Proceedings
FORTY-EIGHTH
ANNUAL MEETING
of the
UNITED STATES
LIVESTOCK SANITARY
ASSOCIATION

U. S. BUREAU OF ANIMAL INDUSTRY
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HOTEL LA SALLE
Chicago, Illinois
December 6, 7, 8, 1944
Proceedings
FORTY-EIGHTH
ANNUAL MEETING
of the
UNITED STATES
LIVESTOCK SANITARY
ASSOCIATION

HOTEL LA SALLE
Chicago, Illinois
December 6, 7, 8, 1944
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UNITED STATES LIVESTOCK
SANITARY ASSOCIATION

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HISTORICAL

Records of the early meetings of the Interstate Association of Livestock Sanitary Boards are very meager. The first meeting of the organization was held in Fort Worth, Texas, September 28-29, 1897, primarily to inspect a vat for dipping cattle and sheep that had been constructed in that city.

The name of the organization was changed at the 13th annual meeting held in Chicago, Ill., in 1909, to the United States Livestock Sanitary Association. All meetings since 1909 have been held in Chicago.

Meetings Data

<table>
<thead>
<tr>
<th>Meetings</th>
<th>Date</th>
<th>Place</th>
<th>President</th>
<th>Secretary</th>
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<tr>
<td>1</td>
<td>Sept. 28-29, 1897</td>
<td>Fort Worth, Tex.</td>
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<td>2</td>
<td>1898</td>
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<td>3</td>
<td>1899</td>
<td>Chicago, Ill.</td>
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<td>4</td>
<td>1900</td>
<td>Louisville, Ky.</td>
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<td>5</td>
<td>Oct. 8-9, 1901</td>
<td>Buffalo, N. Y.</td>
<td>E. P. Niles</td>
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<td>7</td>
<td>Sept. 22, 1903</td>
<td>Denver, Colo.</td>
<td>W. E. Bolton</td>
<td>Hon. W. P. Smith</td>
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<td>8</td>
<td>Aug. 23-25, 1904</td>
<td>St. Louis, Mo.</td>
<td>J. C. Norton</td>
<td>Hon. W. P. Smith</td>
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<td>1905</td>
<td>Guthrie, Okla.</td>
<td>Hon. W. P. Smith</td>
<td>S. H. Ward</td>
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<td>11</td>
<td>Sept. 16-17, 1907</td>
<td>Richmond, Va.</td>
<td>D. F. Luckey</td>
<td>G. A. Jarman</td>
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<td>Chicago, Ill.</td>
<td>Chas. E. Cotton</td>
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<td>Chicago, Ill.</td>
<td>John F. DeVine</td>
<td>J. J. Ferguson</td>
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<td>16</td>
<td>Dec. 5-6, 1912</td>
<td>Chicago, Ill.</td>
<td>Mazyck P. Ravenel</td>
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<td>Peter F. Bahnson</td>
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<td>J. G. Wills</td>
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<td>D. M. Campbell</td>
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<td>W. F. Crewe</td>
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<td>26 Dec. 6-8, 1922</td>
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<td>T. E. Munce</td>
<td>Theo. A. Burnett</td>
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<td>27 Dec. 5-7, 1923</td>
<td>Chicago, Ill.</td>
<td>W. J. Butler</td>
<td>O. E. Dyson</td>
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<td>28 Dec. 3-5, 1924</td>
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<td>J. G. Ferneyhough</td>
<td>O. E. Dyson</td>
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<td>31 Nov. 30-</td>
<td>Chicago, Ill.</td>
<td>L. Van Es</td>
<td>O. E. Dyson</td>
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<td>L. Van Es</td>
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<td>32 Dec. 2-5, 1928</td>
<td>Chicago, Ill.</td>
<td>C. A. Cary</td>
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<td>33 Dec. 4-6, 1929</td>
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<td>Chas G. Lamb</td>
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<td>A. E. Wight</td>
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<td>J. W. Connaway</td>
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* Information not available.

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<th>1941</th>
<th>1942</th>
<th>1943</th>
<th>1944</th>
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ADDRESS OF THE PRESIDENT

By J. M. Sutton

Sylvestor, Georgia

The Problems of Livestock Sanitation are inseparably entwined with economic production of livestock and livestock products, and to a considerable extent they constitute an important factor in the health of the human family.

This Association, organized primarily to combat parasitic infestation in cattle and sheep (ticks and scabies), grew and expanded to include other diseases of economic and health significance due to the vision and loyalty of its members.

The official roster of its presidents, secretaries and committee members, has been in the past and is today an official Who’s Who in American Livestock Sanitation. Many of our most active members have gone to their reward but the service they rendered is still bearing fruit. Some of the older problems have been solved, or reduced to the vanishing point, notably glanders, tick eradication and foot-and-mouth disease. More recently, recognized diseases still challenge our knowledge and ingenuity as to their economic control.

The progress made in livestock sanitary control work is a glowing tribute to the splendid cooperation of research men, regulatory officials, owners of livestock and livestock transportation agencies. Without this cooperation, progress has always been and will continue to be slow; projects may even temporarily fail.

The greatest variable factor in livestock sanitary control work is the general attitude of the public. Most livestock owners, dealers, truckers and railroads are good cooperators, generally speaking, because they realize that restrictive rules and regulations are essential to prevent the spread of contagious and communicable diseases. Others of these same groups, less well informed, are indifferent, evasive, and at times hostile to official restrictions.

We shall probably never see the day when everybody will hail restrictive livestock sanitation regulations as essential or beneficial, but we must have the cooperation and support of a majority of the breeders and dealers in livestock and poultry to make our services successful and profitable. We can have this essential cooperation when such regulations are based on understanding and confidence; understanding of our aims and purposes, and confidence in our determination not to impose useless restrictions. All regulations should be basically sound and conservative in principle, and in their enforcement. Regulations bristling with potential but unnecessary details are difficult to enforce, and are frequently evaded or violated.

Uniform regulations, especially for interstate traffic, are very desirable. They are essential, and why shouldn’t interstate regulations be uniform? Their only service is to prevent the spread of contagious, infectious, and communicable livestock diseases from one state to another. Legal requirements that will protect the State of Maine against traffic-borne livestock diseases will also protect Florida, California, Oregon, and any other state.

I asked Dr. Bahnsen, a former president of this organization and for twenty years State Veterinarian of Georgia, what he considered the greatest handicap in
our effort to secure uniform interstate livestock health regulations. He replied, "The pride of authorship." Can he be right? The records of this Association show that he took an active part for many years trying to solve this problem.

Many Veterinarians, except those located in active livestock centers, are unable to inform their clients what the necessary procedure is to ship an animal to an adjoining state. It is true the United States Livestock Sanitary Association publishes a small bulletin giving a synopsis of State regulations, but States' regulations are often changed or amended, especially in States that have frequent administrative changes.

Conservative laws or regulations, rigidly enforced, obtain better results than drastic regulations poorly supervised and only periodically enforced.

This is not a new problem. The records of this Association show it has been actively up for consideration for more than 30 years. Much progress has been made, but the task is still with us.

We are making a special effort to clarify this knotty problem at this meeting. Our program provides for a paper by F. E. Mollin, Executive Secretary of the American National Livestock Association, Denver, Colorado on—"Interstate Movement from the Viewpoint of the Cattle Breeder."

Mr. John S. Clark, president of the Purebred Dairy Cattle Association, of Huntington, Long Island, N. Y. will present a paper on—"Interstate Regulations from the Viewpoint of the Dairy Cattle Breeder."

Dr. C. P. Bishop of Harrisburg, Pa., will present a paper on—"Interstate Regulations from the Viewpoint of the Regulatory Official."

Our Committee on Laws and Regulations, of which Mr. H. W. Norton of the Holstein-Fresian Association is a member, has under the leadership of Dr. C. P. Bishop labored diligently seeking a formula that will be acceptable to most, if not all the states. I sincerely hope that their recommendation will offer a final solution to this problem.

The recent, frequent, and extensive outbreaks of rabies among foxes, and other carnivorous animals makes it desirable to have Congress amend the Act of 1884, enabling the Secretary of Agriculture to suppress and exterminate contagious, infectious, and communicable diseases of dogs, and other carnivorous animals. A Bill has been introduced by Mr. Reese of Kansas, in Congress, to so amend this law. I urge every member to solicit the support of his Congressmen and Senators on the passage of this Act. (House Resolution #5007.)

The Meat Inspection Service of the Federal Government was transferred by Executive order to the Office of the War Food Administration, presumably as a war measure. This change is not to the best interest of public welfare.

Such strictly technical services should remain under the direct supervision of men especially trained for this purpose. It is hoped that at an early date this service will be returned to the Bureau of Animal Industry, the organization that brought it to its present state of perfection.

The matter of brucellosis in livestock is again given primary attention in our annual program. The subject is ably presented in its various phases by men who have devoted much time to the study of this disease.

Anaplasmosis is an important economic disease of southern cattle, and it has been
reported in the range states and in northern dairy areas. Research studies should be carried forward to develop good methods of diagnosis, the location of the centers of infection, manner of spread, and then adequate regulation enforced to control or to eradicate it. Anaplasmosis is now spreading and is uncontrolled.

Due largely to the interest and ability of our Secretary, Dr. R. A. Hendershott, our program is literally loaded with excellent papers calculated to clarify many perplexing questions in livestock sanitation, and other related subjects.

The meeting is yours. Its success depends on the interest of its members. Each session, since I first became a member in 1927, has been a source of inspiration to me, and I hope this session will prove to be a source of inspiration to you. I appreciate the opportunity you have given me to serve as your president for the past year, and I thank you for the honor you have bestowed upon me.
MEMORIAL SERVICE
UNITED STATES LIVESTOCK ASSOCIATION
December 6, 1944
BY J. L. AXY, D.V.M.
Indianapolis, Indiana

The following persons passed away during the year 1944.

David S. White (O.S.U. '90) of Columbus, Ohio, the first dean of Ohio State University, College of Veterinary Medicine and a past president of the AVMA (1920–1921), died January 7, 1944, at the age of 74.

Mrs. John L. Tyler, wife of Dr. John L. Tyler of Whittier, California, an honored friend and dutiful wife of a distinguished colleague, died December 31, 1943, at the age of 71.

Mrs. Mary Forrey Baker of Chicago, Illinois, wife of the late Dr. A. H. Baker, long time dean of the Chicago Veterinary College, affectionately known to veterinary students—of which I was one—as Ma Baker, died March 21, 1944, at the age of 81.

Ortho O. Wolf of Ottawa, Kansas, a prominent stockman, farmer, and leader in State and National Farm Bureau activities, died March 31, 1944, at the age of 70.

Harry D. Port (C.V.C. '14) of Cheyenne, Wyoming, ex-president of the United States Livestock Sanitary Association, died April 25, 1944, at the age of 53.

Charles E. Collins of Kit Carson, Colorado, a prominent rancher, and leader in the Livestock Industry, died in March, 1944.

Clarence J. Young (Ont. '94) of Fort Worth, Texas, Inspector in Charge of Meat Inspection at Fort Worth, Texas, since 1931, died July 15, 1944, at the age of 60.

Erlend V. Lagerberg (St. Jos. '18) of Fort Morgan, Colorado, who lost his life in an attempt to rescue a twelve-year old boy from drowning, died August 8, 1944, at the age of 49.

Horatio L. Van Volkenberg (Corn. '18) of College Station, Texas, Head of the Department of Agriculture, Professor of Parasitology at the Agricultural Mechanical College of Texas, died October 13, 1944, at the age of 51.

Claude Henry Case (O.S.U. '04) of Akron, Ohio, one of America's foremost veterinarians, died August 27, 1944, at the age of 64.

STANDING SILENT PRAYER BY ALL

Again I find myself called upon to conduct this memorial service and in compliance therewith, I humbly confess I feel very keenly an inadequacy of qualification to construct sentences to express thoughts comparable to the occasion. I prefer to think they are not gone, they are just away. Although we know they shall not return, we who remain must not forget the ever present opportunity to prepare to meet them in that home not made with hands; eternal in the heavens.
No poor words of mine can add glory or lustre to their lives, but may I cite said lives as sign posts on life's highway, directing us to the culminating peaks of progress, peace, and world understanding.

We join with those they left who were near and dear to them, and together we will find solace and comfort in keeping their memory fresh, for "Memory is the only friend that grief can call its own."

Their lives shall be our inspiration. We shall continue to work and plan toward the realization of their aspirations and the attainment of their ideals.

Their greatest memorial is the fertile productive land, healthy livestock, wholesome meat, and pure milk. To all of these they made a wonderful contribution, courageously facing the rising sun of every new day, grappling with and solving its complexities, that we might have more churches, better schools, happy homes, and good government.

Gratefully we memorialize them today and may their souls rest in peace, awaiting one clear call to awaken and come forth—when worldly things shall be no more, and answer roll call "On that beautiful isle of somewhere."

