger funds are made available, either through appropriation of public funds, which may not come about until the livestock industry demands it, or through grants-in-aid by other interested industries.

In the meantime, the search for an effective therapeutic agent against the disease in the acute form and during the carrier state continues. Thus far none has been found that will withstand a critical test. At least one therapeutic agent reported in the literature as giving favorable results has been tested by your chairman (unpublished) and found completely worthless. He has also found at least one practicing veterinarian who tried this drug on cases of anaplasmosis in the field and had to abandon it because too many animals treated with it died nevertheless. Progress in this phase of the problem depends more upon the chemist than the research veterinarian. The chemist must first make the new compound available.
before the veterinarian can test it on the cow. It is evident that the manufacturing chemist has as large an interest in the problem as the veterinarian and the unfortunate owner of the cow suffering from anaplasmosis, and it is to him that the research worker is looking for the real solution of this phase of the problem. In the meantime more reports are coming in that a large blood transfusion in acute cases is the best therapeutic measure available at this time.

The manufacturing chemist also has a large stake in the other remaining phase of the problem, that of the control of the fly and mosquito vectors. No satisfactory toxicant is now known that will control these elusive vectors, but the hope is that among the many new toxicants now being developed one effective against these vectors, especially against the viscerously biting horseflies, may be found at any time.

It is the consensus of your Committee that research on this problem as already outlined and partly in progress must continue and that steps should be taken to increase the interest of the manufacturing chemist as well as the livestock industry in this problem.
Tuberculin was discovered by Robert Koch in 1891 (41) as a result of his injecting dead tubercle bacilli into healthy and tuberculous animals. The dead bacilli had no effect on healthy animals but were toxic to tuberculous animals. Koch found that the toxic material was present in extracts prepared by growing bacteria on a glycerinated, peptonized beef infusion medium, evaporating the culture to 1/10 of its original volume and filtering out the bacteria. The extract or filtrate was known as Old Tuberculin, or tuberculine brute de Koch. The method first devised by Koch is essentially the method still used to produce Koch's Old Tuberculin (6).

Although tuberculin was first used and is still used to a limited extent in the treatment of tuberculosis, its greatest value, due to its ability to cause characteristic reactions in a tuberculous but not in a healthy animal, has been as a diagnostic agent. It was first used for that purpose in 1890 by von Bergman (7), who even before Koch's paper was published, used it as a diagnostic agent in the case of a tumor of the cheek of a man. Its usefulness for testing cattle was immediately recognized by veterinarians throughout the world and as early as March 31, 1892, a herd was tested in the United States. The first herd tested belonged to Dr. J. E. Gillingham, Villanova, Pennsylvania, and the test was made by Dr. Leonard Pearson, State Veterinarian of Pennsylvania with tuberculin he had brought from Europe (24).

Preliminary tests with tuberculin were begun in the Bureau of Animal Industry in 1892, and in the same year the Bureau announced (48) that it was prepared to furnish tuberculin for the diagnosis of tuberculosis. The tuberculin was at first furnished to federal and state veterinarians, but later it was also furnished without charge to other state, county, and municipal officials on the condition that the Bureau be supplied with records of all tests and of all autopsies, and under the further condition that the tests be supervised by competent veterinarians (25). The demand steadily increased until in the twelve months ending June 30, 1906, 103,510 doses were prepared and distributed (50).

As soon as the preparation of tuberculin was begun by the Bureau, chemical studies were begun of it and also of the tubercle bacillus. A series of papers resulted. One of the papers (14) called attention to the large amount of fat or wax in tubercle bacilli. In a later paper (15), several fatty acids were identified and there was also found an acid of higher carbon content than ever before reported in plants. A third paper (16) contained the first reported analysis of the ash of tubercle bacilli. The observation that the ash contained a high percentage of phosphoric acid led to a modification of the medium used in the Bureau to produce tuberculin. Potassium phosphate was substituted in place of the sodium chloride of Koch's original medium.
Although not directly connected with the preparation and use of tuberculin, the discovery in 1895 by Theobald Smith (49) that there are two different types of tubercle bacilli, human and bovine, affecting animals was of the greatest importance to man and to the livestock industry. His discovery was first confirmed by Ravenel (47) of the University of Pennsylvania who reported that the bovine type was more virulent than the human for all species of animals, except possibly swine.

When Koch questioned the possibility of the bovine type affecting human beings, a number of investigations regarding the virulence of the different types were carried out in the Bureau by de Schweinitz, Dorset, Schroeder, Cotton, Mohler, Washburn, and McBryde (11, 12, 13, 17, 45, 18, 44). According to Salmon, who was then the Chief of the Bureau, the most important result of these investigations was the finding that some tubercle bacilli isolated from humans could produce tuberculosis in cattle and the further demonstration that virulent bacilli isolated from children possessed the morphological and cultural characteristics of the bovine bacillus. The work, therefore, demonstrated according to Salmon, that Koch was mistaken when he claimed that "human tuberculosis is different from bovine and cannot be transmitted to cattle" and further suggested that children could be infected from cows' milk (58).

The studies also resulted in the development of a new solid medium (19) using whole eggs, which greatly facilitated isolation of tubercle bacilli. This medium either unmodified or modified in various ways, is still used to isolate tubercle bacilli from sputum and infected tissue and has been of great aid in the diagnosis of tuberculosis. Incidentally, the development of this medium was an outcome of the assignment of Dorset to a local hospital for the purpose of isolating and typing tubercle bacilli from tuberculous patients. Another result of that work was the isolation of three strains, now known as PN, C, and DT, of tubercle bacilli, which proved to be particularly useful for the production of tuberculin. These strains were isolated from tuberculous children. They possess the characteristics of the human type of the tubercle bacilli and have been used by the Bureau since before 1904 to produce tuberculin for cattle testing. Transplants have been sent to laboratories in all sections of the world.

The generally favorable reports following the use of tuberculin supplied by the Bureau led not only to a greater appreciation of tuberculin as a diagnostic agent, but of more importance, revealed the alarming extent to which cattle were infected. Thus, Russell (57) reported that of 853 cattle, contained in 70 herds which were tested in 1903 and 1904, 50 per cent were infected with tuberculosis. Infections ranging from 50 to 100 per cent were reported in herds in many other states (26).

Following these reports, the Bureau began in 1906 to test herds with tuberculin in an attempt to free them from the disease. Results, particularly in the District of Columbia, indicated that by the use of tuberculin, eradication could be accomplished. Thus, in 1910, of 1701 cattle tested in the District, 18.87 per cent reacted, but by 1917 this figure had been reduced to 0.84 per cent of 1060 cattle tested (27).

The testing in the District was carried out first by the Pathological Division and later by the Quarantine Division and results of autopsies strikingly confirmed the results of the tuberculin tests.

In this connection, it should be mentioned that a form of agreement for use in tuberculin testing was drawn up in 1908, (51) and on April 27, 1908, the herd of
Ford and Graham, Garrett Park, Maryland, was tested under this agreement. The owners received from the chief of the Bureau a certificate stating that the entire herd had been tested by a Bureau Inspector and that the 82 cattle tested were free of tuberculosis and were tagged U.S.BAI-1403-1487, inclusive (28).

The agreement under which this herd was tested provided for identification of animals tested, identification and slaughter of reactors and cleaning and disinfecting of premises. The Ford and Graham herd was, therefore, the first in the United States to be accredited under a definite plan. However, the first herd accredited under the current plan, "Uniform Methods and Rules for Tuberculosis-Free Accredited Herds," approved December 23, 1917, was the United States Soldiers' Home Herd, Washington, D. C. That herd received Certificate No. 1 on February 6, 1918 (29). Only within the past year has that herd been dispersed.

The success of the tests with tuberculin in the District of Columbia and contiguous areas provided convincing evidence that tuberculosis could be eradicated from a particular area or herd. Based on this conviction, a campaign to eradicate tuberculosis was planned and in 1917 money was obtained from Congress to inaugurate the campaign. The Tuberculosis Eradication Division was formed to direct that campaign.

At the time the Tuberculosis Eradication Division was formed, the only official test was the subcutaneous tuberculin test. This test was time consuming and, therefore, greatly limited the amount of testing that could be done. Experiments with other methods of testing carried out over a period of two and one-half years (30), demonstrated the reliability of the intradermic test. Good results were also obtained with the ophthalmic test. On March 1, 1920, the intradermic test was recognized by the Bureau (52), and on December 3, 1920, the United States Livestock Sanitary Association (46), ruled that a herd to be accredited must pass a combination of two of the three tests (subcutaneous, intradermal, or ophthalmic). For use in the ophthalmic tests, a method of producing tuberculin in the form of discs was developed by the Bureau (53).

The Bureau, therefore, began to supply the three forms of tuberculin, production increasing to the point where in 1929, 412,680 cc. of subcutaneous tuberculin, 2,018,595 cc. of intradermic tuberculin, and 2,797,035 ophthalmic discs were supplied to federal and state inspectors (54). By that time the dependability of the intradermic method of testing had been generally recognized. As a consequence, the use of the subcutaneous and ophthalmic tuberculin gradually decreased and in 1936, the distribution of subcutaneous tuberculin and ophthalmic tuberculin was discontinued (55). In that year, 3,135,400 cc. of intradermal mammalian tuberculin and 8,280 cc. of avian intradermal tuberculin were shipped to the various states by the Bureau. For some years past, annual production has been about 1,000,000 cc. or enough to test about 10,000,000 cattle.

Shortly after the plan to eradicate tuberculosis was inaugurated, efforts to improve tuberculin were intensified. The work had as its chief objective the development of more potent and more specific tuberculins. Investigations involved biochemical studies of tubercle bacilli, of tuberculin, and of the culture media used to produce tuberculin. The investigations resulted in a number of contributions to the knowledge of the tubercle bacillus and of its product, tuberculin. These included: 1. the finding that the reaction curves of tubercle bacilli which had been considered
characteristic of different types of mammalian tubercle bacilli were dependent upon the rate of growth of tubercle bacilli or the speed at which changes were brought about in the culture medium and upon the type only insofar as different types tended to grow at different rates (32); 2. the identification of two active principles in tuberculin, one responsible for producing the skin reaction, the other responsible for the systemic or lethal effect (23, 35); the finding that materials such as charcoal and infusorial earth could absorb the active principle from tuberculin (22); and the identification in tuberculin of a complicated carbohydrate from which two simple sugars, mannose and arabinose, were separated and identified (21). Studies also were made of the growth and metabolism of the organism (31, 33, 36, 37). These studies included investigations of sources of nitrogen for growing the bacteria and of the factors that influenced growth and resulted directly in the development of a new medium (34) for the cultivation of the tubercle bacillus used to produce tuberculin. Per unit volume the new medium produced about four times the amount of growth afforded by Koch's old beef infusion medium.

The new medium was composed of relatively simple chemicals and it was, therefore, possible to produce successive lots of tuberculin which were of more uniform composition than could be done with beef infusion and peptone media. In the new medium the amount of each constituent used was based upon the amount that could be utilized by the growing bacteria. After the bacteria had grown, the medium, aside from a small amount of salts, contained only products produced by the tubercle bacilli. These were either active and needed or inactive and harmless. The culture filtrate or tuberculin, therefore, contained no unused medium constituents such as were abundantly present in Koch's tuberculin. Further tests on laboratory animals demonstrated that the tuberculin derived from cultures grown on the synthetic medium was three to four times as potent as the tuberculin derived from Koch's medium. The good results obtained in laboratory tests led to extensive field trials in which the new and old tuberculin were tested comparatively on more than 13,000 cattle (20). The outstanding result of these tests was the finding that of 1,268 animals that reacted to the new tuberculin and in which lesions of tuberculosis were found, 135 failed to react to the old tuberculin. The old tuberculin, therefore, missed 11.2 per cent of the infected animals that reacted to the new tuberculin. The per cent of no-visible-lesion cases was about the same for the two tuberculins. The preparation of the old type of tuberculin was, therefore, discontinued, and since the end of 1934, all tuberculin distributed by the Bureau has been of the new type, that is, derived from cultures grown on synthetic medium.

The new tuberculin detects more tuberculous animals than the old, and the primary objective of tuberculin testing is to detect infected animals. However, the specificity of the new tuberculin is not appreciably different from the old. Its use has not solved the no-visible-lesion problem which has been attacked from many angles. An early discovery by Traum (61) had shown that some reactors to the tuberculin test had no visible lesions of tuberculosis but did have skin lesions. The cause of skin lesions and their relation to the tuberculin reaction were extensively studied by Traum (62, 63) and later Crawford of the Bureau (8, 9, 10) made a number of contributions to this subject. Without going into details regarding the problem of the no-visible-lesion cases, it may be said that attempts to improve the
specificity of tuberculin have been carried on simultaneously with attempts to improve potency.

These attempts have been directed along three lines—treatments with physical, chemical, and biological agents. The work has been carried out with products prepared from various kinds of acid-fast bacilli including Mycobacterium tuberculosis, human, bovine, and avian types, M. paratuberculosis, and M. phlei and also with cattle sensitized with those organisms. Part of this work has been carried out in cooperation with the Allergy Division, Bureau of Agricultural and Industrial Chemistry. Physical agents used to treat tuberculin and related allergens have comprised heat, filtration, electrophoresis, and radiations, including atomic (tuberculin was exposed at Bikini). Chemical treatments have included precipitation with various reagents, hydrolysis, and treatments with various chemicals that act on proteins. Among the biological treatments used were the preparation of tuberculin with a number of different strains of bovine tubercle bacilli and treatment of tuberculin with various biological products such as enzymes and in some cases molds and bacteria. None of the treatments earlier employed resulted in significant increases in specificities. However, for the benefit of other investigators a description of the various treatments, including the results obtained, was published (3).

The active agent of tuberculin is a protein, and proteins not only have a very complicated structure, but they are easily injured or altered. Two proteins such as the one responsible for the tuberculin reaction and the one responsible for the johnin reaction may closely resemble each other chemically in their gross characteristics but be distinctly different immunologically. Present knowledge of the chemistry of proteins is limited. It is thus problematical as to whether a protein responsible for the tuberculin reaction can ever be completely separated from a protein responsible for another reaction such as the johnin reaction. So far, no means of effecting a complete separation has been found. However, an important recent finding (40) is a way to produce products that appears to be more specific when tested on artificially sensitized animals than the allergens from which they were derived. Whether such products will be more specific on naturally infected cattle remains to be seen. Nevertheless, the fact that specificity has apparently been increased is encouraging, and work along that line is being continued.

Another recent finding is that tuberculins prepared from the bovine type of bacilli seem more specific than tuberculins derived from the human type of bacilli that have been used for about 50 years to prepare Bureau tuberculin. However, the tuberculins from bovine type bacilli were found in the recent work, as in all past work by the Bureau, to be definitely less potent than the regular Bureau tuberculin, and as long as the object of the Bureau’s work is eradication, potency cannot be sacrificed for specificity (1).

The work begun in the 1890’s on the nutrition of tubercle bacilli is also being continued. Following the adoption of the synthetic medium for producing tuberculin, it became particularly desirable to find a substitute for the amino acid, asparagine, which supplies the nitrogen for the multiplying bacteria and which is costly and at times difficult to obtain. Very promising substitutes have been found (36). At times, growth of the bacteria on some of these substitutes was very erratic. Search as to the cause revealed that traces of certain elements were necessary for
growth not only on substitutes for asparagine but for highly purified lots of asparagine itself (2). As a result of these findings, increasingly large amounts of tuberculin are now being produced on relatively cheap ammonium glutamate medium instead of the more expensive asparagine medium. Needless to say, the change was not made until extended trials established that the tuberculin from the glutamate medium was equal in potency and specificity to that from the asparagine medium (56).

Other by-products of the attempts to increase specificity were: (1) the development and recognition of the cervical test as a valuable tool for use in problem herds—herds from which the disease had not been eradicated by the usual tests (38, 43, 59, 4); (2) the finding that B.A.I. intradermic tuberculins appear to lose potency at a rate of about 15 per cent per year (5); (3) the determination of the relative efficiency of a number of methods of tuberculin testing using autopsy results as a standard (60); (4) the finding that the *hominis* and *bovis* varieties of *Mycobacterium tuberculosis* on the one hand are closely related, while on the other hand *Mycobacterium tuberculosis*, variety *avis*, and *Mycobacterium paratuberculosis* are closely related, and animals sensitized to one of the allergenically similar groups (*bovis* and *hominis* on the one hand and *avis* and *paratuberculosis* on the other) will react to the allergens produced by the other group and also to some extent to the allergen produced by *Mycobacterium phlei* (39); and (5) the devising of a dermal thickness gage which will allow the measurement of reactions in a purely objective manner (42).

Of all the Bureau's work with tuberculin, the most important by far is its use of tuberculin to eradicate tuberculosis. By that use tuberculosis in cattle has been reduced from an overall average of 4.9 per cent in 1918 to 0.14 per cent in 1950. Regardless of the work done in the laboratory, that great victory over one of the most important livestock diseases could not have been accomplished without the untiring devotion and zeal of the field men who applied the test and the state and federal officials who directed the work.

REFERENCES


POSTMORTEM AND LABORATORY DIAGNOSIS OF BOVINE GRANULOMAS ENCOUNTERED IN MEAT INSPECTION WITH SPECIAL REFERENCE TO TBERCULOSION

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The accurate diagnosis of a disease such as bovine tuberculosis is of primary importance in an eradication or control program. Through the test and slaughter method, supplemented by meat inspection post mortem records, the results of the bovine tuberculosis eradication program conducted by the United States Bureau of Animal Industry, in cooperation with the state livestock sanitary officials in each of the states, show a reduction of the disease from 4.9 per cent infection in 1918 to 0.19 per cent at the present time for the entire United States. Early in the testing program, when the disease was prevalent, one reactor was encountered in approximately every 25 animals tested (1). During this period lesions found in tuberculin reactors at autopsy were not considered to be a problem in the differential diagnosis between tuberculosis and other granulomatous conditions. However, with the present low incidence of infection, requiring the testing of 500 animals to find one reactor (1), the percentage of lesions of tuberculosis found at autopsy has diminished materially and a relative increase in “no visible lesion” and “skin lesion” cases has appeared in the postmortem records.

Federal meat inspection regulations require the recording of all cases of tuberculosis whether in reactor or nonreactor cattle. Reports are then submitted to the field inspector in charge, who is responsible for the conduct of the tuberculin testing program. When lesions of tuberculosis are found in a reactor from a herd under federal supervision, further testing of the herd must be continued until the infection is eliminated. Likewise, tuberculous lesions from nonreactor cattle encountered on routine post mortem inspection are reported to the field inspector in charge when the place of origin of the animal can be established by brand or other marks of identification.

Although the identity of comparatively few animals can be established under present marketing methods, nevertheless by this procedure new foci of tuberculosis infection have and are being uncovered in unsuspected herds. It, therefore, constitutes a valuable adjunct to the eradication of the disease. In some instances, however, follow-up tests resulting from meat inspection reports on lesions found in both reactor and nonreactor cattle have failed to uncover any reactors. The time, expense and effort of Bureau officials and cattle owners in testing a herd, particularly a beef range herd, with negative results, have been of no little concern to ranchers, state livestock sanitary officials and Bureau field inspectors in charge. In order to prevent unnecessary testing of herds on the basis of direct meat inspection reports, laboratory examination of lesions suspected of being tuberculous is being made.