Mr. President, I move this service be made a part of the permanent records of the Association and that a copy be sent the family of each person named.
INTERSTATE MOVEMENT OF LIVESTOCK FROM THE VIEWPOINT OF THE BEEF CATTLE BREEDER

By F. E. MOLLIN

Executive Secretary, American National Livestock Association, Denver, Colorado

The Association which I represent, the American National Live Stock Association, has for many years taken a very keen interest in all matters pertaining to the breeding and marketing of beef cattle, and we consider the maintenance of efficient sanitary organizations and the promulgation of rules and regulations covering the interstate movement of such livestock as being of prime importance to all of us. It so happens that a Federal Bureau of Animal Industry was first advocated by a group of stockmen meeting in Wyoming in 1884 and it is of interest to note that the existence of contagious pleuro-pneumonia in some of the eastern states led to that action. That early gathering tersely stated the situation when it resolved "That it cannot be extirpated without the action of the general government cooperating with the State authorities." That statement is just as true today as it was then. At the same meeting a recommendation was made for the formation of a national cattle growers association and while it was quite a number of years before a permanent organization evolved, the American National Livestock Association is also the outgrowth of that early meeting.

I think we all can point with pride to the accomplishments of the Bureau of Animal Industry in its 60 years of activity. That organization has led the way and commanded the respect of sanitary officials throughout the entire country, and indeed throughout the entire world, with the result that today our herds and flocks are not matched by those of any country in the world from the standpoint of freedom from disease. This accomplishment is due not solely to the activities of the Bureau itself but rather to the fine teamwork between the Bureau, your fine organization, the state sanitary officials and the breeders of livestock.

Because we want this situation to be a permanent one we deem it highly important that the Bureau of Animal Industry continue to lead the way and that its recommendations, first cleared with your organization, should govern nationwide, with only such modifications as are indicated by differences in type of operation, geographical considerations, etc. In these rare instances complete national acceptance of a common plan may be impractical.

I welcome the opportunity today to discuss with you frankly the subject assigned to me. I deem it a distinct honor and take it as an expression of the sincere desire of your association to work with the livestock industry for the common good. I want to make it clear in the beginning that I do not profess to any knowledge of scientific matters but there has to be a meeting point someplace between the scientific fraternity on one hand and the practical breeders of livestock on the other to make the thing work.

A year ago at our convention in Denver we had a round table discussion on this subject. It was participated in largely by purebred cattle breeders, all members
INTERSTATE MOVEMENT OF LIVESTOCK

of our association and many of them operators of commercial range herds as well. As a result of that discussion the convention adopted a resolution dealing specifically with Bang's disease which reads as follows:

"WHEREAS, There now exists much confusion and lack of uniformity in state sanitary regulations against Bang's disease; therefore be it

RESOLVED: That we urge the Bureau of Animal Industry to adopt regulations recognizing calfhood vaccination for the movement of cattle interstate; and

BE IT FURTHER RESOLVED, that we urge all states to adopt standard regulations in conformity with the standards established by the Bureau of Animal Industry."

Following that meeting we have had several meetings in Colorado at which there has been attendance from many of the adjoining states, some from a greater distance and even from Canada. At one of these meetings Dr. Paul Taussig of Colorado, Dr. R. M. Gow, State Veterinarian of Colorado, and myself were appointed a committee of three to present to Dr. William A. Hagan, then assistant to the Chief of the Bureau of Animal Industry, the needs of the livestock industry in the west in regard to the interstate shipment of calves vaccinated with the *Brucella abortus* vaccine Strain 19. We made the following recommendation in a letter dated March 15, 1944. "Calves under 18 months of age officially vaccinated by the *Br. abortus* vaccine Strain 19 when 4 to 8 months of age, may be shipped interstate without test at time of shipment, when individually identified by mark, brand, tattoo or other acceptable identification, and when certified by the state sanitary official of the State of origin that they have been officially vaccinated and identified."

This conformed to the recommendation adopted by the United States Livestock Sanitary Association at their annual convention in Chicago in December 1943. We recommended further to Dr. Hagan as follows: "We urge that the Bureau consider rules and regulations for the interstate movement of properly vaccinated calves. The livestock men know that in the past the Bureau, by rules and regulations, has controlled the interstate movement of tubercular cattle and has practically eliminated the Texas Fever from the United States along with other contagious and infectious diseases including tuberculosis. If it had not been for the Bureau's Leadership the individual states would not have been able to accomplish these results, and unfortunately there is little uniformity in the rules and regulations of the various states in regard to the control of *Br. abortus*. The Western range and purebred industry knows that if the Bureau assumes the leadership we will again have more workable and equitable regulations as to the movement of cattle interstate. We sincerely hope that our meeting in Denver has given you an insight as to what the Bureau can do for the Western range and purebred industry, and in fact for the country as a whole. We respectfully urge you to submit this recommendation to Dr. A. W. Miller, Chief of the Bureau of Animal Industry." In reply to this letter we received a letter from Dr. A. W. Miller, Chief of the Bureau, dated March 23, 1944 from which I quote, "We are in favor of uniformity in state regulations on this subject and supported the recommendations of the executive committee of the United States Livestock Sanitary Association at its meeting in Chicago, December, 1943. At this time we feel it would be inadvisable for us to recommend the issuance by the Secretary of a regulation such as you suggest."
Dr. Miller's letter further recommended that pending such universal action the States in our own section of the country could accomplish much the same purpose by individual action along the lines of the recommendation of your executive committee a year ago. I am glad to say there has been some progress in this direction, but in our opinion much faster progress would follow the issuance of a formal order by the Bureau covering this matter.

Our interest in this matter is not confined solely to the interstate movement of calves vaccinated with the *Br. abortus* vaccine Strain 19. It is just a part of the larger problem involved but at the moment this particular issue commands the general interest. The need for uniformity in regulations extends far beyond that. Today sanitary officials inspecting shipments being made ready to move interstate have to operate with book in hand to determine just what the exact requirements are for each destination state involved. One of our western association secretaries, in commenting on this situation, said that the breeders in his state had to operate with a knowledge of four sets of state regulation—their own state and those of the three adjoining them.

As showing the importance of this matter from the practical viewpoint I wish to call your attention to the fact that we have in this country today the greatest number of cattle ever recorded—approximately 82,200,000 head as of January 1, 1944. Some 70 per cent of all our meat animals are on farms and ranches in the states west of the Mississippi River. In the 17 states west of the Missouri River ordinarily called the "range states" there is a surplus of beef cattle and the main outlet for this surplus is in the East, supplying the need for stockers and feeders in the Corn Belt proper and adjacent states. This same area also produces a surplus of purebred breeding stock and they are disposed of over a wide range of territory.

The vast scope of the cattle industry in this country is shown by the fact that the estimated total slaughter of cattle and calves for the year 1944 will be about 33,000,000 head—some 5,400,000 head above last year's slaughter and 5,300,000 head above the previous record set in 1942.

In the foregoing I have tried to develop the situation as it exists today from the standpoint of the beef cattle breeder. It is not my desire to be critical of anyone. Instead, I think that we should commend both the Bureau of Animal Industry and your organization for the fine accomplishments of the past. Our last close contact with your organization was in the working out of the tuberculosis program. There was some resistance to it in various parts of the country but teamwork on the part of breeders, and sanitary officials overcame this objection until the job was done. Now it is time that we should endeavor to perfect our teamwork for the control of Bang's disease; admittedly the problem is not so simple. There is much yet to learn but sanitary regulations, as I see it, must develop with advances in knowledge of proper control methods if they are not to hamper this great industry in the period of control development.

In view of the developments to date, I see no reason why the Bureau of Animal Industry should not issue a regulation covering the interstate movement of calves vaccinated at the proper age with *Br. abortus* vaccine Strain 19. Your executive committee has approved such a regulation. The Bureau of Animal Industry says it supported this move on your part. Why not make it official? Certainly much faster progress could then be made toward uniform treatment thereof.
The resolution adopted at your meeting a year ago and which we followed in our efforts in the West was limited to the range and semi-range areas. We can see no reason, however, why this regulation should not apply to the country as a whole. Certainly it merits serious consideration and if the Bureau will promulgate it as an official regulation it will be up to each state to consider it and we hope, favorably. In making such a decision it would seem that the livestock breeders of each state should have a voice in the matter. While we cannot speak for them all, it is our belief that they would generally approve such uniform interstate requirements.

I believe that livestock breeders are themselves to blame for not taking a sufficiently keen interest in the matter of sanitary regulations. It is my understanding that in the early days of your organization, breeders, as such, were more active in your deliberations than they now are, and thus in any given meeting you brought together the scientific viewpoint based upon your knowledge of the disease in question, and the indicated methods of control and the practical viewpoint of the livestock breeders who have to operate within the confines of the rules and regulations prescribed. I hope it may be possible to stimulate greater attendance by breeders in your national and regional meetings. I believe they are still eligible to membership. I assume that if breeders again accept this responsibility that they will be welcome and I feel sure that much good will come from such activity on their part. It seems to me that the problems of the sanitary fraternity are essentially the problems of the livestock industry itself.

To consider the matter for a moment solely from the standpoint of disease control, I wonder if we are not better off with practical regulations than with regulations so rigid that they are onerous to everyone concerned. The prohibition era taught us the difficulty of enforcement of a law which was not popular and was not generally supported. Is there in this room a man who does not know of some evasion, some laxity in enforcement, that stems back to too rigid regulations? While I will not attempt to cite specific instances, I am told that even some of the state sanitary officials themselves do not insist upon enforcement to the letter of their own rules and regulations, but there they are in the book, and to the uninitiate, at least, they are to be enforced.

Then we have heard of regulations which are applied drastically at the state's border, denying entry to any shipment which has not complied 100 per cent with the requirements, but that same high standard is not enforced within the confines of the state itself. Such a situation leads at once to the charge that the regulation is artificial and not based upon sound sanitary requirements.

There could be many other instances cited where the regulations now in effect are burdensome and confusing to say the least. The record is sufficient to show convincing need for greater uniformity. Uniformity as to rules and regulations; uniformity as to the type of test to be used (whether plate or tube in the case of Bang's disease); uniformity as to age requirements; descriptive charts, etc; and all along the line. We do not assess any blame for the situation either to the Bureau of Animal Industry nor to your organization but we do believe that the combined efforts of the Bureau and your organization can and will lead the way out of this confused maze of regulations. It should be noted that regulations issued by the Bureau, and endorsed by your organization, can and should be changed without difficulty whenever the situation warrants. Certainly it would be much more
practical and efficient to change a Federal regulation so that every state would know at once of such a change, than to try to accomplish the same purpose by a change in varying degree by 48 separate state official bodies.

In closing may I express the hope that your organization at this meeting will move in the direction of such uniform action and will urge the Bureau of Animal Industry to lead the way. We can never have complete uniformity or even uniformity to the fullest possible degree until the Federal Bureau of Animal Industry assumes complete jurisdiction over the interstate movement of livestock as we believe was the intention when this Bureau was established.
INTERSTATE HEALTH REGULATIONS FROM THE VIEWPOINT OF THE REGULATORY OFFICIAL

BY C. P. BISHOP, V.M.D.

Director, Bureau of Animal Industry, Harrisburg, Pennsylvania

It is generally conceded that each state has the right to enact laws and promulgate regulations for the admission of livestock. It is also the prerogative of the individual states to outline and define their policies and procedures in their efforts to prevent and control the transmissible diseases of livestock.

It is impossible for me to present the attitude of the various livestock regulatory officials on the importation of all classes of livestock. However, I may express in a measure the general aspect of their opinions.

Each livestock regulatory official is charged by law with the prevention, control and eradication of transmissible diseases of livestock, including poultry.

The prevention and control of transmissible diseases of livestock has a two-fold purpose. First, their relation to public health and second, their great economic importance. It is well established that the livestock industry is the keystone of the arch of agriculture which, to remain profitable and productive, must be kept healthy. Therefore, whatever is done or left undone in the matter of effective prevention and control of these diseases, will have an effect upon the public as a whole. Thus, the question becomes one of great public importance as we view it, properly within the regulatory scope of the Federal government and the states.

Laws and regulations governing the movement of livestock should foremost and specifically be designed to prevent and control transmissible diseases. Such laws and regulations should never be promulgated unless and until they become necessary from a disease prevention and control standpoint. All will agree that laws and regulations are necessary to prevent and control the traffic in diseased animals, and thus safeguard the health of our herds and flocks.

I think, generally speaking, that the regulations with respect to the interstate movement of livestock, particularly swine and sheep, are satisfactory and with a semblance of uniformity. This is due to the leadership assumed by the United States Bureau of Animal Industry in promulgating regulations in the interstate movement of such livestock and for certain specific diseases affecting various species of animals.

I am sure each of us realizes the responsibility which we have to discharge in approving animals for interstate shipment. It is our duty to safeguard the health of such animals not only from a tuberculosis and Bang’s disease standpoint, but due consideration should also be given to other transmissible diseases, both bacterial and parasitic.

On account of the interest and attention being given to the brucellosis program in this nation and the problems created in the movement of cattle vaccinated as calves, I will confine my remarks largely to brucellosis interstate requirements.

With few exceptions, the Eastern States do not breed and raise sufficient cattle to supply their requirements. As a result, thousands of dairy, breeding and feeder
cattle must be imported annually. Many states have expended large sums of public funds, owners have sustained losses and made sacrifices in efforts to eliminate and control brucellosis in their herds, and much has been accomplished and progress made in placing herds on a brucellosis-free basis. Therefore, the responsibility in protecting the health and investment becomes extremely important. It would be false economy to continue the expenditures unless adequate protection is provided against the disease.

A livestock regulatory official should not be looked upon as a dictator in promulgating rules and regulations governing the movement of livestock, interstate as well as intrastate, since such officials have much concern and grave responsibility over the health in transfer of livestock, for the reason that transmissible diseases usually go hand in hand with traffic in livestock and, such traffic is an important factor and must be given serious consideration if our efforts to control brucellosis in cattle are to prove successful.

There are definite principles involved in the prevention and control of diseases, and the fundamental considerations regarding intrastate as well as interstate transfers of cattle are found in the status of the entire herd of origin, as well as that of the transferred individuals. Brucellosis gains entrance to a herd because the organism responsible for the disease has been introduced in one way or another, and all too frequently by the addition of an infected animal.

A single blood test is not considered sufficient insurance that the animal is free from infection of brucellosis, yet it is a step in the right direction and furnishes a protection in many cases. A more ideal regulation is one that requires all imported dairy and breeding cattle to come from accredited Bang's disease-free herds, or negative herds in modified accredited areas, or at least from negative herds under the Individual or Area Plans, with an additional test prior to shipment and then held in isolation on the purchaser's premises until a negative report has been obtained some 30 to 90 days after arrival.

Such regulations are necessary at the present time, and the aim should be to promulgate regulations in keeping with these principles as soon as the brucellosis control work has advanced to warrant their adoption in each state.

In promulgating rules and regulations for the protection of herds and areas under Federal-State supervision for brucellosis prevention and control, we should remember that such measures should also apply to the intrastate movement of cattle for additions to such herds and areas and be at least in keeping with the interstate brucellosis requirements of the state, and particularly conform to the Uniform Methods and Rules for the Establishment and Maintenance of Brucellosis-Free Areas.

Vaccinated calves are not likely to be spreaders of Brucella organisms until they reach breeding maturity, but traffic of any kind between herds not known to be free, and those that are free is dangerous. Consequently, we would recommend that the movement of cattle that were vaccinated as calves under Federal-State supervision between 4 and 8 months of age be restricted and required to come from accredited herds or herds with a negative status, and the individual animals to be moved to be negative to an official blood test within a specified time of the date of entry, except when a special permit is issued by the livestock sanitary official of the state of destination for the importation of calves under 18 months of age, which were
vaccinated under official supervision between the ages of 4 and 8 months and not negative to an official blood test at time of importation, but originated in a herd with a favorable brucellosis status, and are to enter herds of like status within the importing state.

The interest among livestock owners in the prevention and control of brucellosis in cattle and in the establishing of brucellosis-free herds has gone forward faster than was anticipated by even the most enthusiastic and optimistic advocates of this line of work. Many more owners are becoming convinced that their only hope lies in the blood test, elimination of reactors, good sanitation and preventive measures, with calfhood vaccination as an aid or adjunct. Thus, the demand for adequate interstate regulations as a preventive against brucellosis has been made by the owners or in the interest of the owners themselves. Breeders in some buying states demanded more stringent regulations.

It is, indeed, discouraging to the purchaser of cattle and the livestock regulatory official responsible for approving cattle for shipment to find upon test of a consignment that the entire lot of cattle show a suspicious reaction to the blood test and upon immediate retest find a number of animals positive to the test and to suspects. This would clearly indicate that samples of blood were collected from one or more animals but not from each individual animal in the shipment.

It is also an unpleasant and costly experience for the purchaser of cattle in another state, after being assured by the seller who in most cases is a dealer, that the cattle meet all health requirements for shipment into the state of destination, to learn some days later that the livestock sanitary official of the state of origin cannot approve the animals as their tuberculosis and brucellosis status is questionable. Furthermore, although Holsteins were purchased, the identification tags were for Guernseys; and due to the discrepancy in the tag numbers, the cattle will have to be placed in quarantine until their health status can be determined.

These and other situations that undermine the confidence of purchasers of cattle and react unfavorably to the marketing of cattle and to the industry as a whole and prevent more freedom in the movement of cattle, could be avoided in many instances if the regulatory official in the state where the cattle originated would not permit the cattle to be shipped and moved interstate unless and until the certificate of health accompanying the cattle is approved. Such certificates should not be approved until the animals have been properly identified, their health status determined and the requirements of the state of destination satisfied. In addition, these interstate health charts should be forwarded so that they will reach the regulatory official of the state of destination before the arrival of the animals. By the adoption of such a program, I feel certain the interstate movement of cattle would be facilitated without imposing the hardship of quarantine and expense of testing cattle at destination, and would aid materially in safeguarding the health of the cattle in the herds and areas to which the shipment was consigned.

Breeders of dairy and breeding cattle, dealers, veterinarians and livestock regulatory officials should have a proper regard and appreciation for herds that have attained a free or negative brucellosis status. They will then better understand why many owners will purchase only cattle with such a favorable health status.

Such cattle are most desirable; and we are not helping the industry nor fully
protecting the herds to which they may be added by criticizing purchasers that
demand cattle with that health standard or the livestock regulatory organization in
the purchaser's state that directs or makes it necessary to purchase such cattle.

If a breeder is disappointed in not finding a ready sale for his cattle due to the
fact that his animals do not meet the requirements, he should not condemn the
health regulations but should "tightly his belt" and with perseverance and his
veterinarian's guidance and assistance determine to reach the desired goal, namely,
a brucellosis-free herd.

It would be impossible to achieve success in the prevention and control of bru-
cellosis, whether in interstate cattle or native herds, without an enlightened and
interested owner and the fullest cooperation and sympathetic support of the
practicing veterinarians.

The longer I am engaged in transmissible disease prevention and control work,
the more impressed I am with the necessity of honesty and integrity being practiced
by every person participating. One should also have a definite plan and stick to it.

In order to obtain more uniformity in our interstate brucellosis requirements for
admission of dairy and breeding cattle, we must have more uniformity in the plans,
methods and procedures for the prevention and control of brucellosis which are
recognized as official in the various states. This applies particularly to the blood
testing of cattle and the vaccination of calves under official supervision, proper
identification and quarantine of reactors to the blood test until disposed
of under
official supervision, controlling and restricting the movement of cattle from infected
herds so they will not be admitted to other herds under official supervision.

All veterinarians should be interested in and familiar with the principles and
approved methods available for the effective prevention and control of brucellosis.
This applies particularly to those veterinarians whose clients breed or raise cattle
or engage in the traffic of livestock. They should also give their full cooperation
to the regulatory officials, whether Federal or State, in the enforcement of both
interstate and intrastate regulations.

In keeping with this thought, it would seem that official measures, in their
essentials, should be made to do no less, and can do little more, than to reinforce the
orderly process by giving aid to those who are starting out on a plan or method
of prevention and control, giving recognition to those who succeed, and increasing
safety as the years go by to those who obtain cattle from approved herds.

Livestock regulatory officials in carrying out their duties are at times criticized
by livestock men and dealers for causing what may seem to them unnecessary
interference in the free movement of livestock intrastate or interstate, but if we
render the service to the livestock industry and keep in mind the purpose of that
service, we will, no doubt, have rendered the "greatest good to the largest number"
and have the satisfaction of at least having tried to do a good job.

Without the loyal support of the herd owner, cattle dealer, veterinarians, and
other participating agencies in preventing and controlling diseases, regulations
designed to obtain desired results will fail. Honesty, integrity and efficiency on the
part of all who participate or enter into the breeding, raising, selling, testing, certify-
ing or otherwise handling of livestock, makes for confidence between the seller and
buyer and also regulatory officials. This is essential to a healthy and profitable
livestock industry and the free movement of livestock between the states.
INTERSTATE REGULATIONS FROM THE VIEWPOINT OF THE DAIRY CATTLE BREEDER

BY JOHN S. CLARK

President, Purebred Dairy Cattle Association, Huntington, Long Island, New York

I appreciate very much the invitation of your Committee to meet with you folks here today and to have the opportunity to present to you a serious problem of the American dairy cattle breeder.

The Purebred Dairy Cattle Association is composed of representatives from the five major dairy breeds. This organization is attempting among other projects to standardize and simplify the present interstate health shipping laws for the movement of dairy cattle.

The Purebred Dairy Cattle Association is very serious and sincere in considering uniform rules and regulations pertaining to this subject which affects thousands of us who own dairy animals.

We breeders are interested in this subject for one purpose only—to safeguard the health of our herds and to promote the interstate movement of healthy cattle with a minimum of expense, delay, red tape, and confusion. Cattle owners hold no brief for traffic in diseased animals. We believe this entire subject should be considered only as a health problem. It should not be considered as a political football, nor as an economic barrier to livestock shipments between the states.

Cattle breeders look to trained veterinarians for leadership; as educators, guides and even police in the control of our animal health program. We frankly do not know what the laws should be. Many of us think area testing for Bang's is as sound as the area testing for tuberculosis.

For over one-half a century the United States Bureau of Animal Industry in cooperation with various state officials has made most remarkable progress in the control and eradication of a great many contagious and infectious diseases of livestock. Many uniform regulations have been soundly and satisfactorily established.

Unfortunately the problem of the Bang's disease has not yet been cleared. A wide-spread confusion results both with cattle owners, state officials and practicing veterinarians. Breeders do not understand how animals may be considered healthy in one state and from the same test by the same veterinarian be not so considered in another section.

It is hardly necessary to call your attention to the great variety of laws, rules and regulations governing animals crossing state lines. This results in great difficulty and unnecessary time and expense to both buyers and sellers in the movement of dairy cattle.

We all readily recognize and appreciate the fact that each state has its own health problems; that disease is more prevalent in some states than in others—also some states have made far greater progress in disease control than in other states.

Due to the difference existing in the care of housed dairy cattle of the North East and unhoused beef cattle of the South West, many of us have thought it would be wise if uniform interstate health laws might be developed by your Veterinary
Committee for various areas of the country by sections, especially where the health and herd management problems are somewhat similar.

The tuberculosis problem is becoming quite well straightened out. However, the same cannot be said regarding the movement of Bang's-free herds or of vaccinated cattle. With the introduction of vaccine for Bang's in dairy animals, the problem has become more complicated and bewildering not only to herd owners but to veterinarians themselves. Many of us who have healthy accredited herds do not even know whether or not we should vaccinate. In talking with many veterinarians, I have found that they are far from agreement on this matter. While thousands of young animals are being vaccinated, there has been a tendency among farmers and breeders to relax sound herd management practice, many farmers think the mere process of vaccination would be the solution and all difficulties remedied. Proper herd management is the foundation for healthy cattle and the veterinarians are saving thousands of dairy herds annually in both timely and sound advice to farmers throughout the country.

Various states recommend blood testing animals at different ages—some at 4, some at 5 and some over 6 months of age. Should not the veterinary recommendations be more uniform? A clear statement from the Federal Government and your Sanitary Committee regarding the entire Bang's problem, with satisfactory evidence of good results, would be of untold help to the man who is really trying to create and maintain a healthy herd.

I realize that the changing of various state health laws takes a long time and is most complicated, though less difficulties are encountered in some sections than others. Your health syllabus regarding state health laws published Sept. 1, 1943 takes 194 fine-typed pages. Cannot this be simplified without danger to American livestock health?

Some of the problems vexing breeders is the State Permit requirement in some states after the breeder has the necessary health shipping charts. This is a matter causing confusion and delay at many public sales.

State fairs and public exhibitions will certainly be greatly relieved if our laws can be more uniform. Vaccinated 4-H calves and other young animals can be shown at some fairs but not at others depending on the variance of the laws.

Last September, the Purebred Dairy Cattle Association had a meeting at Springfield, Mass. where veterinary leaders of eleven northeastern states and the Federal Government met with representatives of the five dairy breeds in the hope of getting uniform state laws for the movement of clean healthy cattle in that section. Our conference was well attended and a fine spirit of cooperation existed throughout the entire meeting.

Doctors Bishop of Pennsylvania and Hendershott of New Jersey of your Sanitary Committee gave us all splendid cooperation and really sound leadership in this matter.

Those of you who have to do with interstate permit charts can well appreciate some of the confusion that exists at present as regarding shipping Bang's tested cattle. Dr. Howe of New York State has taken up the problem of standardizing interstate health shipping papers. Many of the states at present have different kinds and forms of charts that are most confusing. Some are scarcely understandable. Many of these state papers have not been changed for years.
Similar conditions existed in the breeding records kept by the artificial breeding rings for artificial insemination records. The Purebred Dairy Cattle Association spent a great deal of time on this matter and finally with the aid of college professors, breeders and veterinarians, produced a uniform and standard breeders' record book with the same terminology which is now used by each of the dairy breeds. This saves a veterinarian from carrying five different books of various sizes and detail. A similar idea on interstate health charts should be really worthwhile.

I appreciate the opportunity to present this subject to your membership for consideration. I can promise the full cooperation and support of the Purebred Dairy Cattle Association and its five member organizations for a sound, practical health program.
REPORT OF COMMITTEE ON LAWS AND REGULATIONS


STATE HEALTH REQUIREMENTS GOVERNING ADMISSION OF LIVESTOCK

With the hope of obtaining more uniform regulations governing the interstate movement of livestock, our President, Dr. J. M. Sutton, requested the Committee on Laws and Regulations to devote its time and effort to drafting health requirements that might serve as a guide or basis for promulgating laws and regulations by the various states, thereby, serve to obtain more uniformity even though some states may have occasion to modify the requirements to meet certain conditions peculiar to their location and class of livestock involved.

I am sure we recognize the problem confronting us and realize that in offering suggestions for a regulation, it is most difficult to anticipate the respective restrictions which each state may see fit to impose.