Laboratory workers engaged in meat inspection diagnosis are aware that other lesions of a granulomatous character found in cattle are sometimes indistinguish-
able from those of tuberculosis and require laboratory examination for differential diagnosis. In the experience of the writers, caseo-calcareous or calcified lesions of actinobacillosis, actinomycosis, coccidioidal granuloma, other fungus infections and Corynebacterium pyogenes often have a yellowish granular appearance strongly resembling the gross lesions of tuberculosis. Occasionally lesions of carcinomatosis and parasitic conditions such as pentastomiasis of lymph nodes also resemble tuberculosis. Lesions of all the mentioned conditions have at one time or another been submitted to the Denver laboratory as suspected tuberculosis from both reactor and nonreactor cattle.

As a result of observations made in Bureau laboratories, the Meat Inspection Division of the Bureau of Animal Industry issued memorandum MID-50-5 (2), dated February 13, 1950, entitled "Laboratory Confirmation of Tuberculous Lesions Found on Nonreactor Animals of the Beef Type", which reads in part as follows: "Because of the difficulty, and in some cases considerable expense, experienced in rounding up herds of range cattle for testing, it is desirable that occurrences of tuberculosis reported by veterinary meat inspectors on Form FI-11C when involving nonreactor beef-type animals be confirmed by laboratory diagnosis before action is taken by members of the field organization of the Tuberculosis Eradication Division. Accordingly when a lesion of tuberculosis or a lesion resembling tuberculosis is found by a veterinary meat inspector in connection with his post mortem examination of a nonreactor beef-type animal, a specimen representative of the lesion shall be sent to the pathological laboratory serving his area." On the basis of experience in this laboratory, the memorandum may well have included lesions found in reactor cattle.

MATERIAL AND METHODS

This study consists in the examination of 222 granulomatous lesions received during a period of ten years at the Denver laboratory for confirmation of post-mortem diagnoses. Of these cases from both tuberculin reactors and routinely slaughtered animals, 108 were submitted as suspected lesions of tuberculosis. The majority were submitted from federally inspected establishments in 11 western states. There are included, however, 15 cases from tuberculin reactors which were killed in local plants, the postmortem examination having been conducted under the supervision of federal veterinary field inspectors. Tuberculoid skin lesion cases are not included in this report.

The diagnoses were made by either wet preparations, stained smears, cultural methods or histologic sections. In many instances two or more methods were used to arrive at the diagnosis and, when necessary, animal inoculations were made. Of the 108 cases (Table 1) submitted as suspected of being tuberculous, 56 (51.8 per cent) proved to be positive. The remaining 52 cases (48.2 per cent) in this particular group showed the following conditions in order of their frequency: actinobacillosis, 19; coccidioidal granuloma, 14; Corynebacterium pyogenes, 6; fungus infection, 5; parasitic, 5; actinomycosis, 2; neoplasia, 1. Of five lesions examined post mortem, two were diagnosed as actinobacillosis, one as neoplasia, and two were undetermined. Laboratory examination showed all of these to be lesions of tuber-
tuberculosis. The table, in addition, shows the diagnosis of other granulomatous conditions on post mortem inspection, as well as the results of the laboratory findings.

An analysis of the cases submitted as probable lesions of tuberculosis (Table 2) shows the following: Of 31 lesions from tuberculin reactors, 20 (64.5 per cent) were confirmed by laboratory examination as compared with 11 (35.5 per cent) which proved to be non-tuberculous and should in reality be classed as "no visible lesion" cases. Among the 77 cases submitted as suspected of being lesions of tuberculosis

### Table 1
Postmortem and Laboratory Diagnosis of 222 Bovine Granulomas

<table>
<thead>
<tr>
<th>POSTMORTEM DIAGNOSIS</th>
<th>Laboratory Diagnosis</th>
<th>TOTAL CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tuberculosis</td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Coccidioidal granuloma</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Actinobacillosis</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Actinomycosis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Neoplasia</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Undetermined</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

* One case proved to be *Actinomyces asteroides* by cultures and animal inoculation

### Table 2
Lesions Submitted as Suspected Tuberculosis by Federal Veterinary Inspectors

<table>
<thead>
<tr>
<th>KIND</th>
<th>Laboratory Diagnosis</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tuberculosis</td>
<td>Other Conditions</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Tuberculin reactors</td>
<td>20</td>
<td>64.5</td>
</tr>
<tr>
<td>Routinely slaughtered animals</td>
<td>36</td>
<td>46.7</td>
</tr>
<tr>
<td>All cases</td>
<td>56</td>
<td>51.8</td>
</tr>
</tbody>
</table>

from routinely slaughtered animals, 36 (46.7 per cent) were found to be positive in contrast to 41 (53.3 per cent) which proved to be lesions of other conditions.

### Discussion

It is obvious from the data presented that a gross diagnosis of tuberculosis is not always possible and that in case of doubt, specimens should be submitted to the laboratory. This is of particular importance when the testing of a herd may depend on the diagnosis.

In the experience of one of us (Davis) the incorrect diagnosis, by post mortem examination, of the 48.2 per cent of the cases submitted as tuberculosis is understandable and is by no means a reflection on the sincere efforts and good judgment
of the veterinary inspectors. Actually many of the cases so diagnosed were indistinguishable from tuberculous lesions.

The necessity for continued tuberculin testing is evident from the number of condemnations for tuberculosis of carcasses and parts of carcasses as revealed in the report of the Meat Inspection Service (3) for the fiscal year 1950. The records show a total of 1,135 bovine carcasses condemned for generalized tuberculosis. Of these 678 were of nonreactor cattle and 457 were of reactors. In addition there were 1,689 slight cases of tuberculosis resulting in condemnation of a part or parts. Of these cases 882 were of nonreactor cattle and 807 of reactor cattle.

Actually the number of cases of tuberculosis reported is very small considering that post mortem inspection of 13 million cattle was made under federal supervision during the fiscal year 1950. Nevertheless continued vigilance must be exercised to keep the disease under control.

The findings in this study must not be construed to mean that approximately 48 per cent of all cases reported as tuberculosis were incorrectly diagnosed. It is reasonable to assume, however, that on the basis of data presented, an appreciable number of the cases diagnosed as tuberculosis would have proved to be other granulomatous conditions upon laboratory examination.

**SUMMARY**

1. The postmortem and laboratory findings in 222 bovine infectious granulomas are presented.
2. Among 108 cases submitted with a postmortem diagnosis of suspected tuberculosis, 56 (51.8 per cent) proved to be tuberculosis, whereas 52 (48.2 per cent) cases were found to be other conditions.
3. A post mortem diagnosis of tuberculosis cannot always be made on the gross appearance of the lesion.
4. Caseo-calcareous or calcified lesions of coccidioidal granuloma, actinobacillosis, actinomycosis, *Corynebacterium pyogenes* and other fungus infections are often indistinguishable from tuberculous lesions, necessitating laboratory examination for correct diagnosis.

**REFERENCES**

All of us associated with the livestock industry agree, that during the period since 1940, until very recently, we have been able to register only mild enthusiasm over any discussion on bovine tuberculosis. There has been acceptance of the continuing problem of tuberculosis among our cattle, but too many seem to have carried the attitude that the disease has reached an irreducible minimum and from this point on the regulatory forces can hope to fight only a holding battle. Even though the country during the last few years has been held to the low average of around 0.20 per cent infection, there have been uncovered annually too many herd foci of infection which undetected or uncontrolled could spell trouble ahead. The results of a similar situation were evidenced during the period from 1943 to 1945 when the rate of infection was allowed to rise from the low of 0.18 to 0.24 per cent, an increase of one-third within 24 months.

The possibility of conditions again being right for such a resurgence was brought forcefully to the front in 1949 when this Association approved recommendations requiring a six-year retest of all animals for reaccreditation of areas, other than range or semi-range, after January 1, 1951. We remember the debate that accompanied this decision and the discussion that continued throughout the following year while regulatory officials were studying their finances and the veterinary requirements that would be necessary to do this job. As with any major problem affecting its industry a properly awakened membership will usually come up with the answer. From our observations now, we believe the controversy during that year over the merits of the proposed six-year testing requirement served to alert the livestock industry and the veterinary profession to the real potentials of our tuberculosis problem.

While the unusually good reports of this last year's work cannot be attributed to any recently revised formula for area reaccreditation, they do seem to reflect the thinking which has been building up and now brought to bear through the more restrictive requirements proposed in 1949 and then carefully revised, but in no way weakened, in 1950. It has, however, come to our attention during this year, that because of some misinterpretation, the present regulations have been thought by certain ones to constitute a general easing of requirements. Your careful study of the current testing requirements will, I'm sure, indicate this to be a false impression, although the selectivity now permitted does very properly allow reaccreditation of certain areas without the retest of all animals. This provision will permit channeling the greater share of funds and manpower into those areas which have shown, through reports of tests and postmortem findings, more than the minimum amount of infection defined as permissive for percentage area testing.

1 Dr. Winter is Assistant in Charge of the Brucellosis and Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture.
If our conclusion is correct, that the present guide for area tuberculin testing is simply the written text of thinking already being applied in the field, the reported results of the past year's work should serve as a fair index to the acceptance of these regulations and their probable effectiveness in our future cooperative efforts.

One of the conditions stressed in the current regulations is that full data be made available on the amount of infection revealed through slaughters as a factor in computing incidence of infection for reaccreditation purposes. This naturally obligates all concerned with the handling of slaughter animals to provide the best possible information on the origin of those cases which may show lesions of tuberculosis so that areas and herds involved can be readily located. As an aid to this admittedly important phase of the project, the Brucellosis and Tuberculosis Eradication Division and the Meat Inspection Division have developed a new form for use by inspectors on the killing floor in reporting cases of tuberculous animals.

This form has been well accepted and is proving very helpful in bringing to light more sources of infection than heretofore. Even so, there is still the need for better identification of animals consigned for slaughter, if this reporting service by the Meat Inspection Division is to function to the fullest. Under the present plan the Meat Inspector responsible for reporting the case back to the field is, in turn, furnished with a report of the field research and herd testing which results from the information provided through disclosure of the infected case. There is reason to believe a reporting system of this type, if given the benefit of proper animal identification, could be the means of locating the majority of our field sources of infection. If reaccreditation of lightly infected areas is to be continued on the basis of percentage testing the effective reporting of slaughter cases must be a requirement. Only recently a herd test revealed 74 tuberculous reactors in one of our southern states that had protested loudly the requirement of complete area testing as suggested at the 1949 meeting of this Association. These were more reactors than the entire previous year's testing had disclosed in this particular state. A check must be maintained on all areas and while we agree a complete retest each six years of those areas with minimum infection cannot be justified, a continuing determination of their status must be possible. The present regulations, plus improved animal identification and sales records, promise the answer at a minimum expense. Efforts for improved identification and recording of slaughter animals are continuing.

Statistical reports can hardly be termed entertaining reading, but those of us interested in the tuberculosis program will find the 1951 report on the progress of the tuberculosis project both interesting and gratifying. A number of these reports are available here and others can be had through request to the Washington Office of the Bureau. Your review will show that for the last nine years, since the low of 0.18 per cent infection was reported in 1943, the total number of tests has been running fairly even, at between eight and nine million annually, with this year's testing slightly over the average, but about one-half million under last year. The most gratifying result of this year's testing is the drop in total reactors to an all time low of 12,353 as compared with 17,733 of a year ago, with a corresponding decline in the average infection rate to 0.14 per cent or 30 per cent less than the 0.19 that has been reported for each of the past three years. We hope and believe that this reflects a determination on the part of the livestock industry and regulatory officials.
to break that stalemate in infection rate with which the industry seemed to be saddled and which some were accepting as the best that could be done.

These are the data for the country and everyone has reason to feel proud of the year's accomplishment, but we have in the past witnessed the results of over-confidence, so let's study the record again for some different angles.

In looking over the report by states, it is interesting to see that six states, i.e., California, Minnesota, Wisconsin, Illinois, Ohio and New York, accounted for more than half of the testing done this year.

These six states, which are representative of the dairy areas report an average infection rate of 0.15 per cent, as against 0.14 for the country, a very close relationship and indicative of a successful effort to eradicate tuberculosis from the dairy branch of the livestock industry, commonly considered especially vulnerable to the disease.

On the other hand, we note several states with large cattle populations which are showing the highest reported incidence of infection but where far too little testing is being done. We hope each state will give careful study to its own status and profit from the experience of certain others where in the past the disease has been given an opportunity to re-establish itself. Those states are to be commended for the resolute action taken in again bringing the disease under control, but the process is costly both in animals and money, something which all states can well ponder.

There is also evidence to indicate transfer of support from the tuberculosis program to the brucellosis eradication project in some areas. It is appreciated that all states are being faced with this dual responsibility and with certain ones this is especially acute at the present time. With tuberculosis now being so definitely reduced, however, it is hoped each state will weigh carefully its relative responsibilities in the light of the investment already made in the tuberculosis project, and the importance of following through at this strategic time. It is the Bureau's policy to expend every possible effort toward advancing this present encouraging tuberculosis situation.

**AVIAN-SWINE TUBERCULOSIS**

In correlation with the over-all tuberculosis eradication effort, the groundwork is being laid for collective study by educational, regulatory and commercial groups, of information now available on avian-swine tuberculosis as the basis for developing improved educational procedures in this field. Data accumulated by the Bureau through test surveys in midwestern states seems now to be complete with respect to the incidence of infection and the related problems.

The poultry extension service is organized to work closely with the industry and has indicated its interest in helping to advance any educational program which may result from the organized thinking of those groups closely concerned with this problem.

**PARATUBERCULOSIS**

Fourteen states reported tests for paratuberculosis with a total of 3,014 conducted during the year. This testing was limited largely to herds showing clinical evidence of the disease, and disclosed 3.7 per cent reactors. The Bureau Regional Laboratory
at Auburn, Alabama, is continuing research on the disease, and assistance with the diagnosis of specimens from the field.

SUMMARY

Reduction in the incidence of tuberculosis which made the national average for the year the lowest in history has resulted largely from concentrated effort in a few states. More activity in the others will be necessary to continue the reduction drive.

Reports of occasional herd foci of infection of heavy proportions, even in the more lightly infected states, should cause all regulatory officials to remain concerned over the ability of bovine tuberculosis to quickly re-establish itself.

Records of work conducted during the past year under the current regulations for area reaccreditation seem to reflect an awakened attitude on the part of the industry and regulatory officials alike toward tuberculosis eradication. These lend to the conviction that the incidence of infection can be further reduced from the present all-time low, and revive the hope for eventual eradication of this disease.
REPORT OF THE COMMITTEE ON TUBERCULOSIS

HOWARD W. JOHNSON, Beltsville, Maryland, Chairman; D. H. RICKS, Oklahoma City, Oklahoma; A. K. KUTTLER, Washington, D. C.; W. A. HAGAN, Ithaca, New York; M. N. RIEMENSCHNEIDER, Denver, Colorado; G. H. GOOD, Cheyenne, Wyoming; J. W. CROUSE, Trenton, New Jersey; ORLAN HALL, Ottawa, Ontario, Canada; A. G. PICKETT, Topeka, Kansas; EDWARD ARNOLD, Nenzel, Nebraska; GEORGE A. GODFREY, Animas, New Mexico

At the suggestion of committee members and state livestock sanitary officials your Committee has carefully reviewed the Uniform Methods and Rules for the Establishment and Maintenance of Tuberculosis-free Accredited Herds of Cattle and Modified Accredited Areas and recommends for your adoption the following:

UNIFORM METHODS AND RULES FOR THE ESTABLISHMENT AND MAINTENANCE OF TUBERCULOSIS-FREE ACCREDITED HERDS OF CATTLE AND MODIFIED ACCREDITED AREAS

Unanimously adopted by the United States Livestock Sanitary Association, November 16, 1951, and approved by the Bureau of Animal Industry, effective December 28, 1951

Part I

Individual Accredited Herd Plan

1. (a) A tuberculosis-free accredited herd is one in which no reactors have been found on at least two annual tuberculin tests and physical examinations. Herds in which infection occurs shall be quarantined and must successfully pass at least three tuberculin tests and physical examinations given at intervals of not less than 60 days in order to be released from quarantine, then to qualify for accreditation or reaccreditation the herd must pass another, or fourth, test in not less than 12 nor more than 14 months following the test on which infection was disclosed. Such physical examinations and tuberculin tests shall be applied by a veterinarian regularly employed by the state or federal Bureau of Animal Industry or by an accredited veterinarian under the supervision of a veterinarian regularly employed by the state or federal Bureau of Animal Industry.

(b) A herd with no evidence of recent infection in which reactors are disclosed as a result of the tuberculin test may be reaccredited following a 60-day negative retest if no visible lesions or skin lesions only are disclosed on post mortem examination of the reactors found.

(c) When an accredited herd or a herd in the process of accreditation is to be tested by an accredited veterinarian the following regulations are to be observed:

(1) The accredited veterinarian shall not conduct such tests until he has received written authorization from the proper cooperating state or Bureau officials.

(2) The accredited veterinarian shall submit a report of such tests in accordance with the regulations of the cooperating state and federal authorities. These
officials reserve the right to supervise any tests conducted by an accredited veterinarian.

2. (a) The official tuberculin test shall be the intradermic or the subcutaneous test. The intradermic injection shall be a measured amount of tuberculin, not less than 0.1 c.c. for routine testing nor less than 0.2 c.c. for testing known infected herds, when intradermic injections are made in the caudal or cervical areas. The intradermic injection of tuberculin in the cervical area in herds in which infection occurs may be used only when approved by state or federal cooperating officials.

(b) State and federal authorities may require that any herd in which infection has been found shall not become accredited unless the final or accrediting test has been made by a combination of either the subcutaneous and intradermic test applied in the caudal fold, or a combination of the tests listed under paragraph (a) above.

(c) The veterinarian who applies the tuberculin test shall inform all cattle owners concerning tuberculosis of other domestic animals, including poultry and swine. Owners or caretakers should also be informed of the possibility of cattle becoming sensitized as a result of exposure to people affected with tuberculosis.

3. The entire herd, or any cattle in the herd, shall be tuberculin tested or retested at such times as are deemed advisable by the cooperating state and federal authorities.

4. No animal that has been designated as a reactor at any time shall be presented for retest.

5. Reactors to the tuberculin test shall be promptly removed from the farm and after their removal the infected premises shall be thoroughly cleaned and disinfected with a disinfectant approved by the United States Bureau of Animal Industry, and in a manner satisfactory to the cooperating state and federal authorities. Full information is desired with respect to every factor that might have a bearing on the appearance of infection in the herd, such as: Past history of herd; water supply; light; ventilation; sanitation; management; manner of making additions to the herd (source, isolation pending retest, and retests); disposal of waste products; human infection; avian infection; Johne's disease, etc.

6. Herd owners are required to house, feed and care for their cattle under such sanitary conditions as will tend to promote good health, and to follow such recommendations as are made by the cooperating state or federal authorities.

7. Calves in accredited herds shall not be fed milk or other dairy products from other herds not fully accredited, or from unknown sources, unless such materials have been properly pasteurized.

8. (a) The herd owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the grade animal to be marked by a tag or other means satisfactory to the cooperating state and federal authorities.

(b) Each herd owner is required to keep a record of all additions.

9. All vehicles shall be cleaned and disinfected before they are used for transporting cattle to herds maintained under this plan.

10. Herd additions must originate in tuberculosis-free accredited herds or in herds of comparable status in a modified accredited area.
11. Accredited herd certificates may be issued by the cooperating state and federal authorities and shall be valid for one year unless revoked.

12. Failure on the part of an owner to comply with these methods and rules shall constitute sufficient cause for the revocation of the accredited herd certificate.

Part II

Modified Accredited Area Plan

13. The provisions of the individual accredited herd plan that relate to testing, removal of reactors, cleaning, disinfecting and sanitation shall apply to the modified accredited area plan. All infected herds shall be quarantined and tested as provided in paragraph 1.

14. Modified accredited areas that disclosed on the last test of all cattle (except as hereinafter provided in paragraph 19) not more than 0.2 per cent infection may be reaccredited for a period of six years if a retest of ten or more per cent of the cattle in the said area discloses a degree of infection not exceeding 0.2 per cent, provided that in calculating the degree of infection all post mortem meat inspection reports of tuberculosis and otherwise disclosed cases of tuberculosis accumulated in said area since the last test are included and provided further that adequate state laws and regulations permitting effective quarantine and testing of infected herds as provided in paragraph 1 are enforced.

15. Modified accredited areas that disclosed on the last test of all cattle (except as hereinafter provided in paragraph 19) more than 0.2 per cent infection may be reaccredited for a period of six years if a retest of all cattle (except as hereinafter provided in paragraph 19) in the said area discloses a degree of infection not exceeding 0.2 per cent provided that in calculating the degree of infection all post mortem meat inspection reports of tuberculosis or otherwise disclosed cases of tuberculosis accumulated in said area since the last accreditation test are included and provided further that adequate state laws and regulations permitting effective quarantine and testing of all infected herds as provided in paragraph 1 are enforced.

16. If the retest of an area as provided for under either paragraph 14 or 15 discloses a degree of infection of more than 0.2 per cent but not more than 0.5 per cent the area may be reaccredited for a period of three years. Infected herds shall be quarantined and retested as provided in paragraph 1.

17. If the retest of an area as provided for under either paragraph 14 or 15 discloses a degree of infection of more than 0.5 per cent but not more than 1 per cent, the infected herds shall be quarantined and retested. If the total number of reactors found as a result of this retest is less than 0.5 per cent of the entire cattle population the area may then be reaccredited for a period of three years. Infected herds shall be retested as provided in paragraph 1.

18. If the retest of an area as provided for under either paragraph 14 or 15 discloses more than 1 per cent infection, accreditation shall be suspended until all

1 It is not intended that reaccreditation tests as provided under paragraphs 14 and 15 should interfere with more frequent tests when state and federal cooperating officials consider such additional testing necessary.
cattle (except as hereinafter provided in paragraph 19) in the area have been re-tested, and the degree of infection reduced to not more than 0.5 per cent.

19. A county or area may be remodeled in the range or semi-range region upon compliance with paragraph (a) or (b) and other provisions in this section:

(a) When all bulls, purebred breeding cattle, milk cows, at least 10 per cent of the semi-range breeding females, and such other cattle as may be considered necessary by the state and federal department cooperating are tuberculin tested.

(b) When all bulls, purebred breeding cattle, milk cows, barnyard cows and home fed cattle are tuberculin tested, or properly identified post mortem reports are produced showing that at least 10 per cent and not less than 25 animals of the breeding herd have been slaughtered within a year, and that such post mortem examination failed to disclose lesions of tuberculosis.

If under paragraph (a) or (b) of this section a reactor or any other evidence of infection is revealed in any herd by post-mortem reports, etc., including post mortem inspection at packing plants of those branded cattle that are sold direct from the range for immediate slaughter, then all the cattle in that herd or associated with the diseased animal shall be immediately tuberculin tested in accordance with the provisions of the modified accredited area plan. The area may then be remodeled for a period of six years, if the total number of reactors and cattle found tuberculous upon post mortem examination from the area is not more than 0.2 per cent of all the cattle tested in the area.

20. The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper livestock sanitary official of the state of destination.

21. Reactors found in herds where no visible lesions or skin lesions only are found, and where there is no history or other evidence of infection, will not be counted in determining the percentage of infection as provided in sections 13 to 19 inclusive. No-visible-lesion reactors will be counted when found in herds where any lesion reactors are found, or in herds where lesions of tuberculosis have been found on post mortem meat inspection reports.

COMMENT

DR. JOHNSON: The Committee has instructed me to make some comments in regard to Section 20, which I should like to re-read: "The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper livestock sanitary official of the state of destination."

The Committee's attention was drawn to the fact that in the origin of the tuberculosis eradication program the industry had been promised that after modified accredited areas were established, cattle would move freely interstate—in other words, that they would not be subject to further testing at the time of movement.

It was felt by the Committee that this was a tremendous statement, and that the Committee should refer this matter for further consideration by next year's Committee, in order that a full report might be given to this Association as to the
desirability or necessity of either complying with the promise or bringing out reasons why this should not be done.

Further, the Chairman of your Committee was instructed to comment on the fact that, as we all know, as a result of the war and the scarcity of veterinarians, and so on, there has been some lack of testing, which at the present time might justify the lack of compliance with former agreements with the industry.
ASPECTS OF CONTROL IN BOVINE LEPTOSPIROSIS

CHARLES J. YORK, A.B., D.V.M., PH.D.

From the Veterinary Virus Research Institute, New York State Veterinary College at Cornell University, Ithaca, New York

In recent years workers in various parts of the world have recognized and reported upon the occurrence of leptospirosis in cattle. First recognized in Russia (1), Australia (2), and Palestine (3), it was later observed in Connecticut in 1944 (4). Since then reports have been made of new outbreaks in many different parts of the United States (5–9). In 1948 the leptospiral organism was isolated from cattle in the United States (7). Later this strain was proved to be antigenically different from the Leptospira bovis found in Palestine and Russia (10), which also causes disease in man. Recent work indicates that the strain of leptospira found in the United States is more closely related to Leptospira pomona (11), reported in Australia as the cause of disease in cattle and in man, and which also is found in swine and in man in some parts of Europe.

Although there have been reports of bovine leptospirosis from widely separated areas in the United States, actual incidence of this disease in the cattle population of any given area has not been determined as yet. A major difficulty of this determination has been the lack of a routine serological test. In our laboratory, a simplified complement-fixation test has been devised recently and applied in a preliminary survey of the incidence of leptospirosis in the State of New York.

Details of the test have been submitted for publication and should be available soon to those interested. In preparing the constituents of this test, complement was obtained from guinea pigs and maintained in a frozen state, although it is available commercially. Amboceptor is also a stable product and can be purchased. Sheep cells are easily obtained and when stored in Alsever’s solution, can be maintained for one month. Antigen is prepared from hen’s eggs inoculated with a strain of leptospira that has been maintained continuously in eggs since 1947. Although not too difficult to prepare, several procedures are required. Therefore, it is hoped that at least one industrial company will render this service to diagnostic laboratories by making the antigen available commercially. This would, of course, make the performance of routine tests much easier.

In determining the value of this test, 12 calves between the ages of four and six months were inoculated with a pathogenic strain of leptospira that had been maintained by continuous guinea pig passage. Serum samples were taken from each calf before inoculation and again three to four weeks afterwards. Serum samples were also obtained from 21 non-infected cattle, part of a herd maintained at this laboratory under conditions designed to keep them free of infection. In addition, samples were taken from 214 cattle from 24 different farms where symptoms of leptospirosis were observed. Samples were obtained from 32 of these cattle during or shortly after clinical illness was observed, and again three to five weeks later. The results of complement-fixation tests on sera are summarized in Table I.

As can be seen in Table I, complement fixation tests on sera taken from cattle...
before experimental inoculation were negative. Similarly, there was no fixation of complement with sera from the disease-free herd. Sera from naturally infected cattle taken during the acute phase of the illness were negative or showed a very low titer. However, in each case, sera from cattle after experimental inoculation or after recovery from natural infection fixed complement in significant amounts, ranging in end-point dilutions from 1-8 to 1-256.

**Table I**

*Result of Complement-Fixation Tests with Sera of Normal, Experimentally Inoculated and Naturally Infected Cattle*

<table>
<thead>
<tr>
<th>CATTLE FROM WHICH SERA OBTAINED</th>
<th>NO. OF SAMPLES</th>
<th>DILUTION OF SERA FIXING COMPLEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1-4</td>
</tr>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-inoculation</td>
<td>12</td>
<td>0/12</td>
</tr>
<tr>
<td>Post-inoculation</td>
<td>12</td>
<td>12/12</td>
</tr>
<tr>
<td>Disease-free herd</td>
<td>21</td>
<td>0/21</td>
</tr>
<tr>
<td>Infected herd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute phase</td>
<td>32</td>
<td>8/32</td>
</tr>
</tbody>
</table>

* Numerator indicates the number of samples showing complete fixation of complement at a given dilution. The denominator indicates the number of samples tested.

**Table II**

*Complement-Fixation Tests with Leptospiral Antigen, Using Sera of Cattle Convalescent from Other Diseases*

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>NUMBER OF CATTLE TESTED</th>
<th>COMPLEMENT-FIXATION RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brucellosis</td>
<td>20</td>
<td>Negative</td>
</tr>
<tr>
<td>Virus diarrhea</td>
<td>12</td>
<td>Negative</td>
</tr>
<tr>
<td>Winter dysentery</td>
<td>15</td>
<td>Negative</td>
</tr>
<tr>
<td>Vibrionic abortion</td>
<td>10</td>
<td>Negative</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>12</td>
<td>1-8 to 1-128</td>
</tr>
</tbody>
</table>

The specificity of this test for leptospirosis was checked with sera of cattle convalescent from brucellosis, virus diarrhea, winter dysentery and vibrionic abortion. The results can be seen in Table II.

There was no cross reaction with leptospiral antigen, although complement was always fixed with known leptospiral positive serum. Hence, it is felt that the complement-fixation test is specific and will reliably detect the presence of cows that have been infected with leptospirosis.

Leptospirosis has been reported as occurring in widely separated areas in the United States, as shown either by guinea pig inoculation or by serological test. The
states in which the disease has been reported are shown on Map I. Since the incidence of leptospirosis in the cattle population of any one area had not been determined, a preliminary survey, making use of this complement-fixation test, was begun in New York State. In this survey the sera were tested at a 1–4 dilution. This dilution was chosen, in order to have the most sensitive yet apparently reliable test, since negative serum always failed to fix complement even at a dilution of 1–2. Sera from 1074 cattle that represented 105 herds in 33 counties have been tested up to the time of this report.

As shown in Table III, 12.8% of the animals in 35.2% of the herds from 57.5% of the counties gave a positive test for leptospirosis. The spread of the disease through the State may be seen on Map II. Although the actual number of tests completed is small, compared to the number of cattle in the State, it is, nevertheless, felt that study thus far completed gives an indication of the actual incidence of the disease.

In order to understand leptospirosis, it is necessary to have some conception of the clinical features, not only in the individual animal but also the general course of the disease in a herd. For convenience of discussion, clinical manifestations that may be seen are divided into several groups—asymptomatic, mild, and severe. These are tabulated in Table IV.

In infected herds that we have had an opportunity to study, the incidence of leptospirosis varied from 50% to 70% and in many instances presented a serious economic problem for the herdsman. Of those infected, 5% usually died, although it was sometimes as high as 25% in young stock; 5% to 10% showed severe signs
of illness; 20% to 40% had mild symptoms, i.e., primarily high fever and drop in milk production; while another 20% to 30% had an asymptomatic or non-apparent illness. Of the number that became infected in a herd, regardless of the form taken,

Table III
Incidence of Bovine Leptospirosis in New York, as Shown by Complement-Fixation Tests on Cattle Sera

<table>
<thead>
<tr>
<th>Counties</th>
<th>Number Tested</th>
<th>Number Positive</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herds</td>
<td>105</td>
<td>36</td>
<td>35.2</td>
</tr>
<tr>
<td>Cattle</td>
<td>1074</td>
<td>138</td>
<td>12.8</td>
</tr>
</tbody>
</table>

up to 25% of the cows aborted. This abortion occurred at almost anytime during pregnancy.

The fate of the organism in the infected animal can best be seen in Text Figure I. During the febrile stage, the disease is septicemic in nature, with organisms found in blood and milk. During the last day or so of fever, the organisms begin to localize in the kidneys, producing a focal interstitial nephritis, with leptospira shed in the
urine thereafter for at least 90 days. Although the possibility of another host acting as a carrier should not be ruled out, all available experimental and epidemiological

**TABLE IV**

*Symptoms of Leptospirosis in Cattle*

<table>
<thead>
<tr>
<th>FORM OF DISEASE</th>
<th>SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-apparent</td>
<td>Slight fever, probably not noticed</td>
</tr>
<tr>
<td>Mild</td>
<td>Fever—103 to 106</td>
</tr>
<tr>
<td></td>
<td>Depression</td>
</tr>
<tr>
<td></td>
<td>Anorexia</td>
</tr>
<tr>
<td></td>
<td>Milk production drops sharply</td>
</tr>
<tr>
<td></td>
<td>Milk thickened, yellow, occasionally bloody</td>
</tr>
<tr>
<td></td>
<td>Loss of weight</td>
</tr>
<tr>
<td>Severe</td>
<td>Fever—104 to 107</td>
</tr>
<tr>
<td></td>
<td>Marked depression</td>
</tr>
<tr>
<td></td>
<td>Anorexia</td>
</tr>
<tr>
<td></td>
<td>Sharp drop in milk production</td>
</tr>
<tr>
<td></td>
<td>Thickened bloody milk</td>
</tr>
<tr>
<td></td>
<td>Hemoglobinuria</td>
</tr>
<tr>
<td></td>
<td>Icterus</td>
</tr>
<tr>
<td></td>
<td>Death—variable</td>
</tr>
<tr>
<td>Abortion</td>
<td>Occurs with all forms of the disease</td>
</tr>
</tbody>
</table>

![Graph](image)

**Fig. 1.** Features of illness in a calf following inoculation with leptospira. Note recovery of organism from blood during fever and from urine for extended period afterward.

evidence indicates that the disease is spread by the medium of the urine from an infected to a susceptible animal, either within a herd or from herd to herd. In many instances, however, there may be weeks or even months after introduction of an
infected animal into a susceptible herd before clinical cases of the disease are noted. That is not to say, however, that inapparent infections are not occurring within the herd during this period of time.

The long period of time in which cattle may act as spreaders of the leptospiral organism, serves to emphasize the need for more extensive use of serological tests for detecting cattle that have had leptospirosis before such carriers of the disease are introduced into an uninfected herd or area. It may be that the test described in this paper will be modified, as with most serological tests, and that, in the future, a new and better test may be devised. However, the components of the complement-fixation test, as described, are sufficiently stable, the procedure for the test is simple, and the specificity of the test is reliable enough to allow for extensive use by various diagnostic laboratories. Such a test should be applied to cattle moved between states, especially to those areas where the disease has not yet been reported. Further, a diagnostic service should be available to cattle owners through their veterinarian, especially if new introductions are to be made into an uninfected herd, or it could be used as a clinical aid in herds that may have become infected with leptospirosis.

In this study it is evident that leptospirosis is a widely spread disease in New York State, and, if similar work were to be done in other areas, it is probable that a similar disease picture would be found. It appears urgent, therefore, to find some means of curtailing further spread of the leptospiral infection. This problem could be approached by use of a vaccine and by use of a method to eliminate the carrier condition. To this end, preliminary experiments conducted at our laboratory indicate that certain antibiotics are successful in eliminating the leptospiral organism from the kidneys of carrier animals. In addition, work with inactivated vaccines indicates that it is possible to produce an effective immunity in cattle against leptospirosis.

REFERENCES

REPORT OF COMMITTEE ON INFECTIOUS DISEASES OF CATTLE

Dr. H. U. Garrett, Des Moines, Iowa, Chairman; Dr. William Peterson, St. Paul, Minnesota; Oda Mason, Laramie, Wyoming; I. B. Boughton, College Station, Texas; L. M. Roderick, Manhattan, Kansas; Peter Olafson, Ithaca, New York; George Hopson, New York, New York; Roy Forehand, Carlsbad, New Mexico; H. S. Cameron, Davis, California.

Your Committee on infectious diseases of cattle has been asked to make a report on diseases other than tuberculosis, brucellosis and anaplasmosis. In order for this report to be at the national level, we sent a questionnaire to each livestock sanitary official of all 48 states. Our questionnaire asked for a report on the prevalence and control measures, if any, of the following diseases: mastitis; anthrax; blackleg; calf diphtheria; coccidiosis; vibro fetus; Q. fever; listerellosis, leptospirosis. Space was provided for other diseases, remarks and suggestions.

Of the 48 states to whom these questionnaires were sent, replies were received from 45. In the space left on the questionnaire for remarks and suggestions, three other diseases were mentioned: infectious keratitis; visicular stomatitis; trichomoniasis.

Of the 45 states reporting, 42 stated mastitis was a definite problem. One replied incidence very low; another did not make a statement as concerns mastitis in his state. Three states report percentages of some form of mastitis in their state as follows: 20 per cent of all herds; another 20 to 40 per cent and the third, 50 to 60 per cent.

Seven states report anthrax as of frequent occurrence, but is controlled by one of the methods of vaccination. Seventeen states reported the disease as having been diagnosed, but is not considered a problem; while in 21 states the disease has not been reported recently.

Eleven states reported blackleg as of frequent occurrence and in most areas routine vaccination is practiced. Thirty states report occasional cases, while four states report the disease has not been prevalent in recent years.

Calf diphtheria is reported as quite prevalent, and causes considerable loss in eight states. Twenty-seven states report the occurrence of calf diphtheria, but it is of minor importance. Ten states report little occurrence of this disease.

Vibro fetus reported prevalent in two states, but neither of these states went into detail as to how serious the situation is. From our report vibro fetus has been diagnosed in 29 states, while 14 states reported that no definite diagnosis had been made of this condition in their state.

Eleven states reported coccidiosis very prevalent, but in most of those states it is not considered a serious problem. Twenty-four states reported coccidiosis as present, but is being controlled in most cases. Ten states reported the disease had not been diagnosed.

Q Fever was reported prevalent in two states with one reporting 15 per cent of dairy cattle infected with no control measures enforced. Five other states report the
disease as having been diagnosed, while 38 states report Q Fever had not been diagnosed.

Listerellosis was reported as being present in 22 states, and with no information on the number of cases. Twenty-three states reported no diagnosis having been made.

Two states reported leptospirosis as being a problem. One state reported that it was more or less becoming quite a problem and that quarantine and isolation is practiced on some premises. The death loss was reported as quite high. One owner reported 75 cases, with 32 deaths all in cattle under one year of age. Nineteen states reported identification had been made of the disease, but no extensive investigation had been carried on to determine the prevalence of the disease. Twenty-one states reported that diagnosis had not been made.

Infectious keratitis was mentioned in the reports of three states. Two of them stating that the disease was quite prevalent, another that it was common in many areas.

Visicular stomatitis was mentioned by two states, with one state declaring it had quite an extensive outbreak in 1949, but no reports for this year. Our informant states that he feels that the disease is quite important because of the confusion with foot and mouth disease and is important economically. The other state reporting that the disease has appeared extensively in some years, and in other years of minor importance.

One state reported trichomoniasis as rather prevalent with loss as significant and control not satisfactory, while one other state reported the disease had been diagnosed and may be quite important, but no definite data available.

SUMMARY

From the data obtained it appears quite evident that mastitis is a very important problem to the dairy industry. With the use of anti-biotics, many cases have responded to treatment, which in the past were sacrificed. Much is yet to be learned about this disease.

We recommend that a committee be appointed on mastitis for next year.