Several years ago, the Committee on Uniform Laws and Regulations reported and gave a summary on the health requirements of the various states on the interstate movement of livestock. This report entailed a great deal of time and effort, and clearly revealed that only where there are Federal laws and regulations promulgated, is there a semblance of uniformity of the health requirements.

In reviewing the regulations of the various states, it is our opinion that in a general way they are satisfactory, except the brucellosis or Bang's disease requirements for admission of dairy and breeding cattle, and cattle vaccinated as calves under Federal-State supervision.

The lack of uniformity is due, largely, to differences in the progress of brucellosis control work in the states involved; lack of uniformity and accord in the plans, methods and procedures in our control program for brucellosis; differences in the degree of infection; failure to properly restrict and dispose of reactors under official supervision; unofficial, secret blood testing and vaccination of cattle; variations in the requirements governing the intrastate movement of cattle for addition to herds under official supervision for brucellosis control and that some states import a larger number of cattle for dairy and breeding purposes.

In formulating the brucellosis or Bang's disease requirements as presented in this report, including cattle vaccinated as calves, we have recognized the suggestions and recommendations offered by the Committee on Brucellosis of this association a number of years ago. The Committee agreed that the fundamental considerations regarding all interstate transfers of cattle are found in the status of the herd of origin, as well as that of the transferred individuals; furthermore, that no animal in a herd in which calfhood vaccination is being practiced shall be disposed of for any purpose other than slaughter while revealing a positive or suspicious titer to an
official test for brucellosis, except upon written permission from the proper cooperating Federal or State officials. Any animal vaccinated as a calf and failing to react when tested at a time more than a month subsequent to vaccination may, we believe, be accorded the same privileges that apply to non-reacting, unvaccinated animals of the same status in other respects.

The livestock industry desires safe and sane laws and regulations for the prevention and control of diseases—a real protection to an important industry. They properly look to the veterinarians for guidance and advice. This is a responsibility we must assume and an opportunity to render a real service to the livestock industry.

Regulations that might be applicable and reasonable for the interstate movement of cattle between such states as Wyoming, Montana, Nebraska and Colorado, etc., would not be satisfactory as far as New York, New Jersey, Maryland and Pennsylvania are concerned.

We believe that, with the proper spirit of "give and take" between states, we can arrive at some common basis, whereby requirements can be accepted and adopted by a large percentage of states, particularly, by groups of contiguous states whose interests are similar.

Under the leadership of members of this Committee, representatives of the livestock industry and livestock sanitary officials of various groups of states have met to consider requirements for a regulation which would be acceptable to those states and to offer suggestions for a constructive report of this Committee.

The interest displayed and recommendations offered by various groups is appreciated by the Committee, and has been an important contribution, making for uniformity by general agreement at least on essentials and principles that should be embodied in the report of the Committee.

Without the support of adequate regulations by herd owners, practicing veterinarians, cattle dealers and other cooperating agencies, designed to prevent and control transmissible diseases in our livestock, the task of the livestock sanitary official is impossible of accomplishment. The best way to bring about this support and confidence is for all stockmen, veterinary practitioners, livestock dealers and livestock sanitary officials to execute honestly and efficiently every phase and detail of the procedure which is theirs to perform in order to breed, raise, sell, transport and otherwise handle healthy animals.

GENERAL

No animal, including poultry or bird of any species, that is affected with, or that has been recently exposed to, any infectious or transmissible disease shall be imported into the state until written permission for such importation is obtained from the chief livestock sanitary official of the state of destination. An official certificate of health means a legible certificate, made on an official form from the state of origin or from the United States Bureau of Animal Industry, issued by veterinarians in the employ of the United States Bureau of Animal Industry, accredited veterinarians or licensed graduate veterinarians from a college which has been recognized by the American Veterinary Medical Association, and which veterinarians are approved by the recognized livestock sanitary official of the state of origin.
Livestock imported into the state shall be accompanied by an approved health certificate or permit, where required, which must be attached to the waybill or shall be in the possession of the driver of vehicle or person in charge of livestock, if moved on foot. A health certificate or permit will be void after thirty (30) days.

The health certificate shall contain the names and addresses of the consignor and the consignee, with an accurate description or identification of the livestock. A copy of the approved certificate shall be forwarded to the livestock sanitary official of the state of destination before arrival of livestock.

Livestock entering the state without a proper health certificate and not meeting the health requirements shall be held in quarantine at owner's expense until released from quarantine by the livestock sanitary official.

All trucks, railway cars and other conveyances used for the transportation of livestock and poultry shall be maintained in a sanitary condition.

The owners and operators of railway cars, trucks and other conveyances that have been used for interstate movement of any livestock infected with or exposed to an infectious or transmissible disease, shall be required to have such cars, trucks and other conveyances thoroughly cleaned and disinfected under official supervision. Proper notice of cleaning and disinfection or such certification shall be attached to the waybill or in the possession of the operator of truck or other conveyance.

HORSES, MULES AND asses

These animals may be imported into the state when accompanied by a health certificate, issued by a licensed graduate veterinarian and approved by the proper livestock sanitary official of the state of origin, giving an accurate description of the animal or animals and certifying that the animal or animals as determined by a physical examination are free from any evidence of an infectious or transmissible disease and have not been recently exposed to any communicable, infectious or parasitic disease.

A copy of the approved health certificate shall be forwarded to the livestock sanitary official before the arrival of the animals at destination.

No health certificate will be required for horses or mules of the United States Army or horses which are consigned to any race track or entering the state temporarily for exhibition purposes.

CATTLE—DAIRY, BREEDING AND FEEDER

Tuberculosis. Cattle for dairy and breeding purposes, feeder cows, heifers and bulls of beef breeds, including calves and cattle for exhibition purposes, may be imported into the state provided they are identified as originating in (a) Tuberculosis-free accredited herds, or (b) Qualified negative herds from modified accredited tuberculosis-free areas. If such herds have not passed a negative tuberculin test within (12) months prior to entry, the cattle from these herds to be imported into the state shall be tuberculin tested within thirty (30) days prior to entry.

Feeder. Cattle of the beef breeds, which do not come within the tuberculosis requirements, as provided, may be imported into the state for temporary feeding purposes, provided they are not under quarantine for tuberculosis and have passed a negative tuberculin test within thirty (30) days of entry or consigned to a public
stockyard under official supervision where they shall be tuberculin tested by an approved veterinarian.

Steers from herds not under quarantine for tuberculosis may be imported without a tuberculin test, provided they are maintained separate and apart from dairy and breeding cattle.

Cattle which originate in a herd in which infection is disclosed are not eligible for entry unless such herd has passed three (3) consecutive negative tuberculin tests at least sixty (60) days apart without evidence of infection.

Brucellosis (Bang's Disease). Cattle for dairy and breeding purposes, feeder cows, heifers and bulls of beef breeds, including calves and cattle for exhibition purposes, may be imported into the state, provided they come directly from:

(a) Herds officially accredited brucellosis-free or qualified herds in modified accredited brucellosis-free areas, in which all animals in the herd over six (6) months of age were negative to an official test for brucellosis within twelve (12) months of entry, and the animals for entry were negative to an official blood test within thirty (30) days of the date of entry.

(b) Herds under Federal-State supervision for the control of brucellosis, in which all animals in the herd over six (6) months of age were negative to an official blood test within three (3) months of entry, and the animals for entry were negative to an official blood test within thirty (30) days of the date of entry—such test not to be applied within thirty (30) days of the date of the previous herd test.

(c) Unvaccinated calves under six (6) months of age will not be required to be blood tested prior to entry, provided they are identified as the progeny and come directly from negative or accredited brucellosis-free herds in accordance with paragraphs (a) or (b).

(d) Cattle vaccinated under Federal-State supervision with *Brucella abortus* vaccine between four (4) and eight (8) months of age which originate in herds in accordance with paragraphs (a) or (b), wherein all unvaccinated animals over six (6) months of age and all vaccinated animals over two (2) years of age are negative to one or more official blood tests, may be imported into the state, provided they are negative to an official blood test within thirty (30) days of the date of entry.

(e) Cattle under eighteen (18) months of age vaccinated under Federal-State supervision with *Brucella abortus* vaccine between four (4) and eight (8) months of age, which originate in herds in accordance with paragraphs (a) or (b) may be imported into the state if not negative or without an official blood test, but the importation shall be at the request of the purchaser and subject to the approval and special written permit issued by the chief livestock sanitary official of the state of destination.

A special written permit for the importation of vaccinated cattle, which are not negative to an official brucellosis test, or have not been tested since vaccination, is necessary in order to meet the health requirements for the establishment and maintenance of brucellosis-free herds and areas, and in order that such animals may be kept under supervision and their destination known.
(f) Cattle under eighteen (18) months of age vaccinated under Federal-State supervision with *Brucella abortus* vaccine between four (4) and eight (8) months of age, which originate in herds not meeting requirements under paragraphs (a) and (b), may be imported into the state if not negative or without an official blood test upon request of the purchaser, and shall be subject to the approval and special written permit issued by the chief livestock sanitary official of the state of destination.

A special written permit for the importation of vaccinated cattle, which are not negative to an official brucellosis test, or have not been tested since vaccination, is necessary in order to meet the health requirements for the establishment and maintenance of brucellosis-free herds and areas, and in order that such animals may be kept under supervision and their destination known.

(g) Cattle for dairy and breeding purposes, feeder cows, heifers and bulls of beef breeds not provided for in above classifications may enter the state provided they were negative to an official test for brucellosis within thirty (30) days prior to entry. Such cattle will not be eligible for additions to herds and quarantined areas under Federal-State supervision for the control of brucellosis.

Tests for brucellosis shall be conducted in a state laboratory, an approved laboratory or by a veterinarian approved by the proper livestock sanitary official of the state where the cattle originate.

*Health Certificate.* Cattle conforming to the preceding tuberculosis and brucellosis requirements shall be accompanied by a health certificate issued by an accredited veterinarian approved by the proper livestock sanitary official of the state of origin. The certificate shall contain a statement certifying that the cattle are free from any evidence of an infectious or transmissible disease, and have not been recently exposed to any communicable, infectious or parasitic disease. The certificate shall also contain the tuberculosis and brucellosis status of the herd from which the imported cattle originate, results of brucellosis and tuberculin tests, description, age, tag or tattoo number, specific brand, registry name and number of each animal to be imported and names and addresses of the owner, consignor and consignee. The officially approved health certificate shall be forwarded to the chief livestock sanitary official before the arrival of cattle at destination.

The health certificate for the importation of calves under six (6) months of age, as provided in paragraph (c), shall include the identification of the dam and tuberculosis and brucellosis status of the herd in which the calves originate.

The health certificate covering importation of cattle vaccinated as calves under official supervision shall contain a statement as evidence of vaccination, age of cattle when vaccinated and date of vaccination.

*Feeder Steer.* Feeder steers may be imported without a brucellosis test certificate, but shall be accompanied by a health certificate issued by a licensed graduate veterinarian and approved by the proper livestock sanitary official, certifying that the cattle are apparently free from any communicable disease.

Steers upon arrival at destination shall be maintained separate and apart from all other cattle until moved for slaughter or other disposition, under official supervision.
Public Stockyards and Auctions. No cattle approved for entry into the state as free from tuberculosis or brucellosis shall be assembled, handled or confined in any public stockyard, livestock auction, sales' stable or yard, unless they are properly segregated in thoroughly cleaned and disinfected pens to prevent their exposure to infected cattle or premises.

Immediate Slaughter. Apparently, healthy cattle of strictly slaughter type to be used only for immediate slaughter may be imported into the state without a health certificate or tuberculin or brucellosis test, provided such cattle are consigned for immediate slaughter to a recognized public stockyard where Federal or State veterinary inspection is maintained, or shipped to a slaughtering establishment or slaughtering center that is approved and designated by the Bureau of Animal Industry, United States Department of Agriculture, and the chief livestock sanitary official in the state of destination. Such cattle shall be slaughtered within ten (10) days after arrival at destination, except when the ten-day period is extended by special permit from the chief livestock sanitary official.

Splenetic or Tick Fever. No cattle infested with ticks (Margaropus annulatus) or exposed to tick infestation shall be shipped, trailed, driven or otherwise imported into this state for any purpose.

Cattle from Federal-State tick quarantined areas shall not be imported into this state except in accordance with regulations of the Bureau of Animal Industry, United States Department of Agriculture.

Scabies. No cattle affected with scabies shall be shipped, trailed, driven or otherwise imported into this state for any purpose.

No cattle recently exposed to scabies or from an area quarantined on account of scabies shall be imported into this state except in accordance with the regulations of the Bureau of Animal Industry, United States Department of Agriculture.

Sheep and Goats. Goats for dairy and breeding purposes to be imported into this state shall be accompanied by a health certificate issued by a licensed veterinarian and a record of a negative test for tuberculosis and brucellosis—such tests to be conducted within thirty (30) days prior to importation. The health certificate shall include a description of each animal included in the shipment, giving age, sex, breed, and color or markings.

Breeding and Feeder

Scabies. Sheep and goats for purposes other than immediate slaughter that have been handled in stockyards, stock pens or on premises in public use for livestock shall not be imported into this state until after they have been dipped in accordance with the regulations of the Bureau of Animal Industry, United States Department of Agriculture; and while in transit, they shall be accompanied by a certificate certifying such dipping.