Anthrax appears to be largely confined to well known anthrax districts with annual vaccination being practiced.

Blackleg is well under control in all states.

Calf diphtheria, vibro fetus, Q. fever, listerellosis and leptospirosis need considerably more study and research. A careful investigation of these diseases in the various states would no doubt reveal a higher incidence than is known at the present time.

Your Committee realizes that there are many more infectious diseases of cattle than those upon which we have reported, but we believe the report is on the more common diseases that are met with in most states.
REPORT OF AUDITING COMMITTEE

H. F. WILKINS, Helena, Montana, Chairman; H. GEYER, Columbus, Ohio; V. CHADWICK, Jackson, Mississippi

Mr. President and Members of the United States Livestock Sanitary Association:
Your Auditing Committee has examined the records of the Treasurer of the Association and finds the accounts kept in an orderly manner and correct as set forth in the Secretary-Treasurer’s report to the Association on November 14th.
REPORT OF COMMITTEE ON LEGISLATION

RALPH L. WEST, Chairman, St. Paul, Minnesota; C. W. FLOYD, Sedan, Kansas; R. A. HENDERSHOTT, Trenton, N. J.; F. E. MOLLIN, Denver, Colorado; J. G. MONTAGUE, Fort Worth, Texas; B. T. SIMMS, Washington, D. C.

The Committee on Legislation last year recommended that the officials of the United States Livestock Sanitary Association be directed to confer with the officials of the United States Bureau of Animal Industry and representative livestock producers in the City of Washington, D. C. to work out a new bill in lieu of Senate Bill 2188 which failed of passage in the 81st Congress. This recommendation was duly adopted by this Association.

Pursuant to this recommendation, Dr. B. T. Simms, at the request of Mr. Ferd E. Mollin, President of the United States Livestock Sanitary Association called a meeting on April 3 to discuss and prepare a bill to be substituted for S. 2188. This meeting was attended by F. E. Mollin, Judge Montague, B. T. Simms, and R. A. Hendershott of this Committee, together with representatives of several breed associations and other farm groups. After an extended discussion, the wording of the proposed bill was agreed upon and on June 8, a bill (S. 1629) prepared as suggested by the conference, was introduced by Senator Ellender and referred to the Committee on Agriculture and Forestry.

S. 1629 proposed to amend the Act of May 29, 1884 to permit the interstate movement for immediate slaughter of domestic animals which have reacted to a test for para-tuberculosis, or which, never having been vaccinated for brucellosis, have reacted to a test for brucellosis. It also provided for the return of animals to the point of origin which have been removed from one state or territory and which subsequent to such movement, have reacted to a test for brucellosis. This measure differs from S. 2188 in that brucellosis of swine other than cattle is included and also cattle which have reacted to para-tuberculosis or Johne's disease. Exception is also made in this measure for animals which have ever been vaccinated against brucellosis.

Secretary Hendershott reported the introduction of this Bill to all Members of the Executive Committee of the Sanitary Association with a request that they communicate with their respective senators urging support of this measure. A hearing was held on S. 1629 on September 12, and the Committee reported it favorably to the Senate where it was passed on October 1. In the meantime, Representative Marshall from Minnesota, introduced a companion bill in the House of Representatives. A hearing was held on the House Bill on October 16 and 17. These hearings were attended by several members of your Legislative Committee, together with representatives of livestock organizations interested in its passage. The Bill was reported favorably following this hearing, but because of impending adjournment, it was considered doubtful if action could be taken until Congress reconvened in January. However, the Congressmen interested in this legislation, particularly August H. Andresen and Fred Marshall of Minnesota, W. S. Hill of Colorado, W. R. Poage of Texas and Clifford Hope of Kansas succeeded in substituting the Senate Bill for the House Bill and bringing it to a vote before adjournment where it was
passed on the last day of the session. The Bill has been signed by the President and is now law.

The action of Congress on this measure is very gratifying to all concerned with the control and eradication of brucellosis and culminates the efforts of the United States Livestock Sanitary Association over the last several years to obtain such legislation. For the first time it will be possible and practical for the Bureau of Animal Industry, United States Department of Agriculture, to declare brucellosis an infectious, communicable disease of domestic animals and to adopt sound regulations governing interstate movement of livestock based on its status with respect to this disease.

Rabies

The Committee on Rabies report contains a proposed bill which would change the wording of the Law of 1884 to read, "Domestic animals and poultry", instead of "Livestock and poultry". This change, long needed, will provide a legal means of the United States Bureau of Animal Industry, to cooperate with other federal agencies and the individual states in the control and eradication of rabies. Such a move has long been advocated by our Association.

A BILL

To amend the Act of May 29, 1884, as amended; the Act of February 2, 1903, as amended; and the Act of March 3, 1905, as amended and extended; to include all domestic animals within their provisions, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled; That:

Sec. 1. The Act entitled "An Act for the Establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuropneumonia and other contagious disease among domestic animals", approved May 29, 1884, as amended; the Act entitled "An Act to enable the Secretary of Agriculture to more effectually suppress and prevent the spread of contagious and infectious diseases of livestock and for other purposes", approved February 2, 1903, as amended; and the Act entitled "An Act to enable the Secretary of Agriculture to establish and maintain quarantine districts, to permit and regulate the movement of cattle and other livestock therefrom, and for other purposes", approved March 3, 1905, as amended and extended, are hereby further amended to include within their provisions all domestic animals, and wherever in said Acts the term "livestock and/or live poultry" appears, the term "domestic animals (including live poultry)" shall be substituted therefore, and wherever in said Acts, except in section 11 of said Act of May 29, 1884, the term "animals" or the term "domestic animals" appears the term "(including live poultry)" shall be added after it.

Sec. 2. Section 3 of said Act of May 29, 1884 is hereby amended to read as follows: "Sec. 3. It shall be the duty of the Secretary of Agriculture to prepare such rules and regulations as he may deem necessary for the speedy and effectual suppression and extirpation of contagious, infectious, and communicable diseases of domestic animals (including live poultry), and to certify such rules and regulations to the
executive authority of each state and invite said authorities to cooperate in the
execution and enforcement of this Act. Whenever the plans and methods of the
Secretary of Agriculture shall be accepted by any state in which any such disease
is declared to exist, or any such state shall have adopted plans and methods for
the suppression and extirpation of any such disease, and such plans and methods
shall be accepted by the Secretary of Agriculture and whenever the Governor or
other properly constituted authority of any state signifies his readiness to cooperate
for the extinction of any such disease in conformity with the provisions of this Act,
the Secretary of Agriculture is hereby authorized to expend such sums as may here-
after be appropriated for carrying out the provisions of this Act, in such investiga-
tions and in such disinfection and quarantine measures as may be necessary to
prevent the spread of the disease from one state into another. As used in this section,
the term “state” includes the District of Columbia and the territories and posses-
sions of the United States”.

Sec. 3. Section 11 of said Act of May 29, 1884, is hereby amended to read as
follows:

“Sec. 11. The Secretary of Agriculture, either independently or in cooperation
with states or political subdivisions thereof, farmers’ associations and similar organi-
sations and individuals, is authorized to control and eradicate tuberculosis and
paratuberculosis of animals; avian tuberculosis; brucellosis of domestic animals;
southern cattle ticks; hog cholera and related swine diseases; scabies in sheep and
cattle; dourine in horses; rabies in domestic animals; and contagious or infectious
diseases of animals (including live poultry) such as foot-and-mouth disease, rinder-
pest and contagious pleuropneumonia, which in the opinion of the secretary consti-
tute an emergency and threaten the livestock or live poultry industry of the coun-
try; including the purchase and destruction of diseased or exposed animals (including
live poultry) or the destruction of such animals and the payment of indemnities
therefore in accordance with such regulations as the secretary may prescribe. As
used in this section the term “state” includes the District of Columbia and the ter-
ritories and possessions of the United States.”
REPORT OF THE COMMITTEE ON RESOLUTIONS

D. M. CAMPBELL, Illinois, Chairman; E. P. ATKINSON, Nebraska; C. P. BISHOP, Pennsylvania; T. O. BRANDENBURG, North Dakota; DON COLLINS, Colorado; RADFORD HALL, Colorado; J. G. MONTAGUE, Texas; H. J. ROLLINS, North Carolina

Resolved by the United States Livestock Sanitary Association in its 55th Annual Meeting assembled in Kansas City, Missouri November 16, 1951:

1. That we extend our thanks to the management and employees of the Hotel President for the good service rendered our Association throughout this meeting and our appreciation of the many courtesies shown our members, all of which has contributed much to the pleasure of attendance.

2. That we commend our fellow members, Dr. Hugh Curry and A. G. Pickett for the excellent local arrangements made for this meeting and the many kindesses shown members who called upon them for information or assistance.

3. That we commend the active part taken by the National Wool Growers Association in bringing sheep scab under control and the support it has pledged to bring about the final eradication of this disease.

4. That we again direct attention to the recommendations of President T. O. Brandenburg, which he voiced at our Columbus, Ohio meeting in 1949, to end the duplication of effort, federal and state in cooperative disease control and eradication.

Resolved further: That a committee be appointed to study the recommendations contained in Dr. Brandenburg's presidential address of 1949 and report at our next meeting.

5. That we support the efforts of the Association of Federal Veterinarians to have certain iniquities in the classification of veterinarians in federal employ remedied through regulations if possible and if not possible in that way, through legislation.

Resolved further: That the Committee on Legislation of this Association consult with the Association of Federal Veterinarians with a view to giving them such assistance as they may in procuring any necessary authorization from the Congress.

RESOLUTION NUMBER SIX

Foot-and-Mouth Disease

WHEREAS, The campaign to eradicate foot-and-mouth disease from the Republic of Mexico jointly undertaken by the Governments of the United States and of Mexico has been a remarkable illustration of the effectiveness of cooperative and intelligent approach to a difficult problem; and

WHEREAS, Too much cannot be said in praise of those far-sighted officials of the two governments who conceived the plan of campaign and the management of that campaign in its later phases by Directors Oscar Flores and Dr. L. R. Noyes has been so effective and so thorough that success in the campaign now appears to be assured; and

WHEREAS, However, the history of this disease is such that assurance of success
cannot be definite until all possibility of the existence of the dreaded virus is past, and the livestock industry of this country should not feel secure just because ultimate success seems to be possible; therefore be it

Resolved: That the campaign be continued and that a most careful inspection be maintained until such time as science can, with complete confidence, tell the world that this program has been successfully completed.

RESOLUTION NUMBER SEVEN

Atrophic Rhinitis of Swine

WHEREAS, the disease commonly called atrophic or dystrophic rhinitis of swine has shown a rapid and progressive spread to many hitherto uninfected areas; and

WHEREAS, this disease may, by its insidious inroads, make swine husbandry profitless on infected premises; and

WHEREAS, the disease is a current and serious menace to the future of our American swine industry; therefore

Resolved: That the United States Livestock Sanitary Association, in its 55th Annual Meeting assembled urges that:

1. Atrophic rhinitis of swine be made a reportable disease by statute and/or official regulation in all states and territories.
2. The Federal Bureau of Animal Industry formulate and institute quarantine or other control procedures for swine moving in interstate commerce for purposes other than immediate slaughter with a view to limiting the spread of this and other important diseases of swine.
3. Our Federal Government and the various states containing infected areas encourage and actively support further specific research on atrophic rhinitis of swine.

RESOLUTION NUMBER EIGHT

History of Livestock Sanitary Services

The record of the veterinary service of this country, which extends back to the War of 1812 and sketchily even beyond that, contains almost nothing of what may be called the routine livestock sanitary services of the states. The record contains considerable information on special situations such as the control of glanders, dourine, contagious pleuropneumonia of cattle, foot-and-mouth disease and official control measures for hog cholera and of course, a great deal on the suppression of bovine tuberculosis and the efforts to eradicate brucellosis. The enactment of livestock sanitary laws in the various states, their provisions, who or what was responsible for their passage, how and when and to what purpose they have been amended is but meagerly discussed if at all in our most complete veterinary libraries. The record of the names of those who have held the offices of state veterinarian and their period of tenure is largely lacking, whereas what they accomplished or attempted to accomplish is almost never mentioned.

This information is in the main available among the records in the various state capitols. It should be assembled and published and this Association should do it. The pride of our present livestock sanitary officials in their offices and their states should make them anxious to assemble this material. Much of it will have value in
meeting our present and future problems. A thorough knowledge of what has been accomplished in animal disease prevention or control and how and what has been attempted but failed and why, must certainly be useful information to any livestock sanitary official.

*Furthermore,* in case of revision of the livestock sanitary statutes of any state, to meet changed conditions or to take advantage of new information developed by research or experience, a knowledge of the service since its inception a century ago would prove most useful in planning for its future; therefore

Resolved: That the United States Livestock Sanitary Association urgently requests all its members occupying the position of chief of the livestock sanitary service in each state begin at once a compilation of the history of the service in their respective states and supply a copy of such histories to the secretary-treasurer.

Resolved further: That the secretary-treasurer be authorized and instructed to publish up to 16 pages of an epitome of these histories of general interest and information in all future annual reports of this Association until a brief of the history of the livestock sanitary service in each state shall have been published.
MR. ARNOLD: Mr. Chairman, members of the Association, ladies and gentlemen: I really don't know the purpose of this Committee, as it was appointed at the meeting in Phoenix last year and it made a report then. That report is now before the Executive Committee. I think what is embodied in that report pretty well covered the thinking of the livestock people, as well as another report seemed to cover that which was desired by the regulatory men.

In bringing in the report we felt it would be very helpful to us if it were possible for the Executive Committee to act upon that report before ours was brought in. Consequently we contacted the Chairman of that Committee and asked that the report be acted upon.

As I understand it, the matter was presented to the Executive Committee, and I think those of you who were there know what happened. Be that as it may, the reports that came from the Executive Committee indicated that there was nothing going to be done in that Committee until all of our report was submitted. It left us in something of a quandary to know just what to do.

We have had three meetings of our Committee, and those of us on the producers' end have learned through the grapevine that the things we were desirous of having didn't have much of a chance of being passed. If we were to bring in a report that would be any different from what is known as the Montague report, it would mean that this would be carried over for another year.

This is the situation as far as we are concerned as livestock producers: Some of us have attended these meetings for a good many years, others of us for not as long. In many instances we have traveled a good many miles to attend. In some instances our associations have seen fit to send us here to represent in this organization the wishes of the livestock industry.

It was never intended at any time—and we were never instructed at any time—to come here and try to take over this organization, but that we should come here to work with you men, you scientific men in this industry, if you please, and try to bring about better rules and regulations.

You men know the scientific end of this industry; we know the practical end of it. I have sat in committee meetings and I have had ideas on various matters, and after I talked the matter over with the scientific men I would find I was wrong; and vice versa, some of the scientific men had advanced ideas, and after we showed them our side of the story they would decide they were wrong. Such changes in the regulations should be and have been made.

That is the reason why we, interested in livestock, should sit down together across a table from each other in a fair, open-minded way, with no other idea in mind except to do things for the best interests of the industry. We certainly don't want a
regulation with reference, let's say, to brucellosis, or tuberculosis, or any other
disease, that is not a workable regulation. That would only be a loss of time and
money to us. We want the best regulations that can be drawn up.

Many times it is expedient to take just a little more time and be a little more
cautious. We have educational work to do. For a good many years I have been a
sanitary official in my State, and have had considerable work to do along that line.
I have found that the best way to get this job done was to work with our people,
to begin at the grass roots and formulate a program, bring it along, and educate the
people. I think most of you regulatory men will agree with me that that is the proper
thing to do.

Those of us in the industry have a better idea, sometimes, as to just how certain
matters should be brought about, and how much time should be taken. Sometimes
that little extra time that is taken will save several years in putting across a program.

We are interested in getting these jobs done in the very best way we can get them
done, and I know that the best way to get them done is to work with you men who
are the scientific end of this industry. Those of us who are in the livestock industry
and who know something about it, can tell you what we know. We should be a team,
if you please, working and pulling together.

That is why we have come here year after year. We have paid dues, but we have
not had the opportunity to vote. Your Executive Committee is so set up under your
Constitution and By-laws that it has veto power, if I may use that word, on any-
thing that the livestock people may wish to have done. That is one of the things
we cannot go along with. We are not asking for a great majority; we would be willing
to accept less members on your Executive Committee; but we want these matters
disposed of, as they are disposed of in any other organization I know of, that is,
by the membership and not by a selected group.

The men on the Executive Committee, those of you who are here, are here on tax
money. We are paying the taxes for your being here. It is taxation without repre-
sentation, a matter that caused the outbreak of the Revolutionary War.

I don't think we are unfair in coming here and asking you to bring about legisla-
tion or bills or regulations from the Bureau of Animal Industry. I haven't discussed
this matter with Dr. Simms, but I believe he would welcome a situation of that
kind rather than he would if something were recommended from here and then have
us say, "No, we can't go along with that. We must have certain amendments to it,
otherwise we can't agree with it."

If he puts it out into the country we don't want to have to say we can't go along
with it and that we must rebel against it. I believe any of the top men in the Bureau
would agree with me that a setup of that kind is better to work with than the one
we have.

With that in mind it has been impossible for our Committee to agree. I am sorry
to tell you that I have to report that at this moment we have no report. There isn't
anything we can do about it. You all know what this organization was at the begin-
ning: It was a group of livestock men who got together and formed an organization
for tick eradication. As time went on the regulatory men, after amending the or-
ganization's constitution several times, finally put it in such a position that they
took it over.
We are asking that the organization be put back into its original position as a democratic organization, one which I am sure will lend a great deal of prestige—much more prestige—than it has now.

I feel that this organization more or less is dominated to some extent. A couple of the top-flight men have made some insidious remarks about the livestock men and the industry. I resent that. I don’t care particularly to serve with that type of person. However, in all fairness I want to say that since I have been in this organization I have met some of the finest men it has ever been my privilege to know. I have sat on committees with those men; I have found them fair; they have been gentlemen. They have been wonderful men to work with, and I know they are men we can work with. It is too bad that some of them had to do what they did. Thank God there aren’t many of them in this organization.

I know that a lot of good could come from this if we could work together, but as things stand now that is impossible.

In view of this situation there is only one thing left for us to do. I am going to recommend to the livestock people that we withdraw from this organization until such time as it is possible for us to work with them; that we notify the Bureau of Animal Industry and the Secretary of Agriculture and our various delegates in Congress that the United States Livestock Sanitary Association does not speak for our industry.

I regret having to say this, but I believe it is the only thing we can do. We are not walking out, neither are we closing the doors. I would like to work with a lot of you fine men in this organization. I know that we and they can do this organization a lot of good; but under these circumstances it is impossible, and that is the only way out.

Thank you.

PRESIDENT MOLLIN: Thank you, Mr. Arnold.

Before we open this matter for discussion I would like to ask Dr. R. W. Smith, a member of this Committee, if he wishes to say anything.

DR. R. W. SMITH: I do, sir. Mr. President, members and guests of the United States Livestock Sanitary Association: As a member of this special committee, the chairman of which was the previous speaker, I should like to report that we have had two or three sessions, and that while we could come to a partial agreement on many of the questions before us, we could not agree on all.

I was told by the chairman that if certain agreements could not be reached, there would be no report. Naturally, this deprives me as a member of that Committee from submitting to you a minority report of that Committee.

However, I have listened with a great deal of interest to the discourse that has just been given by Mr. Arnold. It was given with sincere motives, I am sure. However, it does not go the whole way. You have been led to believe that as our Constitution is set up today the Executive Committee is Almighty God and all-powerful. Let us analyze the situation and the facts:

The Purpose of this organization reads as follows: "The purpose of this Association shall be the study of livestock sanitary science, milk and meat hygiene, and the dissemination of information relating thereto, the unification so far as possible of the laws, regulations, policies and methods pertaining to milk and meat hygiene,
and to the prevention, control and eradication of transmissible livestock diseases; to maintain coordination among the various livestock regulatory organizations, and to serve as livestock sanitary science clearinghouse between this Association and the following: The livestock owner, the livestock sanitarian, the milk and meat hygienist, the veterinary practitioner, the transportation and stockyard companies, the milk and meat producing and distributing companies, and various other interested agencies. The word 'livestock' as herein used shall be understood to include poultry."

Article III—Membership: "There shall be two kinds of members, official and individual.

"The livestock sanitary departments of each state, also the United States, and the Canadian, Cuban and Mexican governments, the Territories, Puerto Rico and the Virgin Islands, shall be eligible to official membership in this Association and be represented on the Executive Committee by the livestock sanitary executive official.

"Any person engaged in livestock sanitary work for federal, provincial, state, territory, county or municipal governments and any other person interested in livestock sanitation or milk and meat hygiene may be elected to individual membership."

In our By-laws we read the following:

"Article V—Dues: The dues for individual membership in this Association shall be $3 per annum, payable in advance (on or before January 1st of each year) to the Secretary-Treasurer of the Association.

"The dues for official memberships shall be $50 each per annum, payable in advance (on or before January 1st each year) to the Secretary-Treasurer of this Association."

Now, what are the prerogatives of the Executive Committee? "The Executive Committee shall constitute the administrative body of this Association and shall determine its activities and policies. All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee."

In Article VIII, which seems to be under discussion at this time, under "Amendments" to the Constitution, it reads as follows:

"Article VIII—Amendments: The Constitution of this Association may be amended by a two-thirds vote of the members of the Association present and voting at an annual meeting, provided that the specific amendment to be acted upon shall have been presented in writing at a previous annual meeting, and further provided that the amendment has received the approval of the Executive Committee."

Now, gentlemen, the Executive Committee cannot amend the Constitution without a two-thirds vote of the general assembly, and the general assembly cannot amend the Constitution of this organization without the approval of the Executive Committee. If that isn’t democracy, then I don’t want to live in a place where other things exist.

On the other side of the ledger these men say they come here and they can do nothing but warm their feet and shake hands in the lobby. Who puts on the programs here? Who elects the officers? The Constitution says that the officers of this Association shall be elected from the general assembly, who shall elect a President
and three Vice Presidents. It goes on to say that the President shall appoint all committees of this Association—and the President does it. It states further that the President and the other officers, together with the chairmen and members of the several committees, shall arrange and provide the program.

In our By-laws under the Order of Business it says that there shall be a general discussion. Unfinished business shall be taken up, then new business, nominations, and the election of officers.

If anyone comes to this convention and has to warm his feet downstairs, he has my sympathy. These several committees hold open hearings, and anyone who is a member—an official or an individual—has a privilege and a right to go before those committees and voice his views and state his case. On those committees, if the President is the man we have at the present time or that we have had in years past, all factions of the industry and the profession are represented. When those committee reports are made, I repeat, you have a perfect right to stand on your feet and discuss them from the floor. The Executive Committee, if they are doing their duty, will be listening and will take note of what is said.

Now, this may be a peculiar Constitution and By-laws, but I haven’t found it so. I have been coming here for thirty-one years without a break. The work that this Association has done—while perhaps it could have been better—certainly has made a record that no other organization like it in the world has ever made. There is no country in the world where disease eradication has been dealt with on such a scientific, straightforward and progressive basis as it has in the United States. It has been operated, as far as this Association is concerned, under the Constitution and By-laws that have been criticized here by the previous speaker.

I can well remember when things were different. I don’t know how many of you are in this room right now, but there must be 400 or 500 present. Out of the 400 or 500 here this minute, there are probably 200 different ideas. Those ideas should be expressed. You have a perfect right to express them under our Constitution and By-laws.

But there must be some smaller governing body to check on the mass of literature and reports that go into this voluminous book which is compiled in three days at our convention each year. This book of proceedings means three days of work and programs executed and carried out in our convention each year.

It seems to me that we have been doing a pretty good job. I do not object to a greater representation of industry on the Executive Board. I do, however, object to some of the statements made, that the livestock industry is dissatisfied and that certain people here represent the livestock industry in its entirety. What about the dairy industry? What about the poultry industry? What about the swine industry? They have made no plea for more representation, nor have they voiced any dissatisfaction.

It has been stated that the Executive Committee is made up primarily of paid servants. I am proud of that fact. Let me tell you, gentlemen, that when the livestock regulatory officials of the several states come here, they not only represent those who are growing the livestock of our country, but they represent every soul from the cradle to the grave. They represent every taxpayer in their respective
states, and they are responsible to every taxpayer and to every citizen in their respective states.

Their expenses are paid to come here, and their dues in this organization are paid by those taxpayers. When we say that we should confine our interests solely to the production of livestock, we are missing the boat, because if it were not for the consuming public there would be no livestock for us to control as far as the diseases that they are heir to are concerned.

There seems to be an idea that inasmuch as 80 per cent of the meat producing animals are grown west of the Mississippi River, that is all there is to the livestock industry of our country. May I say to you that by the same measuring stick, 80 per cent of that meat is consumed east of the Mississippi River, and it is folly for us to think that one group can live and survive and grow without the other. The great dairy and industrial east would never thrive, grow nor succeed if it were not for the great beef growing country of the West, and neither would the west grow beef if it were not for the East.

I agree with the previous speaker that we should get together—but not necessarily on a one-sided agreement. If we are going to take in the livestock industry on an equal basis with the scientific men who built this organization to where it is today, then let's take them all in. They seem to want to refer to the livestock industry as just one group—the beef group. How foolish!

I hope I have made it plain to you that under our present setup the general assembly has as much or more to say about the conduct of these meetings as does the Executive Board, which must take care of the financial end of the Association, which must act as a clearinghouse for the reports that are sent out all over the country; and it also must have a check on the general assembly, especially so now when we are moving from city to city and section to section of our country with our annual meetings.

Here in the West you have a predominant gathering of those interested in beef. When we move eastward you will find a predominantly large gathering of those who are interested in dairy and poultry products, and under a setup where all questions could be decided by the general assembly it would be very easy for one section to fight against another—for one section to undo what another section has done. It seems to me that we are letting these so-called mountains hide the green valley that grows below them. We are grabbing at obstacles that have never existed—or at least that haven't existed in the last several years.

I stated that had I had an opportunity I would have been glad to have submitted a minority report that would have provided for the addition of delegates from the industries, to be selected by and from the general assembly. Those delegates would have been active members of the Executive Committee. I don't have that privilege, however, but I do want you to know that those who are at the head, who have been elected or appointed by the duly elected representatives of the respective states to represent the industry in its entirety, are openminded and are now and always will be willing to act for what they believe to be the best interests of this organization which has meant so much to the livestock industry.

Thank you.

President Mollin: Thank you, Dr. Smith.
JUDGE JOE G. MONTAGUE: Mr. President, members of the convention, and guests:
Like Mr. Arnold, I regretfully say to you that his report and the recommendation he has made are the only course of conduct that a self-respecting livestock producer can take.

We are interested in this organization; we are deeply interested in it. Our interest became aroused because we found that statements were being made (and this happened a number of years ago) before the committees of Congress and elsewhere, that the United States Livestock Sanitary Association spoke for the livestock interests of the nation. We who produce livestock, and who at that time knew very little about the United States Livestock Sanitary Association, began wondering what that organization was, and in what way and by what authority it spoke for our industry.

That caused us to make an investigation, and it inspired an invitation from this organization for some of us to join the Association. A good many of us did so.

Two years ago at the convention in Columbus we were made aware of the extremely peculiar Constitution and By-laws of this organization. I will say to you as somewhat of a confession that prior to that time I had never read the Constitution and By-laws, because ordinarily they are not very material in the operation of an organization of this kind.

But I learned at that meeting that this organization was so constituted that regardless of what a convention might do, regardless of what the body politic of the organization might do, regardless of how you might act upon a resolution or an officer's report or a committee's report, the Executive Committee was empowered by the Constitution and By-laws with such authority that it could override the action of the general assembly, veto that action, and take exactly the contrary course of action—and that that contrary course of action would be known and recognized as the official position of the Association, in direct contradiction to the action of the assembly.

That caused us to make some comment in Columbus, and it raised a question that that was a peculiar situation and that there should be some type of amendment to the Constitution and By-laws so as to reinvest in the body of the Association the power to determine its own policies, and for that determination to be the official determination of the Association.

We were sat upon pretty severely by members of the Executive Committee which was then possessed of these extraordinary powers vested in them by these peculiar By-laws.

Nevertheless, last year in Phoenix I proposed three amendments to the Constitution and By-laws, in accordance with the By-laws themselves. The proposal was reduced to writing. You will recall that at the immediate time it was not in writing, but it was reduced to writing before the argument was concluded.

The first of these proposals was to the effect that there should be added to the Executive Committee an actual stockman from each of the forty-eight States in the Union. I am going to analyze these proposals one by one. That proposal has been represented to me by five different members of the Executive Committee (some of them officers of the Association) as being a most unreasonable, intolerable sort of amendment imaginable. Why?
At the present time we have on the Executive Committee the regulatory officials from each of the forty-eight states. Why is it unreasonable that the people representing the industry from those same states should not be on that Executive Committee?

Oh, I realize the fact that an Executive Committee of 100 or more people might be unwieldy; but if that be true, the entire reduction should not be taken from the industry. It might be reduced proportionately throughout.

However, this amendment and the remarks that were made by Dr. Smith, and remarks we have heard around the convention, bring out the fundamental difference between these gentlemen who would perpetuate themselves in power and our thinking, and that difference is this:

Dr. Smith brought it out most clearly to me when he said that the regulatory officials represent the entire livestock industry of the United States. We in the industry will not subscribe to that philosophy. We say that this organization or any other organization in which the livestock regulatory officials represent the regulatory bodies of the states and as members of this Executive Committee—that is their function, to represent the regulatory bodies of their respective states.

We in the industry itself may be egotistical, but nevertheless we feel that we are amply able to represent ourselves, that the regulatory bodies stand on one side of the industry and we on the other. They can't represent us in the functions they perform. They may assert that they represent the entire nation from the cradle to the grave, as Dr. Smith said, but they do not represent the producers of livestock.

As far as I know, the producers of livestock have never empowered any organization or any group of individuals to speak for them in the United States; and most assuredly, when these gentlemen assumed the offices they hold in their respective states, there was not incorporated in their respective oaths of office the function or prerogative of representing the livestock industry of the United States. That is the basic and fundamental difference between us.

They take unto themselves this attribute of being the representative of the livestock industry, and we of the industry say, "You don't represent us. We represent ourselves. We are perfectly capable of selecting our own representatives and empowering them with such powers and duties as we may see fit to give them." That is the fundamental difference.

Dr. Smith says, "Oh, I wouldn't mind letting the livestock industry have some additional representation on the Executive Committee." That is indeed kind of him. We thank him for the crumbs that he would throw from his table; but what part of the industry is he going to allow this representation? This livestock industry of the country is a varied organization. Is he going to confine it to the beef cattle? We of the beef cattle industry don't want that kind of thing. Is he going to confine it to the dairy people? The dairy people don't want just that. Is he going to confine it to hogs or poultry or sheep or goats or to Siamese cats, or what? Who is he going to give this slight bit of additional representation to?

That is something which he as a member, with his self-assumed power and the self-perpetuating power of the Executive Committee, would grant to us in his indulgence and in the graciousness of his soul—to us, who are producers.
Yes, gentlemen, you can talk about democracy. When I mention that word I want to come to my second amendment, which actually has two horns:

Under the present By-laws it says, "The Executive Committee shall constitute the administrative body of this Association and shall determine its activities and policies." I warrant you there isn’t another such statement in any constitution or by-laws in the English language, and I darned near think there wouldn’t even be one in Polish.

To that section of the Constitution and By-laws last year in Phoenix I addressed two amendments. The first was that I sawed off that statement so that it would read merely, "The Executive Committee shall be the administrative body of the Association," and by my amendment I would strike that part which says that the Executive Committee "shall determine its activities and policies."

The second part of my amendment was to strike that part which I will now read: "All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee." To that particular section I addressed an amendment which reads as follows: "All recommendations and reports of officers and committees shall be made to the Association assembled in convention, and that the vote of such convention shall be final on all such matters."

Under the present section of the Constitution and By-laws, regardless of what this convention does, or any other convention operating under these By-laws, the Executive Committee has the power to veto what you do, and to take diametrically the opposite course.

For instance, in the consideration of foot-and-mouth disease, just to illustrate my point, let us suppose that the assembled members of this Association, in convention, adopted a resolution to the effect that if foot-and-mouth disease should break out in this country we should follow the slaughter and burial method, and not use vaccine. Under these By-laws the Executive Committee could say that the United States Livestock Sanitary Association adopts as its policy the doctrine that vaccine should be used in the event of an outbreak of foot-and-mouth disease.

They could do that, and it would be the official policy and stand of this organization, in direct contradiction to the policy adopted by the convention. If that is democracy, Dr. Smith, then I am a Jewish rabbi preaching in a nigger church.

Now, gentlemen of the convention, I want to talk to you a little bit about the democracy of these stands. They would keep to themselves this authority to overrule what you and every other member of the Association adopts as a policy, regardless of the fact that you also are dues-paying members of the Association.

They are official members of the Association and also members of the Executive Committee, and I would bet a lot that their $50 dues that are paid to the Association to insure their position as members on the Executive Committee are paid by the taxpayers of their states, and not by themselves.

Paid out of an appropriation from their state. And they don’t pay it themselves—and yet they would take to themselves power over and above the rights that you, who pay your own dues, might have.

In addition to that, the most fundamental principle of all the American principles is that this country is a self-governed country. We established that principle by a Revolution that was pretty bloody and was fought for seven years against a House
of Lords that, under the laws of that time, had veto power over every act that any of the colonial governments in their assemblage might adopt, just as my lords of the Executive Committee today have the veto power over this convention.

We fought a war over that, and we established in this country the doctrine and the principle—I say it is the immutable principle—that the country must govern itself. But in this assembly, in this Association, we don’t have the American principle. We don’t have an Association governing itself. We don’t even elect the Executive Committee. We have a house of lords sitting as an Executive Committee that is self-perpetuating, writing the policies and determining the activities of this Association. If that is democracy, then give me something else.

We have spoken about taxation without representation. Of course that is it. The amount of money involved is very little, but the principle is very, very important.

May I close my remarks with this statement: The self-respecting livestock people have no other course of conduct to follow than to withdraw from this organization, not only because of the failure of the Executive Committee for a whole year to report on the Phoenix amendments, but because of—oh, a myriad of remarks and statements that were made, some of them by high-ranking officials of this organization to the effect that the effort of livestock people to get recognition here was a Stalin-like movement.

Stalin-like? The man who made that remark either displayed his ignorance or his malice, I don’t know which. What is our principle? Our principle is that we want to be a self-governing organization, and we want to work with our regulatory officials. We don’t want to work for them, and we don’t want to be worked by them.

When they talk about communistic or fascist principles, what are those principles? I will drop that communistic matter, but I call your attention to this philosophy that grew up and that caused the latest great war:

It was a fascist doctrine in Italy and in Germany, where all government was delegated to a little group of bureaucrats, and the power of the citizen to determine his own government, or even to have a voice in his own government, was taken away—just as this effort to reserve and preserve for themselves the power to run this organization, even to contradict the voice of the assembly, is an arrogation of that same fascist philosophy which we fought so hard to overthrow.

Gentlemen of the convention, I say again regretfully that with self-respect to preserve, we livestock people have nothing to do but to withdraw from this organization. We must preserve that self-respect.

PRESIDENT MOLLIN: Thank you, Judge Montague.

Would some other member of the Executive Committee like to appear? Let’s give equal opportunity. Is there any member of the Executive Committee who would like to speak now? All right, Mr. Aaberg.

MR. HERMAN AABERG: Mr. President and gentlemen, I want to make clear whom I represent. I happen to be the director of the livestock department of the American Farm Bureau Federation. The American Farm Bureau Federation is a general farm organization. At the present time we have one and one-half million farm families who pay voluntary dues. Forty-seven states are federated with it. The membership determines the policies at the county level, at the state level, and at the national level.
I want to make it clear that the American Farm Bureau Federation does not speak for any livestock group. We speak only for our membership. I would point out, however, that more than 80 per cent of our members are livestock producers and feeders, and if you add to that the producers of poultry it would be considerably larger. So, I am here to present the views of over one million of our livestock and poultry producers.

About three or four years ago the Board of Directors of the American Farm Bureau Federation requested that I take out membership and participate in this organization. At the meeting in Phoenix last year I learned, to my disappointment, that the Articles of Incorporation and the By-laws did not provide for representation of livestock producers and feeders. I was rather pleased when the convention decided that the Montague amendments were constructive. I understood that those amendments had been referred to the Executive Committee for action. I assumed they had been favorably acted upon. I heard nothing to the contrary.

At a meeting of the Board of Directors of the American Farm Bureau Federation about a month ago, meeting with our National Livestock and Dairy and Poultry Advisory Committees, we considered very carefully these proposed amendments. We thought they were constructive. Upon recommendation of our Directors these amendments were submitted to each of our state farm bureaus, with the request that they give them consideration and, in addition, that they delegate a representative to take out membership, to come to this meeting, to participate in the affairs of the Association, with the understanding that they would be given the privilege of voting on these amendments or any other action of the convention.

I am sorry that it appears that these men will not have that privilege. I think there are representatives here from twenty of our state farm bureaus, and I believe there are dairymen, poultry men, swine men and beef cattle men here. I know they can speak for themselves.

I also want to make it clear that it is the position of the American Farm Bureau Federation (and I believe of every other farm organization) that they presume to represent agriculture, or at least their members. They are unwilling to permit any individual who might be elected or appointed to a state office to speak for them.

I am certain that the American Farm Bureau Federation does not look upon Dr. Simms as the spokesman for the livestock industry just because he happens to be the regulatory official; and yet we have the highest regard and deepest respect for Dr. Simms. We cooperate with him fully. We look upon his office as an administrative office. His job is to administer the law, and I am sure that all of our state sanitary officials as administrators of the law, and not as representatives of the livestock and poultry industries.

I am sure that Mr. Herb Voorhes, President of the New Jersey Farm Bureau, would not look upon Dr. Hendershott as a representative of the dairy, livestock and poultry industry; and yet I know that he feels Dr. Hendershott has done a good job as an administrator of the law. The same would be true in New Hampshire and in any of the other states.

I think Judge Montague has pointed up a very important principle, that we will not stand for this organization or any other organization of similar character speaking for the livestock industry. I know that Sam Russell, of the Illinois Agricultural
Association, who is here and who can speak for himself, who represents 188,000 farmers, is better able to speak for the livestock industry of the State than any other person in it.

The same can be said for Iowa and many of the other states. I will leave it up to the states to speak for themselves if they wish.

I am reluctant to have to say that if we do not have the privilege of having something to say about the policies of this organization, we too have no other recourse but to do that which has been suggested by the representatives of the livestock associations, namely, to recommend to our board of directors and to our state organizations that we withdraw from membership in this Association. I hope that will not be necessary, but I am afraid it is what we shall have to do. I do not make it as a threat because I don’t believe in threats. I do believe in stating the facts, and stating them clearly.