The health certificate covering importation shall include report of inspection by a licensed graduate veterinarian approved by the chief livestock sanitary official of the state of origin, indicating that the sheep or goats are not under quarantine for scabies and are free from symptoms of scabies or any infectious or communicable diseases.

Sheep and goats that have not been handled in stockyards, stock pens or on
premises in public use for livestock may be imported for purposes other than imme-
diate slaughter, if accompanied by a health certificate issued by the licensed gradu-
ate veterinarian making the examination and approved by the chief livestock
sanitary official of the state of origin, indicating that they are free from scabies or
symptoms of any infectious or communicable disease. Upon arrival at their
destination such sheep and goats shall be unloaded directly from the car, truck,
vehicle or conveyance into cleaned and disinfected vehicles or conveyances or upon
clean and disinfected premises.

A copy of the approved health certificate shall be forwarded promptly to the
livestock sanitary official of the state of destination.

Immediate Slaughter. Apparently, healthy sheep and goats may be imported
into this state for the purpose of immediate slaughter when consigned directly to a
recognized public stockyard or to a slaughtering establishment or slaughtering
center that is approved and designated by the Bureau of Animal Industry, United
States Department of Agriculture, and the chief livestock sanitary official.

Such sheep and goats shall be accompanied by a waybill or certificate marked for
immediate slaughter, and shall be slaughtered within ten (10) days after arrival at
destination, except when the ten-day period is extended by a special permit from
the livestock sanitary official.

Transportation. All sheep and goats for purposes other than immediate slaughter
shall be imported in conveyances that have been cleaned and disinfected imme-
diately prior to loading the animals.

SWINE—BREEDING AND FEEDER PURPOSES

All swine imported into this state, except those for immediate slaughter, shall be
accompanied by a certificate of health issued by a licensed graduate veterinarian,
stating that they are free from any symptoms of infectious or communicable disease,
and that each animal has been treated with a proper dose of anti-hog cholera serum
within fifteen (15) days of the date of entry into the state, or that each animal has
been treated by the serum-virus method not less than thirty (30) days immediately
prior to the date of entry into the state.

A certificate of health and certificate of vaccination stating the ear tag number,
date of vaccination, amount of serum or serum and virus used, approved by the
livestock sanitary official of the state of origin, shall be furnished for all swine and
shall be forwarded immediately to the livestock sanitary official in the state of
destination. A copy of the approved certificate of health shall accompany the
swine while enroute.

Purebred swine, if not ear-tagged, shall be identified by registry name and
number and a description sufficient to identify the animal.

Immediate Slaughter. Swine may be imported for immediate slaughter without
a certificate of health, provided they are consigned directly to a recognized public
stockyard or to a slaughtering establishment or slaughtering center that is approved
and designated by the Bureau of Animal Industry, United States Department of
Agriculture, and the chief livestock sanitary official.
POULTRY

Chickens for breeding purposes shall not be imported into the state unless they originate in negative tested flocks under the supervision of the pullorum control phase of the National Poultry Improvement Plan, or have passed a negative blood test for pullorum disease under the supervision of the proper state livestock sanitary official within thirty (30) days of entrance.

Chickens not meeting the above requirements, and other poultry, may be imported into the state, provided they are free from any evidence of an infectious or transmissible disease.

DOGS

All dogs imported into this state for any purpose, with the exception of those for exhibition purposes to be within the state for a limited period of time, shall be accompanied by a certificate of health issued by a licensed graduate veterinarian and approved by the proper livestock sanitary official of the state of origin, stating that the dog or dogs are free from symptoms of any infectious or communicable disease, did not originate within an area under quarantine for rabies and by reasonable investigation have not been exposed to rabies within 100 days prior to importation. A copy of the health certificate shall be forwarded promptly to the livestock sanitary official in the state of destination.

WILD ANIMALS

Wild and semi-wild animals under domestication or in custody may be imported into the state, provided that a report of the number of animals is made to the chief livestock sanitary official in this state within ten (10) days, and that immediate opportunity for examination is afforded a representative of the livestock sanitary service to determine the health status of such animals.

WHO MAY INSPECT

Veterinarians in the employ of the United States Bureau of Animal Industry, accredited veterinarians or licensed graduate veterinarians from a college which has been recognized by the American Veterinary Medical Association and which veterinarians are approved by the recognized livestock sanitary official of the state of origin.

WHO MAY APPROVE HEALTH CERTIFICATES

All health certificates for interstate shipment shall carry the approval of the chief livestock sanitary official of the state of origin.

OFFICIAL

Chief Livestock Sanitary Official
SECOND ANNUAL REPORT OF THE INTER-ASSOCIATION COUNCIL ON ANIMAL DISEASE AND PRODUCTION

BY MARK WELCH

Pearl River, New York

Your representative on the Inter-Association Council on Animal Disease and Production is glad to report that appreciable progress has been made on the livestock programs which were undertaken as one of the first activities of the Council. A war production program on sheep was published in the Journal of the American Veterinary Medical Association in the March 1944 issue. This program is being used by the National Livestock Conservation Program, with whom arrangements have been completed for publication and dissemination. The materials will be issued in two forms because certain sections are applicable to either range conditions or farm conditions alone. A program on dairy goats has been accepted by the American Goat Society for their yearbook and The Goat World. The Council is awaiting word from a third publication which had originally indicated interest in considering the manuscript. A program on swine has been completed and turned over to Dr. Leinbach of the National Livestock Conservation Program for publication. Progress has been slower than anticipated in completing the dairy program.

A meeting of the Council was held in December 1943 concurrent to the annual meetings of the American Society of Animal Production and the U. S. Livestock Sanitary Association. At this time the Committee on Nutrition of the American Veterinary Medical Association discussed with the Council the possibility that the nutritional information contained in the various livestock programs might constitute information which would be of interest and assistance to the veterinary profession. It was subsequently agreed that while this information might be of interest, a more detailed presentation would be of greater value to the veterinary profession. The Council has communicated with the Committee on Nutrition and has offered assistance in obtaining the help of outstanding nutritionists for the preparation of appropriate articles.

Representatives of the Inter-Association Council attended, by invitation, a meeting of the Committee on Animal Health of the National Research Council during the time of the American Veterinary Medical Association meeting held in St. Louis in August 1943. The Committee on Animal Health was advised of the discussions of the Council regarding the resolutions requesting a study of the vaccination of adult cattle against brucellosis which was presented by the American Dairy Science Association at their annual meeting in June 1943. The Council recommended that the Committee on Animal Health make a study of the problem and has been informed recently that the study is nearing completion.

To carry out the idea of cooperation with all groups interested in livestock production and animal welfare, the Council invited Dr. George H. Hart, Chairman of the Committee on Animal Health of the National Research Council, to meet with them at their December meeting for the purpose of coordinating the activities of
the respective groups so as to avoid confusion, conflict, and overlapping. The conference resulted in a clearer understanding of the role of each group.

The Council, following the meeting in July 1943, undertook preparation of a program "Protecting and Promoting the Livestock Industry." These proposals have been submitted to the officers of the respective associations for consideration and suggestions. The general program has been accepted by the American Dairy Science Association, the Poultry Science Association, the American Veterinary Medical Association, and are now being considered at this meeting of the United States Livestock Sanitary Association. It is expected that these proposals, when finally completed and made public, will have a very beneficial effect upon livestock production. Definite action, however, must await approval of the proposals by all of the member associations.

At the annual meeting of the American Society of Animal Production a resolution was passed pointing out the critical manpower situation existing in the livestock field, and proposed that it be called to the attention of the War Manpower Commission. The matter was referred to the Council and appropriate letters were sent to Paul V. McNutt, Chairman of the War Manpower Commission and to General Hershey of Selective Service, with carbon copies to Secretary of Agriculture, Claude R. Wickard and War Food Administrator, Marvin Jones. The efforts of the Council in obtaining classification of animal scientists as essential men were ineffective. It was found, also, that the major portion of the younger animal scientists were already in military service.

The special Committee on Registration of Breeds Produced by Artificial Insemination and Recognition of New Breeds of the American Society of Animal Production referred their report to The Inter-Association Council for consideration. The Council has not had an opportunity to meet and discuss the opportunities the Council might have for assisting in this work which is considered to be of great importance to livestock owners.

The Council would like to call to the attention of the membership of the respective associations a paper entitled "Cooperation of the Five Animal Science Associations in the War Effort," which was presented before the American Society of Animal Production by Dr. George Hart, Chairman of the Committee on Animal Health of the National Research Council. This address was subsequently published in the Journal of Animal Science 3: 91-97, Feb. 1944.

In December 1943 it was announced that Dr. W. A. Hagan, Dean of the School of Veterinary Medicine, Cornell University, had been granted a leave of absence to become a Special Consultant to the Chief of the Bureau of Animal Industry of the U.S. Department of Agriculture. The Council extended their congratulations and indicated their willingness to be of assistance wherever possible.

The Council was invited to attend a meeting of the Committee on Animal Health of the National Research Council, and in turn invited the Committee on Animal Health to attend its meeting on August 21, 1944. The reciprocal invitations were extended to foster closer cooperation. Both meetings were held at the time of the American Veterinary Medical Association meeting.

Last year the Council prepared an annual report as of August 1. In this report a brief statement was made regarding the opportunities for the Council to render
service to the member associations, the livestock interests, and to the public. Active progress was being hampered by the lack of funds, so the following motion was included:

"Therefore, it is hereby moved that the respective associations be requested to provide an annual contribution to the Council on the basis of $25 for the first 500 members and $0.01 for each active member in excess of 500, with the monies to be used for incidental expenses such as postage, mimeographing, clerical help, and the like; such funds to be made available to the Council through the respective representative by October 1 of each year, beginning with the current year."

The American Dairy Science Association have indicated their intention to participate financially in the support of the Inter-Association Council. Furthermore, they have authorized the payment of the expenses of one meeting per year of representatives to inter-association affairs. Among those covered is the representative to the Inter-Association Council on Animal Disease and Production.

Contributions have been received as follows:

<table>
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<th>Association</th>
<th>Amount</th>
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<td>American Veterinary Medical Association</td>
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<tr>
<td>Poultry Science Association</td>
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<tr>
<td>U. S. Livestock Sanitary Association</td>
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</tr>
<tr>
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It was agreed that these funds would not be used unless all associations considered the activities of the Council of sufficient value to join in its financial support. Accordingly, each representative has made provision for handling his own secretarial help. The following constitutes a record of these expenses:

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<thead>
<tr>
<th>Name</th>
<th>Hours</th>
<th>Secretarial Help</th>
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<tr>
<td>G. E. Taylor</td>
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<td>3.75</td>
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</tr>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$139.27</strong></td>
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</tr>
</tbody>
</table>

During the year it became necessary for Dr. Jakeman, the representative of the American Veterinary Medical Association, to request that someone be appointed in his place and Dr. O. V. Brumley has recently been appointed to fill the unexpired term. According to the rules and regulations of the Council, a representative of the American Dairy Science Association should have been appointed for a 5-year term beginning January 1, 1944. At their last meeting that association appointed Dr. W. E. Peterson for this term of office.
RECENT PROGRESS

Recently discovered evidence that ova and larvae of internal parasites of sheep can not usually withstand the winters of the colder sections of the country has paved the way for control in such areas through treating all parasitized sheep during the winter. Both controlled experiments and field studies have shown definitely that a mixture of salt and phenothiazine kept before grazing sheep reduces materially the losses from gastrointestinal roundworms. A combination of winter treating of the ewe flock and use of phenothiazine-salt licks during the grazing season has already resulted in considerable expansion of the sheep industry in some areas in which parasitism was the principal adverse factor. It seems quite possible that sheep husbandry may again become a profitable enterprise in many sections from which these animals have all but disappeared.

The successful treatment of cattle for liver fluke infection with hexachloroethane is a significant contribution to the control of these parasites. The infected bovine has long been a very difficult problem in controlling and preventing losses from flukes. Practical livestock producers learned from experience that certain pastures and ranges were potentially fluky and that it was unsafe to use them for sheep production. The introduction of copper sulphate dust as a control measure for the snail hosts for the liver fluke and of carbon tetrachloride as a treatment for infected sheep made it possible to use such areas for grazing sheep. But any cattle grazing on such areas were apt to act as reservoirs for flukes and laxity in snail control was often followed by explosive losses among the sheep from liver rot. For this reason livestock owners have been advised against keeping both cattle and sheep on potentially fluky pastures. With the hexachloroethane treatment available it may be possible to graze sheep and cattle together on such lands.

Phenothiazine is undoubtedly a very efficient treatment for strongylosis in horses and mules but in a few instances this drug has been very toxic to all or almost all the horses treated on a given farm. While the overall percentage of animal adversely affected has been very low these occasional cases have made veterinarians and livestock owners very reluctant to use this drug for horses. Evidence now at hand indicates that only those horses which are on poor diets are susceptible to
REPORT OF COMMITTEE

phenothiazine poisoning and that mules, even on poor diets, are not poisoned by this drug. This information, together with data establishing the therapeutic dose for mature horses at approximately 25 grams instead of the 50 to 75 grams formerly recommended should lead to much improvement in controlling and preventing losses in equines from strongylosis.