DR. R. W. SMITH: May I ask a question just to clear the record? Mr. Aaberg, you stated you submitted the Montague amendments to your various associations or state farm bureaus?

MR. AABERG: That is right.

DR. SMITH: Did you at the same time submit the Smith amendments which were legally presented and which are now in file and which must be acted upon one way or the other by the Executive Committee?

MR. AABERG: I did not present them.

DR. SMITH: That’s what I thought.

MR. AABERG: But I want to say that the Montague amendments were approved by the convention in Phoenix, while yours were voted down. Therefore, I didn’t feel that your amendments had any standing. However, I learned after I got here that they had been filed and were being considered by the Executive Committee. I wished we had presented your amendments. I feel we should have.

I would like very much the privilege of our folks here having the opportunity to vote on not only the Montague amendments but on yours. I don’t want to rule out that possibility.

DR. SMITH: If you had consulted your Constitution and By-laws you would have known that any vote that this assembly took in Phoenix was just superfluous. Under the order of business it must pass by a two-thirds vote of the assembly after it has lain over a year. Both proposals were submitted in Phoenix.

MR. AABERG: I also recognize, Dr. Smith, that if the Montague amendments are voted upon here by this convention, your Executive Committee still has the power to veto them.

DR. SMITH: Correct. No amendments can be adopted unless they receive a two-thirds vote of the legal voting members of the assembly and also are approved by the Executive Committee. They must lie over one year before they can be brought up for vote.

MR. A. G. PICKETT [Kansas]: I don’t want to make a speech. I want to clear up a statement that Dr. Smith just made. He made it when he presented his case. He would have left the impression that the assembly has the right to adopt these by a two-thirds vote, and then he said they must also be approved by the Executive
Committee. That is wrong. The assembly does not even get a chance to vote on them until the Executive Committee has approved them.

DR. SMITH: It's the same difference.

DR. WEST: Mr. President and members of the United States Livestock Sanitary Association: I would just like to point out that this whole discussion and, as I see it, the failure of the Committee on Revision of the Constitution and By-laws to report, has been predicated upon action which has not yet been taken.

At the present time there are two proposals for the amendment of the Constitution and By-laws. The Executive Committee yesterday was in the process of discussing them. They were just about to be brought to a vote when the Committee meeting was interrupted. It was necessary to discontinue business, and there has been no action taken to date. However, such action will be taken.

This whole assumption has been based on the fact that no action has been taken. There is no way by which action can be taken.

Furthermore, it appears to me that in Mr. Aaberg's proposition that these amendments should be referred to the floor, under the present Constitution and By-laws, are entirely out of keeping, for the reason that the present Constitution and By-laws, which were adopted not by any present members—I don't believe there is a member on the Executive Committee today who was present with these Constitution and By-laws were adopted—but that Constitution and By-laws imposes a very definite duty upon the Executive Committee, namely, that they must approve any proposed amendment before it can be submitted to the general assembly.

In keeping with his duty, if any member of that Executive Committee voted to approve those amendments when in his opinion they were deleterious to the future welfare of this organization, he would be delinquent in his duty. If he voted for them just for the purpose of bringing them out on the floor, he would be approving something which in his heart he knew was wrong. I, for one, would never vote in that manner.

Thank you.

MR. AABERG: May I say that you still would have veto power after that.

DR. WEST: No, sir.

MR. AABERG: Isn't that right?

DR. WEST: No, sir. After it is approved and presented to the organization, if it is carried by a two-thirds vote, it becomes a part of our Constitution and By-laws.

PRESIDENT MOLLIN: Dr. West, I presume you might possibly refer it back without recommendation, in seeking the vote of the convention. I don't know whether that would be according to the rules, but I see no objection to it. At any rate, at one time or other, either before or after the action of the convention, you do have veto power.

DR. WEST: I would like to read that.

PRESIDENT MOLLIN: Dr. Hendershott and Dr. West think it has to be approved first, before it can be submitted to the convention.

We have had very earnest debate. I don't suppose it is proper for me as President to take part in the debate, but if you will indulge me for a few moments I would like to say just a word.

When I took over as President in Phoenix, this one thing was my ambiton—to
bring about better working relations. It doesn't look as though we are going to
achieve them. But next to that, if we can achieve it, then for goodness' sake let's
part friends, and let's not have any malice or any rancor or any heat.

As I have said, we have had earnest debate, ably presented by very capable men.
I am glad it was handled that way. Whatever we do from now on, we are still going
to be friends, and we will go our way in peace.

Thank you.

Mr. Ray Willoughby: Mr. President and gentlemen, first I want to say that I
am a producer, and I represent several producers' industries, one on a national
scale. I told you that yesterday.

I have a sincere feeling for both of these groups. Of course it is my feeling that
the producers and the industry cannot go along with the present Constitution and
By-laws. I concur 100 per cent with everything Tom Arnold and Judge Montague
and these other folks, also Herman Aaberg, said for the industry. I certainly shall
recommend to my people that we withdraw from the United States Livestock Saniti-
ary Association.

This is why I arise to speak, gentlemen: I know Ferd Mollin has done his utmost.
He is a layman, a man of the industry, and he has done all he could to mold this
thing. I felt at times that there was not proper consideration given to the industry,
and I feel that way now. What I got up here to say is that I am not going to leave
here with any animosity in my heart. I don't think you people should, either. I
don't think you should fight and raise dirt about these matters, because only dogs
and bulls and animals fight. You don't get anything done until you sit down and
try to work it out. Time is the best cure for any wounds. In time to come it may
be possible to work this out on a basis that we will all understand.

As of today I would recommend that the industry, in a dignified manner, with-
draw from the United States Livestock Sanitary Association. I speak as their spokes-
man for the industry.

Secretary Hendershott: I want to say that I appreciate the remarks made
by Ray Willoughby. I think all of you know that deep down under all of this I
have been the stimulus for what has occurred today. It has been my desire for a
number of years, and it is still my desire, that we in this organization have greater
representation from the industry. By that I don't mean that I want the industry
to take over. I don't mean to say we want to surrender what we think is our of-
official duty.

But we do need, we have needed in the past, we have enjoyed to a greater ex-
tent in the last few years, I believe, and I hope a few of you fellows will maintain
membership so that we may be able to enjoy in the future, the advice that you can
bring to us from the production side in the deliberations of our committees.

I feel keenly that our committee reports will be better if, on those committees
and helping to make up their reports, we have representatives of the industry
which we are committed under the law to serve. Today we saw an example of that
kind of collaboration which has brought both industry and regulatory medicine
closer together in the interests of the report of the current Committee on Brucel-
losis. I sat in with that Committee the first evening of its deliberations. On that
Committee there was a young man who became a member, at this meeting and
was asked to serve in place of another member of industry unable to be present. I admired his contribution to that Committee. I think we need that sort of man in our group and in our membership.

I think he did more to bring the report up to the point of acceptance than any other one, possibly, other than our good friend Tom Arnold, who also was on that Committee.

That is a thing I envisioned when I started out to broaden the membership of this Association, and I personally have been guilty of inviting individually and collectively many members of industry to participate in our deliberations.

I am sorry—sincerely sorry—that certain things have happened. On the other hand, and in another light, I am not sorry they did happen. We have had more interest in this splendid organization in the last three years than we have had in the ten years before. So, I think some good comes out of all these controversies.

I don't think we can compromise with our view. I spent all evening with the Judge, and we parted friends, I hope. I know I expect him to buy me a dinner when I find him in the halls of Congress, if I get down there, just like he does whenever I can tag him for a meal. I think he is an ornery old cuss in a way, and I like to argue with him. I like him personally. I admire him.

JUDGE MONTAGUE: I resent that word "old". [Laughter]

SECRETARY HENDERSHOTT: I hope that we will still have members of industry assisting us in formulating committee reports. It is important to you, and I know it certainly is important to us.

I don't know what the Executive Committee will do with the two amendments that are before it. We were in hopes that this present Committee, after a year of study, might present to us something better than that which had been presented to us last year.

Before I sit down I would like to clarify one other point: Under our Constitution, any member can propose an amendment to the Constitution. It does not require a vote of the assembly to present it to the Executive Committee. It must lie in the hands of the Executive Committee for action. It lies there for a year, so that all might have an opportunity to study it. At the next annual meeting the Executive Committee must dispose of it one way or another. If the Executive Committee feels the amendment is worthy, and can pass upon it so it can come out on the floor for a vote, at which time it requires a two-thirds affirmative vote of the members in attendance for it to become a part of our Constitution and By-laws.

I hope we will see some of you breeders' faces again, even if you do feel you must now withdraw.


What I have to say is said in dead earnest. I was on the Committee on Eradication of Hog Cholera. I was told today in that meeting that the man who was talking represented the Ohio Swine Breeders, and he got his information from a garbage feeder. I was told he was a damned dirty garbage feeder.

I don't want that kind of representation. These men have stated hypothetical cases. Have such cases as they have cited happened in the past with the present
form of the Constitution and By-laws? I haven't heard you point out anything that has happened that is undemocratic.

We have grass roots. I am a member of the Farm Bureau and I pay my dues. We heard a statement made today that they got their information from the grass roots. I'll tell you the grass roots that you get it from: My wife, who is sick in bed today, was elected secretary of our farm council. In that council we have a doctor of philosophy, an attorney—a man who is second in power in Ohio in the Internal Revenue Department, a veterinarian, a banker, and five or six farmers.

She was secretary, and we drew up some rules and regulations or resolutions and sent them to the county Farm Bureau. In them we stated parenthetically, "If this is published as is, you may publish it; otherwise don't publish it." It was published and it was changed. My wife called the men who are getting their information from the grass roots, out on the farm, and she called them down. There hasn't been one of our meetings published since then, and it has now been two and a half years.

Is that grass roots, when they change your meetings and then they refuse to report the following sessions? Has anything like that happened in this organization, with your high and mighty power in your Executive Committee?

Now, I have tried to find out who would represent me as a swine breeder from the State of Ohio. I would a whole lot sooner have that great Dr. Geyer represent me than a garbage feeder. I will continue to fight for Doc Geyer as head of the State veterinarians in Ohio as long as I breathe, if he continues to be as fair and square as he has been.

I am positive that if you went to the livestock men in the State of Ohio and asked them whether they wanted a garbage feeder to represent them or whether they want Dr. Geyer to represent them, they will choose Dr. Geyer.

In my opinion you have made a mountain out of a mole hill. There has been no proof in any written or verbal statements that I have heard, or by the grapevine, that says this Executive Committee has done anything wrong—that it has been arbitrary in any of its decisions. How an assembly like this could hear the Hog Cholera Committee's report and pass on it in the three days you are here, is impossible for me to understand. We worked and thought about it for two days at Purdue last summer. We thought about it since then; we wrote letters; we have done this and that and something else. How you could consume it all, even though our Chairman read it, and how you could know whether there should be changes made or whether it would be workable, and how you could pass it at a meeting like this, I don't know.

This Executive Committee, the members of which you elect, has a chance to study these things. They are trained along those lines. Dr. Geyer is practical. He was born and reared on the farm. He was a practitioner. He knows what things will work. He has pleaded in every meeting I have ever sat in on with him, "Let's not force these people; let's educate them so they will do it."

An Executive Committee that has a man of that caliber on it—are they high and mighty and all-powerful? I still trust Dr. Geyer as my representative in Ohio, and I think the livestock breeders of that State will trust him before they would trust a garbage feeder.
DR. CURRY: Will the gentleman yield to interrogation?

MR. SMITH: Yes, sir.

DR. CURRY: May I ask how long you have been a member of the United States Livestock Sanitary Association?

MR. SMITH: Over a year; last year. I paid $6 of my own money.

DR. CURRY: You have been a member a little over a year; is that right? Well, I must say that you learn quite rapidly.

I have been a member of this Association for nearly thirty years, and you, according to your statements, know more about the inner workings of this so-called (as you stated) all-powerful Executive Committee than I do.

Gentlemen of the convention, it is with a great deal of reluctance that I arise to say even half a dozen words on the question; but I do want to keep the record straight so that the gentleman from Ohio can go back to his sick wife. I trust you find her greatly improved sir. When that is taken care of, then I trust you will devote your time and attention to taking care of what I imagine is a very valuable herd of swine in Ohio.

Being more or less a host to this convention, when the invitation was presented to this body in Phoenix that we in Kansas City would be most happy to have the privilege and pleasure of having you meet with us here, I feel I should refrain, as your host, from taking any part in the discussion which is so highly explosive as this appears to be. I want to say briefly that all that has been said is not necessarily true, nor can it be substantiated by the record.

I am a member of the Executive Committee. I am in favor of giving representation to the livestock industry, whom we as state livestock sanitary officials are pledged to serve in our respective states. When I took the oath of office I made that pledge.

I know of no better way that I can serve the industry of the State of Missouri except through close cooperation, advice and council. I certainly would be most happy to have a cross section, representing all phases of the livestock industry in Missouri, accompany me to a meeting of the United States Livestock Sanitary Association and that he have the power to sit with me in what has been and is now the closed sessions of the Executive Committee. I feel that the man could go back and could approach the various phases of the industry and could tell them what he saw and heard and what was accomplished at the meeting.

I would have plenty to do to take care of my chores in the livestock disease control phase of that industry. Through cooperation and through action with an unanimity of purpose, we accomplish the greatest things.

Reference has been made to certain amendments presented at the Phoenix meeting. True, two amendments were submitted. One was rejected on the floor of the convention, and one was approved by the convention. The Montague amendment was presented to the Executive Committee with a motion that it be accepted. After a great deal of debate that motion was finally placed on the record.

A motion was made at Phoenix that the President appoint a new committee to make further study toward revision of the Constitution and By-laws. I say advisedly that I would rather not have been on that committee, because I knew from
the very start that the matter was a "hot potato". I even begged to be relieved
of that responsibility.

My approach to this whole problem has been to act more or less in the capacity
of a moderator, holding malice toward none, ever striving to bring about that happy
medium between industry and this Association.

With that thought in mind I attended the Executive Committee meeting last
night, after hunting to find where they were in session, because the meeting was
not held in the room that had been designated for that purpose, which I arranged
for with the hotel management and naturally thought was where the meeting would
be held. We were crowded and packed into a little 2 x 4 room that we could hardly
fit into, crowded to the very corners—for what?—for the purpose of discussing
one of the weightiest problems that has been brought before this Association in
many, many years.

The Committee was in session before we finally located them, and one of the
first motions or actions to be taken was a motion to delay any action on the two
amendments that had been submitted at the Phoenix meeting. Statements were
made later that they should not take any action on those proposals until the
present committee, appointed by President Mollin, submitted a report indicating
what they had in mind.

According to our program, that committee was not scheduled to make a report
until this afternoon. The question was presented to the Executive Committee
with a plea that we come before them to find out what their pleasure was concern-
ing the Phoenix proposals or amendments, or whatever you wish to call them. That
indicated to me that there was somewhere a lack of willingness, a lack of harmony,
or any wish or desire to approach the question with an open mind, and debate it
on its merits.

Well, unfortunately something happened, and the meeting was brought to a
sudden close by a motion to adjourn. Frankly, I was very glad that motion was
made at that time.

Well, unfortunately something happened, and the meeting was brought to a
sudden close by a motion to adjourn. Frankly, I was very glad that motion was
made at that time.

In closing, gentlemen, I just want to say that I regret very, very much that this
problem has come to the point it has reached. There has been entirely too much
political intrigue injected into this matter. That intrigue has been on the part of
some members of the Association. I appreciate the seriousness of that statement,
but I am in a position to defend that statement, regardless of what may be said
to the contrary.

As long as the question is approached in that manner we will never reach the
goal of unanimity of purpose and action so we would be working together like a
good, faithful, team of old brood mares.

It has been said that certain groups would withdraw their membership from the
Association: If you were in a spot where you could listen to Mr. Gromyko, Mr.
Vishinsky, Mr. Molotov, I am sure they could present a picture that would make
you wish you could retire and live behind the Iron Curtain, because it would
sound so good to you. For my part, I would prefer to live in the good old U. S. A., where, thank God, we still have the privilege of free speech without being sent to the government barber, and where we do not have to put up with too much political intrigue in solving these problems.

We still have ways and means of approach, one of them being to meet around a table, precisely as our fighting men in Korea are trying to do in bringing about peace, in the vicinity of Pusan. They have made many attempts, but all have failed. They persist, and will continue to persist until victory prevails for them.

Thank you, Mr President.

DR. QUIN: Mr. Chairman, may I have a moment to arise to speak under the privilege of membership?

PRESIDENT MOLLIN: We will have to cut this off pretty shortly, gentlemen.

DR. QUIN: Gentlemen, I am taking the liberty of speaking to you as Chairman of the Committee on Public Relations of the American Veterinary Medical Association, which represents 16,000 working veterinarians in the United States.

The instructions of the AVMA to our Committee were that we are to exert all possible effort to create better harmony, better working relationships, better unity, between the veterinarians and the livestock people of the United States, that we may mutually curtail livestock losses and thus make a better and more productive industry.

I do not think your differences here today are compatible with the best interests of the working veterinarians and the working livestock people of the United States, and I regret extremely that with the talent available in this room there can't be a moratorium in hypocrisy and oratory and selfish interests, and that the President appoint a special committee to study this proposition and report in the morning, for action, to re-establish unity within your organization.

MR. RAY SWANSON: I am Ray Swanson, from Idaho, and I am a member of the Board of Directors of the American Farm Bureau Federation. If there is any question in the mind of anyone here that Herman Aaberg was not speaking for the American Farm Bureau Federation, I want to set you straight, because he, by authority of the Board, was doing just that; and the Board considered these matters for the last year, and the year before that.

We didn't go out on our own initiative at all. We got our information from people in the states that we represent—the livestock people—so if this gentleman over here thinks that this didn't come from the grass roots, he certainly is mistaken. That information did come from the grass roots.

Regardless of what happens here, folks, whether we withdraw or whether we don't withdraw, we, the members of the American Farm Bureau Federation, are going to continue to work with our representatives of the livestock industry in the various states. I am sure that some good has come out of this discussion, and I don't think it will be very long—if we do withdraw—before we have a unity of thought and organization.

Thank you very much.

PRESIDENT MOLLIN: Do we have time to take up the report? Just one moment before you leave, gentlemen. I would like to refer to the remarks made a moment ago, about a garbage feeder. I don't know the gentleman; I may have met him, but
I don't know him by name. It doesn't make any difference what you feed your cattle or hogs, if you feed them garbage or corn—you are still a hog man, and you are entitled to consideration as a hog man.

I don't care whether you feed your cattle citrus products or beef or corn or anything else—you are a cattle man, and as such we recognize you in the American National Cattlemen's Association.

It just so happens that there is another man in this meeting—I can't see him from here, but he is registered—who formerly had a very large garbage contract, and he raised the pigs, thousands and thousands of them, each year. Certainly he is entitled to the same consideration as is a man who raises pigs or any other cattle. On top of that, he is one of the finest men I have ever known.

As far as I am concerned, when anyone says anything about a man who is a garbage feeder, it doesn't mean a thing to me. He is just as good a livestock man as anybody else. Thank you.
DISPOSITION OF AMENDMENTS TO CONSTITUTION AND
BY-LAWS PRESENTED AT THE 54TH ANNUAL MEETING

SECRETARY HENDERSHOTT: At last evening's meeting of the Executive Committee, Nov. 15, 1951, I was instructed to inform the general assembly that the two amendments which were introduced at Phoenix, Arizona, one year ago, and filed with the Executive Committee, on which action one way or other must be taken at this meeting, were acted upon. Both of those amendments were voted down.