LOST GROUND

Scabies in sheep has appeared, during recent years, in several areas which had apparently been free from this disease. Infection is known to exist in approximately 20 states with rather widespread occurrence in a few of these. Efficient control and eradication measures are well known but with a generation of owners and veterinarians who are unfamiliar with the disease it is not being reported as promptly as is desirable. Shortage of personnel is making it very difficult for livestock sanitary authorities to make the necessary inspections and to give the supervision which is necessary for prompt eradication.

Reports indicate that cattle lice are becoming increasingly destructive. Some owners and veterinarians are becoming alarmed at their seriousness. They are probably being spread to some extent through community sales yards.

The small stomach worm of cattle (Ostertagia ostertagi) is apparently becoming well established in some sections of the Corn Belt. They seem to have been introduced in feeder cattle.

The fringed tapeworm of sheep (Taeniaspis actinoides) is causing increased concern on some of the range lands of western United States.

The kidney worm of swine (Stephanurus dentatus) has been reported from several of the Corn Belt states within recent years. It seems to have been introduced in feeder pigs from the south and to have become established in some localities.

SOME MERITORIOUS PROBLEMS

While this committee is not presuming to outline projects for the workers in the field of parasitic diseases it seems logical to suggest that some problems which are especially important should be given consideration. One of these is the possibility of increasing resistance to parasitic diseases through selective breeding. Attention is called to the fact that plant breeders and pathologists have long recognized the importance of selective breeding as a means of controlling parasites and many of their efforts have been spectacularly successful.

There is available quite a little information concerning the relation of diet to the susceptibility of laboratory animals and dogs to parasites but very little work with large animals has been reported.

SUGGESTIONS

All veterinarians, livestock sanitary officers, and parasitologists should watch for the introduction of parasites through dogs which may be brought back by returning members of the armed forces. Attention is called especially to Tenia echinococcus as the incidence of hydatid cysts is very high in some countries in which our armed forces are now stationed. Since the dog is known to act as a host for
the causative agent of surra, *Trypanosoma evansi*, there is a possibility that this disease may be introduced in returning canines.

The job of controlling and eradicating parasites from our domestic animals is much bigger than dipping or dosing a single animal or group of animals. After the parasitologist has worked out the life cycle and perhaps found an effective method of destroying the harmful agent there is still to be done the stupendous task of working out practical methods of applying control measures in the field, obtaining the cooperation of owners, and organizing the program in such a way that the job at hand can be accomplished at the least expense and inconvenience on the part of the livestock industry. The research worker, the field sanitary officer, the veterinarian, and the livestock owner must combine forces if successful results are to be had.
THE IMMUNITY CREATED BY VACCINATION OF CALVES WITH BRUCELLA STRAIN 19


Cornell University, Ithaca, New York

Since Buck first reported Brucella Strain 19 as a valuable immunizing agent against brucellosis in cattle its use for that purpose has increased steadily until it is now the only strain used in the United States in the preparation of brucella vaccine. Because the expectation of immunity decreases with the age at which the calf is vaccinated, and because the incidence of persistent vaccination reactors increases with that age, the practice of vaccinating calves between the ages of 4 and 8 months likewise has become the standard, the effort being to avoid both objections.

Because of the extensive and exclusive use of Strain 19 in vaccinating calves between 4 and 8 months old, any grounded knowledge of what this vaccination will or will not do becomes of paramount importance, both as regards its immediate effect in reducing losses, and its ultimate status as a sanitary measure.

Two chief influences determine the expectation of immunity, once calves are properly vaccinated. The animal may be held in clean herds protected from exposure or it may be raised in infected herds where continuous, or at least frequent exposure may constantly reinforce the immunity. Since calf vaccination is more definitely indicated in infected herds, our experiment was planned to cover its effects in these herds only.

The original work by Buck named two important qualities of Strain 19 which set it apart from other known strains; namely, low virulence and high immunizing qualities. This report revived hope for vaccination, following indifferent or wholly disappointing results which previously had attended the use of all other strains.

Buck's work subsequently was supplemented by experiments described variously and successively by Cotton, Buck and Smith. These experiments, carefully controlled, included different groups of cattle, each assembled for a particular purpose, and these could not provide data based on a relatively large herd kept under observation over a term of years. The extensive field experiments later reported by Mohler and Wight further established the value of Strain 19 as an immunizing agent, but they did not provide information regarding the incidence of subdued brucellosis in the individual, nor did they include the systematic exposure, to known transmitting infection, of animals vaccinated as calves and subsequently held in the herds for a term of years.

Our experiment was planned especially to provide observations and systematic examinations in a relatively large herd held for a term of years under known natural exposure. Other factors as well were involved, and the cardinal points of the experiment may be thus enumerated:

1. Vaccination of calves between 4 and 8 months of age, with fresh live cultures of Strain 19.
2. Adequate numbers of controls.
3. Carefully checked and frequent natural exposure during the period of observation.
4. Cattle held under observation for a term of years.
5. Systematic examinations of the milk and uterine contents for brucella organisms at the termination of each pregnancy.
6. Systematic blood agglutination tests (monthly) of all the animals.

Important as well, is the inclusion of all of these requirements in the same experiment, for in no other way can a reasonably complete picture of the effects of systematic calf vaccination be obtained.

We made a preliminary report of this experiment in 1941, in which the essentials of the plan were described and the general direction of the results was indicated. In order to make the present report complete in itself the description here will include direct unindicated quotations from the previous report, together with some added detail and certain modifications determined by the course of the experiment subsequent to the publication of the preliminary report.

**EXPERIMENTAL**

The experiment began late in 1936 and terminated on July 1, 1944. Calves negative to the agglutination test were purchased from herds in the vicinity of Ithaca, N. Y. Some were vaccinated between the ages of four and eight months and some were held as controls. Of this original group 35 vaccinates and 23 controls terminated their first pregnancies and are included in our tables. As some of these dropped out others were added by natural increase raising the totals that appear in our final tables. These later additions, of course, appear in less numbers of pregnancies, but the tables in their final form furnish data for accurate interpretations.

*Brucella abortus*, Strain 19, was used in preparing the vaccine, all vaccine was carefully refrigerated, and all over two weeks old was discarded. The cultures were checked monthly for evidence of dissociation, and only cultures from smooth colonies picked from potato agar plates were used as inoculum for vaccine production. Every effort was made to exclude rough variants and extraneous bacteria. Suspensions of the live organisms were made in sterile physiological saline solution, and standardized, at first, to a density of ten times tube No. 1 on the McFarland nephelometer. Later the density was standardized to a reading of 7 on the Cenco-Sheard photometer. This corresponds to the 10X McFarland reading and to the density used by the U. S. Bureau of Animal Industry. In each case 5 cc. of the vaccine thus prepared was injected subcutaneously in the side of the neck.

The cattle were quartered in a box-stall barn, designated the breeding barn, and in a tight three-sided barn facing the south, with loft above, designated the exposure barn. Adjacent to each were a yard and pasture.

In the winter the ration consisted of a good quality mixed hay (timothy, clover and alfalfa) and a grain allowance made up of ground corn, wheat bran, crushed wheat, ground oats, ground rye and oil meal. To this were added cane molasses, di-calcium phosphate and iodized sodium chloride. This mixture contained 12 per cent protein, 2.5 per cent fat, 9 per cent fiber and 9.8 per cent digestible protein.
Pea silage was fed at irregular intervals much of the time. In the flush pasture season no grain was fed but as the pasture failed, grain again was provided. With this ration the cattle were maintained in excellent condition.

In general, the heifers were held in the breeding barn until they were settled in calf, then transferred to the exposure barn until they had dropped their calves and were again ready to breed. A few remained in the exposure barn all the time. In all things, aside from the vaccination, vaccinates and controls were handled alike.

Active, natural brucellosis was maintained in the exposure barn, where the cattle always were loose and mingled freely, by introducing from time to time cows that were about to abort or had recently aborted as a result of Br. abortus infection. Although ample exposure was furnished through the termination of 71 pregnancies, an occasional infected cow from field herds was introduced in order to be sure.

It seems a safe assumption that the infection picked up by the experimental animals did not differ in character or intensity from that in representative field herds. By providing actual spread more frequently the method served only to hasten the date when the organisms actually were taken up by the animals. There is an important distinction between the actual entrance of the organisms into the animal body and the rather loose term “exposure” which merely implies contact of clean animals with infected ones.

Routine monthly agglutination tests were made on all animals, and each time an animal calved examinations of the milk and uterine discharges were made for brucella organisms. In cases of abortion the organs of the fetus were included in the examinations. For the uterine discharges, only guinea pig inoculations were employed. For the milk, guinea pig inoculations were the chief reliance, but these were supplemented frequently by direct cultures. In examining aborted fetuses cultures were made from the heart blood, liver, and contents of the abomasum and small intestine; guinea pig inoculations from the contents of the abomasum and from combined extract prepared from the lung, liver and spleen. From each source, where guinea pigs were used, two was the usual number. There were never less, and occasionally there were more.

From each source, if one or more guinea pigs came to autopsy the report is negative if the organisms were not actually demonstrated in the guinea pig or by direct culture. If they were found by either of these methods the report is positive. In cases where cultures were not made and no guinea pigs came to autopsy the result at the termination of that particular pregnancy, being unknown, is not reported. It is obvious that with these methods there are likely to be a few false negatives, but it is obvious as well, as table 1 will show, that false negatives were infrequent because actual spread was demonstrated in most of the animals that developed blood reactions. False positives probably did not occur.

Table 1 indicates the protection provided by vaccination when the cattle are kept under the most favorable circumstances; that is, under frequent contact with known spreaders tending constantly to reinforce the immunity. Percentages are quoted in all cases but it is obvious that while some are highly significant, others, particularly those computed for the relatively low numbers terminating fifth and sixth pregnancies, indicate trend and not degree. To us, they mean only that the disease in vaccinates and controls, taken as a group, had spent most of its force, as 23
<table>
<thead>
<tr>
<th></th>
<th>1ST PREG. (45 VACC.)</th>
<th>2ND PREG. (37 VACC.)</th>
<th>3RD PREG. (31 VACC.)</th>
<th>4TH PREG. (26 VACC.)</th>
<th>5TH PREG. (13 VACC.)</th>
<th>6TH PREG. (5 VACC.)</th>
<th>TOTAL PREG. TERMINATED (157 VACC.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(33 CONT.)</td>
<td>(26 CONT.)</td>
<td>(19 CONT.)</td>
<td>(10 CONT.)</td>
<td>(4 CONT.)</td>
<td>(1 CONT.)</td>
<td>(91 CONT.)</td>
</tr>
<tr>
<td>Spreadsers (uterine contents milk, or both)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. vacc.</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>% vacc.</td>
<td>15.55</td>
<td>18.99</td>
<td>9.68</td>
<td>38.46</td>
<td>0</td>
<td>0</td>
<td>17.30</td>
</tr>
<tr>
<td>No. cont.</td>
<td>17</td>
<td>12</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>44</td>
</tr>
<tr>
<td>% cont.</td>
<td>51.52</td>
<td>50.00</td>
<td>63.16</td>
<td>30.00</td>
<td>0</td>
<td>0</td>
<td>48.55</td>
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<tr>
<td>Reactors (1-100 or above)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. vacc.</td>
<td>12</td>
<td>10</td>
<td>8</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>% vacc.</td>
<td>26.67</td>
<td>27.03</td>
<td>25.81</td>
<td>46.15</td>
<td>30.77</td>
<td>0</td>
<td>46.46</td>
</tr>
<tr>
<td>No. cont.</td>
<td>19</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>44</td>
</tr>
<tr>
<td>% cont.</td>
<td>57.58</td>
<td>62.50</td>
<td>52.63</td>
<td>50.00</td>
<td>25.00</td>
<td>0</td>
<td>48.55</td>
</tr>
<tr>
<td>Abortions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. vacc.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>% vacc.</td>
<td>2.22</td>
<td>2.70</td>
<td>3.33</td>
<td>15.38</td>
<td>0</td>
<td>0</td>
<td>4.46</td>
</tr>
<tr>
<td>No. cont.</td>
<td>11</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>% cont.</td>
<td>33.33</td>
<td>20.83</td>
<td>0</td>
<td>10.00</td>
<td>0</td>
<td>0</td>
<td>18.58</td>
</tr>
<tr>
<td>Abnormal births* other than abortions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. vacc.</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>% vacc.</td>
<td>2.22</td>
<td>2.70</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>40.00</td>
<td>1.27</td>
</tr>
<tr>
<td>No. cont.</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>% cont.</td>
<td>12.12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4.40</td>
<td>4.40</td>
</tr>
<tr>
<td>Normal parturitions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. vacc.</td>
<td>43</td>
<td>35</td>
<td>30</td>
<td>22</td>
<td>13</td>
<td>8</td>
<td>148</td>
</tr>
<tr>
<td>% vacc.</td>
<td>95.56</td>
<td>94.59</td>
<td>96.77</td>
<td>84.62</td>
<td>100</td>
<td>100</td>
<td>94.37</td>
</tr>
<tr>
<td>No. cont.</td>
<td>18</td>
<td>19</td>
<td>19</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>% cont.</td>
<td>54.56</td>
<td>79.18</td>
<td>100</td>
<td>90.00</td>
<td>100</td>
<td>100</td>
<td>76.32</td>
</tr>
</tbody>
</table>

Among controls: 2 calves dead at term. Blood, milk, uterine contents positive.
1 calf dead at term. Blood, milk, uterine contents negative.
1 week calf at 272 days. Blood, milk, uterine contents negative.
animals, the total number in both groups, calved normally at term without demonstrated spread. Demonstrated by more significant data are the following facts:

1. There is a decided advantage of the vaccinates over the controls, expressed in a higher percentage of live calves, a lower abortion rate, and a lower incidence of spread at calving time.

2. Analyzed further, the data show that vaccination prevented some brucellosis, (46.66 per cent of vaccinates resistant against 33 per cent in controls, table 2); it delayed its development. (Peak in the 4th pregnancy in the vaccinates and in the 1st and 2nd pregnancies in controls, table 1) and it mitigated its effects. (94.27 per cent apparently normal parturitions in vaccinates against 76.92 per cent in controls, table 1). It failed to prevent brucellosis in a surprisingly high percentage of vaccinates (46.66 per cent resistant, hence 53.34 per cent infected, table 1), but in this regard it was still superior to the controls (33.33 per cent resistant, hence 66.67 per cent infected, table 2). While these comparisons are accurate, it is obvious that the final percentage of resistant animals probably would be lower still in both groups under a longer period of exposure, as some animals are included in table 2 as resistant that have been exposed during a limited number of pregnancies. No doubt a few of these would later break if held under continued exposure.

Table 3 requires little comment. It reveals a trend, probably significant, toward a lower percentage of uterine infection in vaccinates, an observation in line with the lower abortion rate in this group. There is not a wide difference between the groups in this respect, and it is likely that additional numbers might modify the comparison in some degree.

<table>
<thead>
<tr>
<th>Table 2.—Animals Resisting Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of vaccinates exposed..............</td>
</tr>
<tr>
<td>No. resisting (no spread or persistent reaction)....................</td>
</tr>
<tr>
<td>Of those resisting:</td>
</tr>
<tr>
<td>4 were under observation a maximum of 1 pregnancy</td>
</tr>
<tr>
<td>2 &quot; &quot; &quot; &quot; 2 pregnancies</td>
</tr>
<tr>
<td>5 &quot; &quot; &quot; &quot; 3 &quot;</td>
</tr>
<tr>
<td>4 &quot; &quot; &quot; &quot; 4 &quot;</td>
</tr>
<tr>
<td>2 &quot; &quot; &quot; &quot; 5 &quot;</td>
</tr>
<tr>
<td>4 &quot; &quot; &quot; &quot; 6 &quot;</td>
</tr>
<tr>
<td>No. of controls exposed...............</td>
</tr>
<tr>
<td>No. resisting (no spread or persistent reaction)....................</td>
</tr>
<tr>
<td>Of those resisting:</td>
</tr>
<tr>
<td>3 were under observation a maximum of 1 pregnancy</td>
</tr>
<tr>
<td>2 &quot; &quot; &quot; &quot; 2 pregnancies</td>
</tr>
<tr>
<td>3 &quot; &quot; &quot; &quot; 3 &quot;</td>
</tr>
<tr>
<td>4 &quot; &quot; &quot; &quot; 4 &quot;</td>
</tr>
<tr>
<td>5 &quot; &quot; &quot; &quot; 5 &quot;</td>
</tr>
</tbody>
</table>
IMMUNITY WITH BRUCELLA STRAIN

Table 4 likewise largely explains itself and while in one sense it is incidental to the main problem, the facts revealed are highly important. The observations include all animals on which limiting titer examinations were made following vacc-

**Table 3. Comparing Manner of Spread of Vaccinates with Controls**

<table>
<thead>
<tr>
<th>Vaccinates</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>(27 pregnancies terminating in spread)</td>
<td>(44 pregnancies terminating in spread)</td>
</tr>
<tr>
<td>Milk positive........... 22–81.48</td>
<td>Milk positive........... 33–75.00</td>
</tr>
<tr>
<td>Milk alone positive....... 12–44.44</td>
<td>Milk alone positive....... 15–34.09</td>
</tr>
<tr>
<td>Uterus positive........... 15–55.56</td>
<td>Uterus positive........... 29–65.90</td>
</tr>
<tr>
<td>Uterus alone positive..... 5–18.52</td>
<td>Uterus alone positive..... 11–25.00</td>
</tr>
<tr>
<td>Milk and uterus positive... 10–37.03</td>
<td>Milk and uterus positive... 18–40.90</td>
</tr>
</tbody>
</table>

**Table 4. Showing Limiting Titer (Complete Agglutination) and Duration of Reaction following Vaccinations of (a) Resistant Animals; (b) Susceptible Animals**

<table>
<thead>
<tr>
<th>Animal No.</th>
<th>Max. Titer 1–</th>
<th>Duration of Reaction (mos.)</th>
<th>Pregnanies under Observation</th>
<th>Animal No.</th>
<th>Max. Titer 1–</th>
<th>Duration of Reaction (mos.)</th>
<th>Pregnanies under Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>12,800</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>12,800</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>31</td>
<td>12,800</td>
<td>4</td>
<td>1</td>
<td>11</td>
<td>12,800</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6,400</td>
<td>18</td>
<td>5</td>
<td>18</td>
<td>12,800</td>
<td>87</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>6,400</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>12,800</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>28</td>
<td>6,400</td>
<td>6</td>
<td>1</td>
<td>43</td>
<td>6,400</td>
<td>3</td>
<td>4</td>
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<tr>
<td>34</td>
<td>6,400</td>
<td>4</td>
<td>6</td>
<td>17</td>
<td>6,400</td>
<td>10</td>
<td>5</td>
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<tr>
<td>49</td>
<td>6,400</td>
<td>21</td>
<td>6</td>
<td>36</td>
<td>3,200</td>
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<tr>
<td>3</td>
<td>3,200</td>
<td>3</td>
<td>1</td>
<td>38</td>
<td>3,200</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>3,200</td>
<td>5</td>
<td>3</td>
<td>47</td>
<td>3,200</td>
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<td>29</td>
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<td>39</td>
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<td>5</td>
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<td>52</td>
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<td>5</td>
<td>2</td>
<td>35</td>
<td>1,600</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>45</td>
<td>1,600</td>
<td>1</td>
<td>4</td>
<td>41</td>
<td>1,600</td>
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<td>50</td>
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<td>1,600</td>
<td>1</td>
<td>3</td>
<td>16</td>
<td>800</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>800</td>
<td>2</td>
<td>6</td>
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<td></td>
<td></td>
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<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>37</td>
<td>No Aggl.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Reaction caused by vaccination, exposure or both.
2 No demonstrated spread in milk or uterine contents.
3 Demonstrated spread in milk, uterine contents or both.

Partial agglutinations are not recorded. The duration of the reactions, as recorded, is such as would be revealed in monthly agglutinations. Following vaccination, the last reading at 1–100 or above, preceding the first two consecutive
BIRCH, GILMAN AND STONE

monthly tests below that level was selected as indicating the last significant titer. The arbitrary selection of this standard does not interfere with the significance of the comparisons involving resistant and susceptible animals.

Contrary to what appears to be a prevailing assumption, there is no consistent relation between the peak of the titer following vaccination and the subsequent resistance of the animal. A slight and perhaps insignificant inclination is toward the expectation of higher resistance as the maximum post-vaccination titer decreases. There is revealed, however, a strong tendency for high maximum titers to be of relatively long duration; but even here, exceptions appear to such an extent that failure in an individual to show agglutination a month or two subsequent to vaccination would not necessarily indicate defective vaccine. Failure of a group

**Table 5.—Record of Spread of Persistent Reactors (9 Mos. or More Following Vaccination)**

<table>
<thead>
<tr>
<th>ANIMAL NO.</th>
<th>DURATION OF REACTION (MONTHS)</th>
<th>PREGNANCIES UNDER OBSERVATION</th>
<th>STATUS AS SPREADERS AT CALVING TIME (ALL BIRTHS APPARENTLY NORMAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>19</td>
<td>5</td>
<td>Milk 1st pregnancy</td>
</tr>
<tr>
<td>18</td>
<td>87</td>
<td>4</td>
<td>Milk 1st, 2nd, 3rd pregnancies</td>
</tr>
<tr>
<td>20</td>
<td>12</td>
<td>5</td>
<td>Milk and uterus, 1st and 2nd pregnancies</td>
</tr>
<tr>
<td>17</td>
<td>10</td>
<td>5</td>
<td>No spread</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>5</td>
<td>No spread</td>
</tr>
<tr>
<td>49</td>
<td>21</td>
<td>6</td>
<td>No spread</td>
</tr>
<tr>
<td>109</td>
<td>10</td>
<td>2</td>
<td>No spread</td>
</tr>
<tr>
<td>71</td>
<td>12</td>
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<td>No spread</td>
</tr>
<tr>
<td>49</td>
<td>21</td>
<td>6</td>
<td>No spread</td>
</tr>
<tr>
<td>108</td>
<td>9</td>
<td>2</td>
<td>No spread</td>
</tr>
</tbody>
</table>

Total vaccinates 45. Persistent reactors 10 (22.22%).

in like circumstances would in most cases deny the presence of brucella organisms, either alive or dead, in the vaccine.

Cow No. 37, an unusual case, requires brief mention. She showed absolutely no agglutinin response to the original vaccination, nor to a second one with a 10 cc. dose. We encounter an occasional fairly well authenticated parallel case in field herds, but they are unusual. This was a resistant cow, as she terminated four pregnancies under observation without any evidence suggesting brucellosis.

Table 5 merely adds to our still meager knowledge regarding the true status of animals that show persistent reactions following vaccination. In this experiment 22.22 per cent of the animals showed post-vaccination reactions enduring more than 9 months. These reactions may persist as a result of the vaccination or they may be caused by exposure strains. In each case, however, the vaccine itself either caused the reaction, or it failed to protect against the exposure strain that did cause it. In the three animals in the group which were demonstrated to be spreaders, (Nos. 8, 18 and 20) there is little doubt that there was failure in protection, for the strains recovered from them almost certainly were not 19. In those that did not become spreaders, either Strain 19, the exposure strains, or both, may have stimulated the reaction.
In this connection the question naturally arises as to whether the brucella organisms recovered from these three cows, and from others in the experiment as well, were exposure strains or Strain 19. Strain 19 differs from field strains in that its virulence for guinea pigs and cattle is lower, and in growing readily on initial culture in the absence of carbon dioxide. Our guinea pigs were carefully noted for lesions, and all brucella cultures were incubated both with and without carbon dioxide. By these methods, the strains without exception, met the standards indicating that they were field strains.

Incidental and unrelated facts brought out in table 5 remain to be mentioned. All three of the persistent reactors that appear as spreaders were in the highest bracket (1–12,800) in their post-vaccination agglutinin response. There were no abortions in the group. Finally it is probable that the relatively frequent exposure caused a higher percentage of persistent reactors than would occur under the hit or miss exposure in field herds. This difference however is properly referable to delayed infection in the field herds rather than to the resistance of the animals. We should add that we receive a disturbing number of reports from owners of field herds who are ready to breed vaccinated heifers and find them still reacting. Our former experiences, even with fully virulent strains, had not led us to anticipate this difficulty as frequently as it has occurred.

In the experiment as a whole five animals recovered. That is, they ceased to react and to spread after having done both. Two of these were vaccinates, three were controls. Three others, all vaccinates, that were not blood reactors at the time of parturition, proved at that time to be spreaders. One of these reacted at the next monthly test, one died of milk fever and could not be retested, while the third, eliminating brucella organisms in the milk only, showed a consistently negative agglutination record, if we exclude her vaccination reaction as a calf.

GENERAL DISCUSSION

It remains to outline, briefly, the bearing of the facts at hand on field vaccination in reducing immediate losses and on sanitary measures looking toward actual reduction of the incidence of brucellosis.

Regarding the immediate reduction of losses, which with questionable accuracy is sometimes designated "control," our results fully support the original claim that the vaccine provides valuable protection. Despite failures, which we should learn to expect even when fresh live vaccine is used, the vaccination prevents, delays or mitigates a high percentage of brucellosis. It is much more effective, as our records show, in delaying the development of brucellosis, and in softening its effects than it is in its actual prevention, as approximately half of our vaccinates eventually acquired the infection and became spreaders, without showing, as a group, extensive or outward manifestations of the disease.

The influence of vaccination in softening the effects of the disease by reducing the abortion rate is well recognized, but its usefulness in delaying the time of infection apparently is not fully appreciated, for the question frequently is put: "If cattle must have the disease eventually what point is there in delaying the time?" So far as the individual cow is concerned a moment's thought makes obvious a wide difference between an animal that breaks down in her first pregnancy, and one that
breaks down, say, in her fourth, with three years of production to her credit. But the chief advantage in the delay lies in its influence in aiding in the establishment of clean herds.

Consider the herds that come under various plans with individual differences, but, as a group, described with reasonable accuracy under the caption: "test and hold, with calf vaccination." Before the days of vaccination the authors and many others have consistently free herds from brucellosis under a plan which permitted the stabling of reactors and clean animals in separate groups in the same barn, but required the removal of reactors during the calving period, and prevented the two groups from actual contact in yard and pasture. The crucial time in some of these herds came when the heifers were in the first pregnancy, and even a semi-immunity enduring three or four years undoubtedly would have been an invaluable advantage in carrying out the plan. Thus, today, the facts at hand support the belief that a plan designated, "Test and hold with calf vaccination and eventual elimination of reactors"; probably embodies the most widely applicable method we have in freeing herds from brucellosis. In this, the delay in susceptibility of the young stock is an important, though by no means the only factor. We doubt if brucellosis in the individual herd can maintain itself against the combined effects of calf vaccination, reasonably careful application of the sanitary measures we have suggested, and the final precaution, too frequently neglected, of eventually eliminating all straggling reactors that remain.