It was the feeling of the Executive Committee—I might say it was almost the unanimous feeling of the Executive Committee, there having been but one vote cast for them—that both of these amendments be set aside and not presented to the assembly for final action at this meeting.
PRESENTATION OF KEY TO RETIRING PRESIDENT

PRESIDENT MOLLIN: We come now to unfinished business of the convention. Mr. Secretary, you have the floor.

SECRETARY HENDERSHOTT: Gentlemen you will recall that two years ago it was decided that we should honor our past presidents by the presentation to them of a key as a memento of their service to this Association. On behalf of the Association, Mr. Mollin, I wish to present to you this key as a memento of your service to the Association, which I am sure is doubly earned inasmuch as you were forced to serve as President of the Association in Dr. Bishop's absence at Phoenix a year ago, and have carried on in admirable fashion the conduct of this Association's meeting at this, our 55th, Annual Meeting of the Association.

Probably I, better than most members of the Association, know the effort expended and the work that is done during the course of the year in advance of our meeting by the officers of this Association. I can report to you that Mr. Mollin has had at all times the interest of this Association at heart. He has been instrumental in helping us in the assigning of members to committees and stimulating them to come through with committee reports. He also has helped us nationally in legislation.

It is a pleasure and an honor for me to present to you, Mr. Mollin, this memento of your service to our Association. [Applause]

PRESIDENT MOLLIN: Thank you. It has been a pleasure to serve you.
PROPOSED AMENDMENT TO THE CONSTITUTION AND BY-LAWS

NOVEMBER 16, 1951

PRESIDENT MOLLIN: Is there any other unfinished business?
Is there any new business to come before the Association?

DR. R. W. SMITH: The new business I wish to bring up is not new business. It is the privilege of presenting a proposed amendment to our Constitution. I want to make it plain that this is not an amendment from the Executive Committee nor from any committee appointed by the Association. It is a proposal submitted by an individual member of this Association, and as such, of course, it cannot be amended in any way by this body. If it were, it would not be an individual proposal.

Under the Constitution and By-laws an amendment must be presented and then must be held over for one year, before any action might be taken on it. I don't propose to go into any discussion as to why this is done, other than to say that out of all the discussion and the committee sessions that I have attended, this will help in some measure, at least, some of the suggestions that have been made. This is the amendment I am proposing:

Amend Article V, Section 2, line 38 of the Constitution, by adding, after the words "Virgin Islands", the following: "... and ten delegates-at-large, selected from the livestock industry, to be elected by and chosen from the membership of the general assembly," so that said Section 2 of Article V would read as follows:

"Executive Committee: The executive Committee shall be composed of the executive officer representing the livestock sanitary department of the various states and territories, the chief of the U. S. Bureau of Animal Industry, the veterinary director-general of the Dominion of Canada, the executive regulatory officer of Cuba, Mexico, the territories of Puerto Rico, Virgin Islands, and ten delegates-at-large selected from the livestock industry, to be elected and chosen from the membership of the general assembly, and the elective officers of the Association."

This is respectfully submitted by Robert W. Smith, Concord, New Hampshire.

PRESIDENT MOLLIN: Thank you, Doctor. As an individual proposal this will be referred to the Executive Committee.

SECRETARY HENDERSHOTT: An amendment to the Constitution and By-laws has been left with me and is signed by an individual member of this Association, which reads as follows:

1. Add, following the last word in line 38 (p. 331, Report of the 54th Annual Meeting):

Also an accredited representative of the beef cattle industry, the dairy cattle industry, the swine industry, the sheep industry, the poultry industry, the horse industry, the railway freight industry, the trucking industry and not to exceed five additional members representing such other interests as the Executive Committee may from time to time provide for.

2. Following the foregoing add a new paragraph as follows:

The accreditation of members of the Executive Committee shall be subject to the approval of that body.
3. Delete from line 40 the following:
and shall determine its activities and policies.
4. Amend lines 41 and 42 to read:
   All recommendations and reports of officers and committees shall, upon presentation
   to the Association, be acted upon by (1) accepting and referring to the Executive Com-
   mittee for its consideration and publication at its discretion, (2) referring back to the
   author or authors for further study and report or (3) rejection.
5. Add a new paragraph following the foregoing to read:
   No action or recommendation which would have the effect of limiting the official au-
   thority of any member of the Executive Committee as established by law or contravening
   the official regulations of any state shall have validity until it shall have been approved
   by the Executive Committee, i.e. the Executive Committee shall have an absolute veto
   authority over such matters.
NOMINATION-ELECTION AND INDUCTION OF NEW OFFICERS

President Mollin: Is there any other new business to come before the meeting? If not, we will hear the report of the Nominating Committee, by Dr. Curry, the Chairman.

Dr. Curry: Mr. President, as Chairman of the Committee on Nominations it affords me great pleasure to advise that your Nominating Committee is in thorough accord and unanimously submits the following recommendations for officers, to serve the Association during the ensuing year:

For President—Ralph L. West, of St. Paul, Minnesota; First Vice President—Dr. T. Childs, Veterinary Director-General, Canada, Ottawa; Second Vice President—Dr. A. K. Carr, Sacramento, California; Third Vice President—Dr. I. G. Howe, of Albany, New York.

Mr. President, subject to nominations from the floor, I move the adoption of the Committee's report.

Secretary Hendershott: I second the motion.

President Mollin: Are there any nominations from the floor?

Voice: I move that nominations be closed.

President Mollin: Do you wish to include in your motion that the Secretary cast the unanimous ballot for the nominees?

Dr. R. W. Smith: Mr. President, I move that the Secretary cast one ballot for the nominees as presented.

Dr. Curry: I second the motion.

The motion was put to a vote and was carried unanimously.

Secretary Hendershott: In accordance with your instructions, it is a pleasure for me to have the privilege of casting the unanimous ballot of this Association for Dr. Ralph L. West as President, Dr. T. Childs as First Vice President, Dr. A. K. Carr as Second Vice President, and Dr. I. G. Howe as Third Vice President.

While I am at the microphone I would like to announce that the total registration at this meeting is 373. About 30 per cent of them were visitors.

Also, while I have an opportunity, I want to tell all of you how much I appreciate the work and effort that has been done by Dr. Hugh Curry and Mr. A. G. Pickett in making the arrangements for this meeting. Without their assistance I am quite certain things would not have run along as smoothly as they did. We all owe them a debt of gratitude for the work they did.

President Mollin: Dr. West, I am sure the audience expects to hear a word from you.

Dr. West: Gentlemen, all I can say is that I very sincerely appreciate the honor you have seen fit to bestow upon me, and I assure you that I appreciate it from the bottom of my heart.

In my opinion the Presidency of this Association is one of the greatest honors—in fact, it is the greatest honor—that could be bestowed upon any veterinary control official in the world. To have one's name listed with the grand men who have pre-
ceded me in this position is really wonderfully gratifying. I don’t believe any of you realize how gratifying it is.

I want to assure you that I will use my best efforts for the Association, to keep it a going concern, and improve, if such is possible, its programs and activities. Thank you.

President Mollin: Dr. Childs, do you have a word?

Dr. T. Childs: Mr. President and gentlemen, I can’t tell you how deeply appreciative I am of the honor you have conferred upon me. I will have quite a hard row to hoe in measuring up to the performance of my predecessor. However, I will do the best I can.

Thank you very much.

President Mollin: Dr. Carr?

Dr. A. K. Carr: Mr. President and gentlemen, everything I could say already has been said by the gentlemen ahead of me. I assure you I appreciate this honor, and I shall do my level best to uphold the integrity of this Association.

President Mollin: I am sorry Dr. Howe had to leave.

It is now a pleasure to turn the gavel over to Dr. West and let him bring the convention to a close.

President West: Is there any further business? If not, I declare the 55th Annual Meeting adjourned. Our next meeting will be held in Louisville, Kentucky.
CONSTITUTION AND BY-LAWS
OF THE
UNITED STATES LIVESTOCK SANITARY ASSOCIATION

ARTICLE I—NAME

The name of this Association shall be "The United States Livestock Sanitary Association."

ARTICLE II—PURPOSE

The purpose of this Association shall be the study of livestock sanitary science, milk and meat hygiene, and the dissemination of information relating thereto, the unification so far as possible of the laws, regulations, policies and methods pertaining to milk and meat hygiene, and to the prevention, control and eradication of transmissible livestock diseases; to maintain co-ordination among the various livestock regulatory organizations, and to serve as livestock sanitary science clearing house between this Association and the following: The livestock owner, the livestock sanitarian, the milk and meat hygienist, the veterinary practitioner, the transportation and stock yard companies, the milk and meat producing and distributing companies, and various other interested agencies. The word “livestock” as herein used shall be understood to include poultry.

ARTICLE III—MEMBERSHIP

There shall be two kinds of members—Official and Individual. The livestock sanitary departments of each state also the United States, and the Canadian, Cuban and Mexican governments, The Territories, Puerto Rico and the Virgin Islands shall be eligible to official membership in this Association and be represented on the Executive Committee by the livestock sanitary executive official.

Any person engaged in livestock sanitary work for federal, provincial, state, territory, county or municipal governments and any other person interested in livestock sanitation or milk and meat hygiene may be elected to individual membership.

ARTICLE IV—MEETINGS

The meetings of this Association shall be annual and special.

ARTICLE V—OFFICERS

The officers of this Association shall be: President, First Vice-President, Second Vice-President, Third Vice-President, Secretary-Treasurer, and an Executive Committee.

The officers of this Association shall hold office for one year or until their successors have been duly elected and qualified.
EXECUTIVE COMMITTEE

36 The Executive Committee shall be composed of the executive officer representing the livestock sanitary departments of the various states and territories, the Chief of the United States Bureau of Animal Industry, the Veterinary Director General of Canada, the executive regulatory officer of Cuba and Mexico, the Territories, Puerto Rico and the Virgin Islands, and the elective officers of this Association.

37 The Executive Committee shall constitute the administrative body of this Association and shall determine its activities and policies.

38 All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee.

39 The First Vice-President shall be ex-officio chairman of the Executive Committee.

40 The Executive Committee shall elect yearly a Secretary-Treasurer for the Association. The Secretary Treasurer shall receive such salary and allowance as may be fixed by the Executive Committee.

41 The Executive Committee shall cause to be audited annually or oftener if deemed necessary, the receipts and disbursements of the Secretary-Treasurer, and shall have authority to hear and determine all complaints filed before it in writing relative to the conduct of any member; and shall have authority to accept or reject applications for individual membership properly placed before them. Three negative votes shall disqualify for such membership.

ARTICLE VI—PROGRAM COMMITTEE

58 The President, the Chairman of the Executive Committee and the Secretary-Treasurer and the Chairman of the respective committees shall constitute the Program Committee. It shall be the duty of the officers of the Program Committee to make the necessary arrangements and provide the program for the annual and special meetings.

ARTICLE VII—DUTIES OF OFFICERS

64 1. President: It shall be the duty of the president to preside at all meetings of this Association; to appoint all committees excepting the Executive and Officers Fraction of the Program Committees; to call special meetings of the Association whenever he considers the holding of such meetings necessary for the good of the livestock industry or upon the written request of five members of the Executive Committee. The president shall be an ex-officio member of all committees.

65 2. First Vice-President: The first vice-president shall be chairman of the Executive Committee. In the absence of the president, he shall preside at the meetings of the Association. In the event of the absence, disability or resignation of the president he shall perform all duties of the president. He shall be an ex-officio member of the Executive and Program Committees.

66 3. Second Vice-President: The second vice-president shall assume the duties of the president in the event of the absence, disability or resignation of the president and first vice-president. He shall assume the chairmanship of the Ex-
CONSTITUTION AND BY-LAWS

79. In the event of the absence, disability or resignation of the first vice-president, he shall be an ex-officio member of the Executive Committee.

80. Fourth Vice-President: The fourth vice-president shall assume the duties of the president in the event of the absence, disability or resignation of the president, first vice-president and second vice-president. He shall assume the chairmanship of the Executive Committee in the event of the absence, disability or resignation of the first and second vice-presidents. He shall be an ex-officio member of the Executive Committee.

81. Secretary-Treasurer: The Secretary-Treasurer shall keep an accurate record of the proceedings of the Association. Whenever authorized so to do by the Executive Committee, he shall publish said proceedings and distribute them to the members of the Association. The Secretary-Treasurer shall also keep an accurate record of the proceedings of the Executive Committee and shall furnish a copy to each member of said Executive Committee. He shall forward to each member of each regulation approved by the Association.

82. He shall keep an accurate account of all Association moneys received and disbursed. He shall also present to the Chairman of the Executive Committee a list giving the name, occupation and address of each applicant for individual membership for the approval of the Executive Committee. He shall perform such other duties as may be authorized and prescribed by the Executive Committee. He shall be ex-officio secretary of the Executive Committee, also an ex-officio member and secretary of the Program Committee. He shall be bonded for not less than ten thousand dollars.

ARTICLE VIII—Amendments

The constitution of this Association may be amended by a two-thirds vote of the members of the Association present and voting at an annual meeting, provided that the specific amendment to be acted upon shall have been presented in writing at a previous annual meeting and further provided that the amendment has received the approval of the Executive Committee.

BY-LAWS

ARTICLE I—Order of Business

Registration.
Call to Order.
Report of Secretary-Treasurer.
President's Address.
Reading of Papers.
Committee Reports.
Discussion.
Unfinished Business.
New Business.
Nomination and Election of Officers.

Adjournment.

A suspension of the By-laws may be made by a two-third majority for the purpose of changing the order of business or to facilitate important business.

**ARTICLE II—APPLICATIONS FOR MEMBERSHIP**

Applications for individual membership shall be made in writing to the Secretary-Treasurer. The application shall give the name, occupation and address of the applicant and shall be accompanied by a fee of three dollars ($3.00), which amount shall include the membership dues for one year. Applications shall be presented in proper form to the Secretary-Treasurer, who shall in turn submit them to the Executive Committee.

An individual member may be expelled for cause by the Executive Committee.

**ARTICLE III—MEETINGS**

The annual meetings shall unless otherwise determined not less than thirty (30) days in advance by a majority of the members of the Executive Committee, be held at Chicago, Illinois, during the time of the International Livestock Exposition. The place for holding the meetings in Chicago as well as the duration of said meetings shall be determined by the Officer Members of the Program Committee of the Association.

The place for holding special meetings shall be determined by the President with due regard to the wishes of the members of the Executive Committee, the subject matter to be considered, accessibility, and the information to be obtained. The notice of time and place of holding a special meeting shall be mailed to the members at least thirty days prior to the date fixed for the special meeting.

**ARTICLE IV—QUORUM**

Twenty-five members of the Association shall constitute a quorum.

Five members of the Executive Committee shall constitute a quorum.

**ARTICLE V—DUES**

The dues for individual membership in this Association shall be three dollars ($3.00) per annum, payable in advance (on or before January 1st of each year) to the Secretary-Treasurer of the Association.

The dues for official memberships shall be fifty dollars ($50.00) each per annum, payable in advance (on or before January 1st each year) to the Secretary-Treasurer of this Association.
UNITED STATES AGRICULTURAL LAWS 1884 AS AMENDED

TITLE 21.—Food and Drugs

Prevention of Introduction and Spread of Contagion

Sec. 111. Regulations to prevent contagious diseases.

The Secretary of Agriculture shall have authority to make such regulations and take such measures as he may deem proper to prevent the introduction or dissemination of the contagion of any contagious, infectious, or communicable disease of animals and/or live poultry from a foreign country into the United States or from one State or Territory of the United States or the District of Columbia to another, and to seize, quarantine, and dispose of any hay, straw, forage, or similar material, or any meats, hides, or other animal products coming from an infected foreign country to the United States, or from one State or Territory or the District of Columbia in transit to another State or Territory or the District of Columbia whenever in his judgment such action is advisable in order to guard against the introduction or spread of such contagion. (Feb. 2, 1903, ch. 349, ss 2, 32 Stat. 792; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 112. Investigations as to pleuropneumonia, and other diseases; regulations

In order to promote the exportation of livestock and/or live poultry from the United States the Secretary of Agriculture shall make special investigation as to the existence of pleuropneumonia, or any contagious, infectious, or communicable disease, along the dividing lines between the United States and foreign countries, and along the lines of transportation from all parts of the United States to ports from which livestock and/or live poultry are exported, and shall, from time to time, establish such regulations concerning the exportation and transportation of livestock and/or live poultry as the results of said investigations may require. (May 29, 1884, ch. 60, ss 4, 23 Stat. 32; Feb. 2, 1903, ch. 349, ss 1, 32 Stat. 791; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 113. Measures to prevent exportation of diseased livestock and live poultry.

In order to prevent the exportation from any port of the United States to any port in a foreign country of livestock and/or live poultry affected with any contagious, infectious, or communicable disease, and especially pleuropneumonia, the Secretary of Agriculture is authorized to take such steps and adopt such measures, not inconsistent with the provisions of sections 111-114, 115, and 117-119, of this title, as he may deem necessary. (May 29, 1884, ch. 60 s. 5, 23 Stat. 32; Feb. 2, 1903, ch. 349, s. 1, 32 Stat. 791; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 114. Regulations for suppression of diseases; cooperation of States & Territories.

It shall be the duty of the Secretary of Agriculture to prepare such rules and regulations as he may deem necessary for the speedy and effectual suppression and extirpation of pleuropneumonia and other dangerous, contagious, infectious, and communicable diseases, and to certify such rules and regulations to the executive authority of each State and Territory, and invite said authorities to cooperate in the execution and enforcement of the provisions of sections 111–114, 115, 117–119, and 130 of this title. Whenever the plans and methods of the Secre-
tary of Agriculture shall be accepted by any State or Territory in which pleuropneumonia or other contagious, infectious, or communicable disease is declared to exist, or such State or Territory shall have adopted plans and methods for the suppression and extirpation of said diseases, and such plans and methods shall be accepted by the Secretary of Agriculture, and whenever the governor of a State or other properly constituted authorities signify their readiness to cooperate for the extinction of any contagious, infectious, or communicable disease in conformity with the provisions of said sections, the Secretary of Agriculture is authorized to expend so much of the money appropriated for carrying out the provisions of said sections as may be necessary in such investigations, and in such disinfection and quarantine measures as may be necessary to prevent the spread of the disease from one State or Territory into another. (May 29, 1884, ch. 60 s. 3, 23 Stat. 32; Feb. 7, 1928, ch. 30, 45 Stat. 59.) Sec. 114a. Control and eradication of diseases; cooperation of States and farmers' associations; purchase and destruction of diseased animals; definition of State. The Secretary of Agriculture, either independently or in cooperation with States or political subdivisions thereof, farmers' associations, and similar organizations, and individuals, is authorized to control and eradicate tuberculosis and paratuberculosis of animals, avian tuberculosis, Bang's disease of cattle, southern cattle ticks, hog cholera and related swine diseases, scabies in sheep and cattle, dourine in horses, and contagious or infectious diseases of animals (such as foot-and-mouth disease, rinderpest, and contagious pleuropneumonia) which in the opinion of the Secretary constitute and emergency and threaten the livestock industry of the country, including the purchase and destruction of diseased or exposed animals (including poultry), or the destruction of such animals and the payment of indemnities therefor, in accordance with such regulations as the Secretary may prescribe. As used in this section, the term "State" includes the District of Columbia and the Territories and possessions of the United States. (May 29, 1884, ch. 60, s. 11, as added Sept. 21, 1944, ch. 412, title I, S. 101 (a), 58 Stat. 734.)

Codification—This section was enacted by the Department of Agriculture Organic Act of 1944.

Appropriations—Section 101 (g) of act Sept. 21, 1944, cited to text, provided that Congress may appropriate such funds as are necessary to accomplish the purpose of this section.

Sec. 115—Transportation of diseased livestock and live poultry prohibited; splenetic fever.

No railroad company within the United States, or the owners or masters of any steam or sailing or other vessel or boat, shall receive for transportation or transport from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, any livestock and/or live poultry affected with any contagious, infectious, or communicable disease, and especially the disease known as pleuropneumonia; nor shall any person, company, or corporation deliver for such transportation to any railroad company, or master or owner of any boat or vessel, any livestock and/or live poultry, knowing them to be affected with any contagious, infectious, or communicable disease; nor shall any person, company, or corporation drive on foot, or transport in private conveyance from
one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, any livestock and/or live poultry, knowing them to be affected with any contagious, infectious, or communicable disease, and especially the disease known as pleuropneumonia. (May 29, 1884, ch. 60 s. 6, 23 Stat. 32; June 28, 1926, ch. 700, s. 1, 44 Stat. 774; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Codification: Act May 29, 1884, as amended by act June 28, 1926, both cited to text, also contained the following proviso: "That until May 1, 1928, cattle infested with or exposed to cattle fever ticks may be shipped in interstate commerce for immediate slaughter after one dipping in accordance with such regulations as the Secretary of Agriculture may prescribe."

Sec. 116. Same; shipment of certain cattle excepted.

Cattle which have reacted to the tuberculin test may be shipped, transported, or moved from one State, Territory, or the District of Columbia to any other State, Territory, or the District of Columbia, for immediate slaughter, in accordance with such rules and regulations as shall be prescribed by the Secretary of Agriculture. The said Secretary of Agriculture may, in his discretion, and under such rules and regulations as he may prescribe, permit cattle which have been shipped for breeding or feeding purposes from one State, Territory, or the District of Columbia to another State, Territory, or the District of Columbia, and which have reacted to the tuberculin test subsequent to such shipment, to be reshipped in interstate commerce to the original owner. (May 31, 1920, ch. 217, 41 Stat. 699.)

Sec. 117. Notice of existence of contagion to railroads; transportation of diseased stock or live poultry; penalty.

It shall be the duty of the Secretary of Agriculture to notify, in writing, the proper officials or agents of any railroad, steamboat, or other transportation company doing business in or through any infected locality, and by publication in such newspapers as he may select, of the existence of said contagion; and any person or persons operating any such railroad, or master or owner of any boat or vessel, or owner or custodian of or person having control over such cattle or other livestock and/or live poultry within such infected district, who shall knowingly violate the provisions of section 115 of this title shall be guilty of a misdemeanor and, upon conviction, shall be punished by a fine of not less than $100 nor more than $5,000 or by imprisonment for not more than one year, or by both such fine and imprisonment. (May 29, 1884, ch 60 s. 7, 23 Stat. 32; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 118. Duty of district attorneys.

It shall be the duty of the several United States district attorneys to prosecute all violations of sections 112–114, 115, 117–119, and 130 of this title which shall be brought to their notice or knowledge by any person making the complaint under oath; and the same shall be heard before any district court of the United States or Territorial court holden within the district in which such violation has been committed. (May 29, 1884, ch. 60, s. 9, 23 Stat. 33; Mar. 3, 1911, ch. 231 s. 289, 36 Stat. 1167; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Federal Rules of Criminal Procedure—Continuance of section under Rule 18, see note by Advisory Committee under said Rule 18, following section 687 of Title 18, Criminal Code and Criminal Procedure.
Sec. 119. Agents to examine and report on methods of treatment of animals, and means for suppression of diseases.

The Secretary of Agriculture is authorized to appoint two competent agents, who shall be practical stock raisers or experienced business men familiar with questions pertaining to commercial transactions in livestock and/or live poultry, whose duty it shall be, under the instructions of the said Secretary of Agriculture, to examine and report upon the best methods of treating, transporting, and caring for animals, and the means to be adopted for the suppression and extirpation of contagious pleuropneumonia, and to provide against the spread of other dangerous contagious, infectious, and communicable diseases. The compensation of said agents shall be at the rate of $10 per diem, with all necessary expenses, while engaged in the actual performance of their duties under sections 111-114, 115, 117, and 118 of this title, when absent from their usual place of business or residence as such agent. (May 29, 1884, ch. 60, s. 2, 23 Stat. 31; Feb. 9, 1889, ch. 122, s. 1, 25 Stat. 659; July 14, 1890, ch. 707, 26 Stat. 288; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 120. Regulation of exportation and transportation of infected livestock and live poultry.

In order to enable the Secretary of Agriculture to effectually suppress and extirpate contagious pleuropneumonia, foot-and-mouth disease, and other dangerous contagious, infectious, and communicable diseases in cattle and other livestock and/or live poultry, and to prevent the spread of such diseases, he is authorized and directed from time to time to establish such rules and regulations concerning the exportation and transportation of livestock and/or live poultry from any place within the United States where he may have reason to believe such disease may exist into and through any State or Territory, and into and through the District of Columbia and to foreign countries as he may deem necessary, and all such rules and regulations shall have the force of law. (May 29, 1884, ch. 60 s. s. 4, 5, 23 Stat. 32; Feb. 2, 1903, ch. 349, s. 1, 32 Stat. 791; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 121. Shipments from areas suspected infected; control of animals and live poultry.

Whenever any inspector or assistant inspector of the Bureau of Animal Industry shall issue a certificate showing that such officer had inspected any cattle or other livestock and/or live poultry which were about to be shipped, driven, or transported from such locality to another as stated in section 120 preceding and had found them free from Texas or splenetic fever infection, pleuropneumonia, foot-and-mouth disease, or any other infectious, contagious, or communicable disease, such animals, so inspected and certified, may be shipped, driven, or transported from such place into and through any State or Territory, and into and through the District of Columbia, or they may be exported from the United States without further inspection or the exaction of fees of any kind, except such as may at any time be ordered or exacted by the Secretary of Agriculture; and all such animals shall at all times be under the control and supervision of the Bureau of Animal Industry of the Agricultural Department for the purposes of such inspection. (Feb. 2, 1903, ch. 349, s. 1, 32 Stat. 791; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 122. Offenses; penalty.

Any person, company, or corporation knowingly violating the provisions of
Sections 111, 120, or 121 of this title or the orders or regulations made in pursuance thereof shall be guilty of a misdemeanor, and on conviction shall be punished by a fine of not less than $100 nor more than $1,000, or by imprisonment not more than one year, or by both such fine and imprisonment. (Feb. 2, 1903, ch. 349, s. 3, 32 Stat. 792; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 123. Quarantine.

The Secretary of Agriculture is authorized and directed to quarantine any State or Territory or the District of Columbia, or any portion of any State or Territory or the District of Columbia, when he shall determine the fact that cattle or other livestock and/or live poultry in such State or Territory or District of Columbia are affected with any contagious, infectious, or communicable disease; and the Secretary of Agriculture is directed to give written or printed notice of the establishment of quarantine to the proper officers of railroad, steamboat, or other transportation companies doing business in or through any quarantined State or Territory or the District of Columbia, and to publish in such newspapers in the quarantined State or Territory or the District of Columbia, as the Secretary of Agriculture may select, notice of the establishment of quarantine. (Mar. 3, 1905, ch. 1496, s. 1, 33 Stat. 1264; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 124. Transportation or delivery therefore from quarantined State or Territory or portion thereof, of livestock and live poultry, forbidden.

No railroad company or the owners or masters of any steam or sailing or other vessel or boat shall receive for transportation or transport from any quarantined State or Territory or the District of Columbia, any cattle or other livestock, and/or live poultry, except as hereinafter provided; nor shall any person, company or corporation deliver for such transportation to any railroad company, or to the master or owner of any boat or vessel, any cattle or other livestock and/or live poultry, except as hereinafter provided; nor shall any person, company, or corporation drive on foot, or cause to be driven on foot, or transport in private conveyance or cause to be transported in private conveyance, from a quarantined State or Territory or the District of Columbia, or from the quarantined portion of any State or Territory or the District of Columbia, into any other State or Territory or the District of Columbia, any cattle or other livestock and/or live poultry, except as hereinafter provided. (Mar. 3, 1905, ch. 1496, s. 2, 33 Stat. 1264; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 125. Regulations for inspection, disinfection, and certification, and delivery and shipment of livestock and live poultry from quarantined State or Territory.

It shall be the duty of the Secretary of Agriculture, and he is authorized and directed, when the public safety will permit, to make and promulgate rules and regulations which shall permit and govern the inspection, disinfection, certification, treatment, handling and method and manner of delivery and shipment of cattle or other livestock and/or live poultry from a quarantined State or Territory or the District of Columbia, and from the quarantined portion of any State or Territory or the District of Columbia, into any other State or Territory or the District of Columbia; and the Secretary of Agriculture shall give notice of such rules and regulations in the manner provided in section 124 of this title for notice

Sec. 186. Moving livestock and live poultry from quarantined State or Territory under regulations.

Cattle or other livestock and/or live poultry may be moved from a quarantined State or Territory or the District of Columbia, or from the quarantined portion of any State or Territory or the District of Columbia, into any other State or Territory or the District of Columbia, under and in compliance with the rules and regulations of the Secretary of Agriculture, made and promulgated in pursuance of the provisions of section 125 of this title; but it shall be unlawful to move, or to allow to be moved, any cattle or other livestock and/or live poultry from any quarantined State or Territory or the District of Columbia, or from the quarantined portion of any State or Territory or the District of Columbia, into any other State or Territory or the District of Columbia, in manner or method or under conditions other than those prescribed by the Secretary of Agriculture. (Mar. 3, 1905, ch. 1496, s. 4, 33 Stat. 1265; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 187. Transportation from quarantined State, Territory, and so forth; penalty. Any person, company, or corporation violating the provisions of sections 124 or 126 of this title shall be guilty of a misdemeanor, and on conviction shall be punished by a fine of not less than $100 nor more than $1,000 or by imprisonment not more than one year, or by both such fine and imprisonment. (Mar. 3, 1905, ch. 1496; s. 6, 33 Stat. 1265.)

Sec. 188. Extension of quarantine law to carriers in interstate commerce. The provisions of sections 123-127 of this title and of section 118 of Title 18 shall apply to any railroad company or other common carrier whose road or line forms any part of a route over which cattle or other livestock and/or live poultry are transported in the course of shipment from any quarantined State or Territory or the District of Columbia, or from the quarantined portion of any State or Territory or the District of Columbia, into any other State or Territory or the District of Columbia. (June 30, 1914, ch. 131, 38 Stat. 419; Feb. 7, 1928, ch. 30, 45 Stat. 59.)

Sec. 189. Payment for animals purchased; computation of value, and amount paid. In case of an emergency arising out of the existence of foot-and-mouth disease, rinderpest, contagious pleuropneumonia, or other contagious or infectious diseases of animals, or European fowl pest and similar diseases in poultry, which, in the opinion of the Secretary, threatens the livestock or the poultry industry of the country, he may expend in the city of Washington or elsewhere any unexpended balances of appropriations heretofore made for this purpose, not to exceed $305,000, in the arrest and eradication of any such disease, including the payment of claims growing out of past and future purchases and destruction of animals (including poultry) affected by or exposed to, or of materials contaminated by or exposed to, any such disease, wherever found and irrespective of ownership, under like or substantially similar circumstances, when such owner has complied with all lawful quarantine regulations: Provided, that the payment for such animals hereafter purchased may be made on appraisement based on the meat, egg-production, dairy, or breeding value, but in case of appraisement based on breeding value no appraisal of any such animal shall exceed three times its meat, egg-production, or
dairy value, and, except in case of an extraordinary emergency, to be determined by the Secretary, the payment by the United States Government for any such animals shall not exceed one-half of any such appraisements: Provided further, that poultry may be appraised in groups when the basis for appraisal is the same for each bird. (June 22, 1946, ch. 445 s. 1, 60 Stat. 270.)

Similar Provisions

Similar provisions were contained in prior appropriation acts for the Department of Agriculture, as follows:

1945—May 5, 1945, ch. 109, s. 1, 59 Stat. 144.
1942—July 22, 1942, ch. 516, s. 1, 56 Stat. 676.
1941—July 1, 1941, ch. 267, s. 1, 55 Stat. 418.
1940—June 25, 1940, ch. 421, s. 1, 54 Stat. 542.
1933—March 3, 1933, ch. 203, 47 Stat. 1442.
1924—Dec. 5, 1924, ch. 4, s. 1, 43 Stat. 683.
   Apr. 2, 1924, ch. 81, s. 1, 43 Stat. 40.
1922—May 11, 1922, ch. 185, 42 Stat. 536.
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<th>STATE</th>
<th>MEMBERS</th>
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<tr>
<td>ALABAMA</td>
<td>Dr. Franklin A. Clark, Dr. M. L. Crawford, Dr. Homer L. Farr, Dr. M. K. Heath, Dr. George Ingram, Mr. Oscar H. Jones, Dr. B. N. Lauderdale, Dr. A. A. Leibold, Dr. I. S. McAdory, Dr. John Milligan, Dr. C. H. Poitevint, Dr. R. S. Sugg, Dr. Jack A. Howarth, Dr. L. M. Hurt, Dr. Ross H. Hurt, Dr. Arthur L. Kelly, Dr. Elmer Lash, Dr. Dean C. Lindley, Dr. Kenneth G. McKay, Dr. A. S. Rosenwald, Dr. Kermit Schaaf, Dr. O. W. Schalm, Dr. R. J. Schermerhorn, Dr. E. F. Sheffield, Mr. Jere W. Sheldon, Dr. C. E. Wicktor, Dr. F. W. Wood</td>
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<tr>
<td>ARIZONA</td>
<td>Mr. John Babbitt, Mr. John R. Beloat, Mr. Ralph Cowan, Mr. E. Ray Cowden, Mr. Robert E. Francy, Mr. Fred J. Fritz, Mr. John M. Jacobs, Dr. K. O. Lassen, Dr. Ward R. Lee, Dr. W. T. Lightle, Dr. Bela Mariassy, Dr. John Micuda, Dr. C. E. Mikkelson, Dr. V. Mikkleson, Mr. Cecil H. Miller, Spurlock &amp; Wetaler, Mr. Fred Turley, Mr. W. A. Clark, Jr., Mr. Don C. Collins, Colorado Serum Co., Dr. C. L. Davis, Mr. Frank Fehling, Dr. R. M. Gow, Mr. Radford Hall, Mr. John Holtorf, Mr. A. T. McCarty, Mr. F. E. Mollin, Mr. Stafford Painter, Mr. Ted Redeiss, Mr. Davis G. Rice, Jr., Mr. William Seeklor, Mr. A. A. Smith, Dr. George W. Stiles, Mr. Alfred Ward, Jr.</td>
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<tr>
<td>COLORADO</td>
<td>Mr. W. A. Clark, Jr., Mr. Don C. Collins, Colorado Serum Co., Dr. C. L. Davis, Mr. Frank Fehling, Dr. R. M. Gow, Mr. Radford Hall, Mr. John Holtorf, Mr. A. T. McCarty, Mr. F. E. Mollin, Mr. Stafford Painter, Mr. Ted Redeiss, Mr. Davis G. Rice, Jr., Mr. William Seeklor, Mr. A. A. Smith, Dr. George W. Stiles, Mr. Alfred Ward, Jr.</td>
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<td>ARKANSAS</td>
<td>Dr. C. C. Franks, Mr. Lewis L. John, Dr. Roscoe K. Balch, Mr. R. E. Boyle, Dr. Wm. H. Boynton, Dr. Hugh S. Cameron, Dr. N. H. Casselberry, Dr. James N. Fulmor, Dr. Theodore J. Hage, Dr. Phil Haims, Dr. George W. Stiles, Mr. Alfred Ward, Jr.</td>
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<tr>
<td>CONNECTICUT</td>
<td>Dr. Frank Ferrigno, Dr. Erwin Jungherr, Mr. David W. Francis, Dr. James C. Kakavas, Dr. Karl C. Seeger, Mr. Howard J. White, Dr. Clarence A. Woodhouse</td>
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ACTIVE MEMBERS 1962

DISTRICT OF COLUMBIA
Dr. Benjamin D. Blood
Dr. Paul J. Brandly
Dr. A. B. Crawford
Dr. S. O. Fladness
Dr. L. T. Giltner
Dr. C. L. Gooding
Dr. R. J. Helvig
Dr. O. E. Herl
Dr. W. O. Kester
Dr. A. K. Kuttler
Dr. James Lieberman
Dr. Clifton D. Lowe
Dr. J. J. Martin
Dr. Fred D. Maurer
Dr. J. A. McCallam
Dr. Albert R. Miller
Dr. B. C. Pier
Dr. M. D. Schneider
Dr. H. W. Schoening
Dr. M. S. Shahan
Dr. Wm. T. Shalkop
Dr. B. T. Simms, Sr.
Dr. Lloyd A. Spindler
Dr. A. L. Tellejohn
Dr. A. E. Wight
Dr. James E. Williams

FLORIDA
Dr. J. A. Acree
Dr. Edward G. Batte
Dr. C. L. Campbell
Mr. John G. DuPuis, Jr.
Dr. James G. Fish
Dr. I. N. Habecker
Mr. V. C. Johnson
Dr. D. A. Sanders
Dr. Leonard E. Swanson
Dr. Bert R. Wilbur
Mr. P. E. Williams

GEORGIA
Dr. Peter F. Bahnsen
Dr. Clifford W. Barber
Dr. Osgood M. Bateman
Dr. Donald E. Cooperider
Dr. C. C. Ellis
Dr. Thomas J. Jones
Mr. J. K. Luck
Dr. C. J. Mikel

IDAHO
Mr. O. I. Blain
Dr. Scott B. Brown
Mr. Seth Burstad
Mr. Fred J. Hill
Mr. T. R. Myers
Mr. J. Wendell Stucki
Mr. Ray V. Swanson
Mr. Van Ness D. Wallentine
Mr. Leon Weeks

ILLINOIS
Mr. Herman Aaberg
Dr. J. O. Alberts
American Aberdeen-Angus Ass’n.
Dr. O. Augspurger
Dr. Paul D. Beamer
Dr. C. E. Blye
Dr. L. E. Boley
Dr. A. E. Bott
Dr. N. R. Brewer
Dr. Harry Caldwell
Dr. D. M. Campbell
Dr. Cliff D. Carpenter
Dr. J. W. Cunkelman
Dr. Homer C. Curtis
Dr. L. R. Davenport
Dr. A. H. Davison
Mr. Milton R. Dunk
Dr. L. A. Dykstra
Dr. C. E. Fidler
Dr. Ralph O. T. Fireoved
Dr. J. D. Fortenberry
Mr. Luther E. Fredrickson
Dr. William J. Gay
Dr. Oliver D. Grace
Dr. Robert Graham
Dr. J. G. Hardenbergh
Dr. O. T. Hayer
The Holmes Serum Co.
Dr. Clarence B. Hostetler
ACTIVE MEMBERS 1952

Dr. M. J. Huggins
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