Further, it is almost certain that there is a subtle advantage attached to calf vaccination that cannot be brought out in any formal experiment. This extends beyond the mere fact that the animals in a vaccinated herd have considerable resistance under ordinary exposure. The advantage lies in preventing even the ordinary exposure. Probably, when unvaccinated clean herds become infected—if we except those instances in which there is actual introduction of outside cattle, or gross carelessness—the break is initiated by a relatively small number of Brucella organisms in a highly susceptible animal. This animal, particularly if she acquires uterine infection, at calving time steps up enormously the dosage to which the less susceptible animals are exposed, and they readily become infected. Even though we cannot, in truth, apply a more optimistic term than "semi-immune" to vaccinated cattle generally, a semi-immune animal is much less likely to succumb to the small initial doses from outside sources than is the highly susceptible one. Thus it is probable that vaccination serves a useful purpose in preventing these initial infections. In this respect, then, calf vaccination has definite value as a sanitary measure in preventing the introduction of brucellosis into clean herds.

On the other hand, there are grave dangers attached to vaccination as a sanitary measure. Chief of these is that, used as an only measure, it leaves in many herds numerous unidentified and unsuspected spreaders of brucellosis. These are a menace to the herds into which they are moved, to cattle moved into the herds of which they are a part, and, if retained too long, they eventually transmit the infection to some of the vaccinated animals native in the herd. This danger exists in a greater degree than we had supposed, and we will be fortunate if it is not intensified by the superficial assumption that, because vaccination provides valuable protection, all cattle should be vaccinated.
However, it is true that unless we elect to do so, we do not have to suffer under all of the disadvantages of vaccination in order to reap its benefits. Selective vaccination, supplementing other measures looking toward clean herds, with the plan of control suited to the individual herd, will keep us moving in the right direction, for we will not then be merely palliating the effects of brucellosis in a constantly widening circle of infected herds. Also, if we apply all available measures of control, we will be on the firmest possible footing should Strain 19 become less effective as an immunizing agent, a possibility we dare not entirely ignore.

Gradually we are modifying our plans of control, including vaccination to suit individual circumstances. For instance, it is recognized that beef herds in the range stages and dairy herds kept under intensive conditions and for a different purpose, cannot economically be made to conform to the same plan of control, though we still talk, perhaps a little too freely, of uniform sanitary regulations covering both groups. In beef herds, the calf crop is the chief consideration, there is only a remote danger that the cattle will transmit brucellosis to man, and sanitary measures supporting calf vaccination frequently are difficult to apply. In dairy herds, on the other hand, milk is the chief source of income, it is used mostly for human food, and even in the absence of vaccination, effective sanitary measures have long been practiced by our most progressive dairymen.

In view of the known susceptibility of many cows vaccinated as calves; of the impossibility of distinguishing between a reaction caused by vaccination and one caused by field exposure; and of the occasional susceptibility of man to brucellosis, pressure for clean dairy herds exerted by health authorities and others, and supported by public opinion, is inherently reasonable, though it is not always reasonably applied.

The application of our findings to inter-herd and inter-state transfers of cattle may be stated in a few words. Vaccinated animals represent less danger than unvaccinated ones, but they nevertheless represent much danger. The prudent buyer, all other things being equal, will seek vaccinated animals. Because these animals are less susceptible they will more readily conform to reasonable regulations governing interstate movement of cattle, but because they frequently are susceptible, at least to a low-grade brucellosis resulting in spread, they cannot prudently be given important concessions in the enforcement of these regulations.

Finally, we think our findings, as they relate to the problem as a whole, and to the more distant future, clearly remove the weight of emphasis from the comfortable and sometimes necessary expediency represented by the word "control" and place it definitely in the direction of eradication, gradual though the latter must be. We do not even have to hold the view that complete eradication is possible in order to accept it as the only logical goal. In the United States, we never have eradicated bovine tuberculosis, perhaps we never shall, but the attempt to eradicate it, in itself, has been one of the signal sanitary achievements of all time. By different methods, but with the same objective before us, brucellosis can be bent to the same pattern.
BANG'S DISEASE CONTROL FROM THE VIEWPOINT OF THE BREEDER

By DR. L. V. WILSON, B.S.
Manager, Boulder Bridge Farm, Excelsior, Minnesota

After listening to the previous paper, I am convinced that there never has been a time when full cooperation between breeders, and our Livestock Sanitary Association and the veterinarians, whose knowledge supports the work of these associations, has been more important. I think the time has come for us to lend them a great deal of support.

The veterinary profession has been developed, not only in the interests of the livestock industry, but also in the preservation of human health. Without the full cooperation of the livestock breeders, which I am proud to represent in a small way, it is impossible for a body such as yours to accomplish what I am convinced is going to be accomplished with great strides in the near future.

My story is a short one. Many times we have questions regarding facts and figures as far as our operation on our various farms is concerned. Those of you who realize what we have gone through in the last few years in regard to help, realize that if we get our work done at all we are doing well, and we haven't much time to incorporate any of our results into facts and figures.

Several gentlemen down front here, who represent the Veterinary Division at the University of Minnesota, will bear with me and will verify the statement that the personnel of the farm I represent has been extremely interested in a sanitary program. I have probably bothered Drs. Boyd, Fenstermacher and West as much as anyone in the state in the interests of preserving clean flocks and herds on this farm.

The other day I was going through some of the cancelled certificates representing our Guernsey head of cattle, and I was amazed to find the number of cancelled certificates that should be returned to the American Guernsey Cattle Club. Many of the breed organizations today are demanding a return, or at least soliciting a return, of registration certificates covering dead animals. This gave me a little substance for my remarks. These certificates represented animals which have been culled from the herd for diseases other than Bang's disease, such as, mastitis, hemorrhagic septicaemia, etc., and the mortality is simply astounding. When one goes further than that, as a good breeder should, and culls animals because of poor productive ability and type, you can see that from necessity one must preserve every good animal in his breeding herd.

We started eighteen years ago with 9 cows and a herd sire on 90 acres of land. Since that time we have developed to the point where we are now operating close to 1,000 acres of land. We also have horses, hogs, sheep, poultry, turkeys and chickens.

Many of my friends have said to me, "If you didn't buy cattle you wouldn't have any trouble." In the past week I have come to realize that any breeder of purebred livestock must of necessity, at some time or other, buy individuals into his herd or else he is lost in the shuffle.
One of the leading herds of Guernsey cattle in America, as you all know, is the one at Langwater Farm, Northeastern Massachusetts. Some few years back I received the greatest thrill I have had since I have been in the business, when I was able to sell an animal at auction to Mr. John S. Ames of Langwater Farm. Every one of us would like to sell at regular intervals some of our surplus animals to outstanding breeding establishments, and the history of breeding livestock shows that we cannot be sufficient unto ourselves, but that it is necessary for us, from time to time, to have new blood that will either cool us off or warm us up. If we are sufficient unto ourselves, and as a result are in behind the hills and over in the other valley, we may not pick up infection such as we are so liable to do out here in the Middle West with our diversified activities; but still I don’t believe we are as liable to progress along the lines that we would like to.

Blood testing for Bang’s disease was practically unknown eighteen years ago, as far as our breeders were concerned. Two years later we adopted the practice of testing. At that time we had some 45 head of females in the herd. We found that 22 cows of the 45 were reactors. Some of the animals we had purchased at a national sale were reactors. They were good cows, selected from the standpoint of their pedigree, type and uniformity, but 22 of the 45 animals were reactors. As I remember it, our charts showed that they read, at least, 4 plus. We had no way of isolating those individuals showing 1 plus, 2 plus or 3 plus other than to segregate them on the other side of the barn in the other row of stanchions, so we turned them out separately.

We were making fair circuits regularly, and in our show herd we had 3 positive cows. We did this for a period of 3 years. Our subsequent tests didn’t show additional reactors, but we did find suspects.

We traveled to various state fairs, national associations and national exhibitions. We didn’t pick up additional reactors. We isolated all our cows, and I was pleased to note the reference made to that practice in the preceding speaker’s paper. We isolated all of them at calving time, gradually working toward an accredited herd, which we succeeded in accomplishing.

All the state fairs and national exhibitions, up to 1935, did not require entirely negative animals on exhibit, and apparently at one of these exhibitions we picked up an infection. I want to say right now that in all fairness to the good advice given me by my friends, we, undoubtedly may have been spared a lot of trouble had we been advised of the fact that there was an infected herd in one of the barns in which we were housed.

We returned home, and on the practice of as good advice as I know exists as far as we breeders are concerned, we isolated our show herd from the rest of the herd for a period of 30 days, and at the end of those 30 days they gave a completely negative test.

We returned some of these cows to the herd; others were left in the isolation barn. During the next 30 days one of the show animals looked like she was going to abort. She was isolated and did abort in 2 weeks. Nine of the twelve head of our show herd became reactors, but we had no additional abortions, and before the whole herd quieted down, some 45 head had been disposed of.

The most important part of this story is that we only had one abortion. The
majority of the animals were suspects. We attempted to handle the suspects by isolation within isolation in which our cattle ran up and down different alleys for months. We tested the whole herd every 30 days, and the suspects every 2 weeks. At this time I wasn’t in any too good physical condition, and I was told to go to bed. When my employer came over to see me, I told him that our herd was producing well, was economically sound, and we were getting calves, but I didn’t know how to battle a condition that was presented to me as simply one or two little crosses on a piece of white paper. I wanted to see something that would give me some assurance that I might not have this happen to me. I wished there was some type of immunization in this battle that would help us. Perhaps if we didn’t test for six months we wouldn’t have to dispose of any more valuable animals.

So we didn’t have any more tests run for six months, and when we did test, the storm had died down. During that time we could go into the bull barn without the bulls jumping through the roof, and the animals had apparently forgotten what it means to have a needle stuck in their neck.

From then on, we practiced what we feel to be a conservative program. We have maintained quite regularly our accredited-herd status. I have been told that the 1 plus or 2 plus reactions that we may have every eighteen months are an indication of a type of infection in the herd that probably immunizes our herd against storms.

A year ago we started vaccination due to conditions that existed around us, and due to the fact that as breeders we must traffic with our neighbors. It is impossible for us to exist unless we traffic with our neighbors in the breeding of purebred cattle.

I trust you will understand, gentlemen, that I am wholeheartedly in favor of any program that will indicate infection of any kind that may exist on a farm, and I want to congratulate our Sanitary Boards on the apparent good will and extreme effort which at the present time they are putting out in the interests of us breeders.
ADVANTAGES OF BREEDING LIVESTOCK IN A BANG’S DISEASE FREE STATE

By Hon. Kerr Scott
Commissioner of Agriculture, Raleigh, North Carolina

I appreciate the opportunity of appearing on your program to discuss some of the advantages of breeding live stock in a state that has all of its counties in a Bang’s-free accredited areas.

As most of you know, we completed the testing of all cattle in all of the counties in North Carolina on July 1, 1942 and at that time the remaining counties were placed in the accredited area. North Carolina was fortunate in not having a high percentage of Bang’s infection, although we had a great many herds that were badly infected and the disease was found in all parts of the state. Our testing program extended over a period of more than ten years and there were more than one and a quarter million tests and retests made during this period. Since July 1, 1942 we have continued our program by testing the required number of cattle in those counties where the accreditation was about to expire and by testing other herds in which we believed that infection might exist. At this time we have under test all herds in the state known to be infected and we are testing all herds that we think might be infected.

The question has been raised as to whether or not a county or a state could maintain its accredited status after it had been established. In North Carolina we have gone through a very trying period during the past two years. There has been, as you know, a shortage of veterinary inspectors as well as other manpower, and there has been the greatest movement of cattle, both intrastate and interstate, during this period that we have ever experienced. However, the records during this two year period show that we have made more than 263,000 tests with 2,555 reactors which, of course, is less than one per cent, notwithstanding that more than 50 per cent of these tests were made in herds that were infected or which we believed might be infected, and also during this time most herds were being enlarged in order to take care of the increased demands for dairy products and beef. As a result of this work, it is now possible in North Carolina for a herd owner to make additions to his herd without bringing in infection, provided he uses reasonable care in making his selections. The animals in practically all of our public sales are free from Bang’s disease and a herd owner is safe in buying in such sales.

Our public live stock market law became effective July 1, 1941. This law provides for the Bang’s testing of all cattle that are returned to the farm. It also provides for the segregation of such animals in the market and for the sanitary operation of the market. We believe that this law has been quite effective in preventing the spread of Bang’s from these markets.

Many herd owners who previously had infected herds have eliminated Bang’s disease by testing and good herd management and many of them have told me that their production and reproduction have greatly increased as a result of eliminating Bang’s disease. We now have more than 500 Bang’s accredited herds that remain
free from infection through the regular application of the blood test and by good herd management. Many of these herds were formerly infected and the owners believe that it is time and money well spent to keep them free of Bang’s disease. All of us have seen herds in which it was almost impossible to raise calves, and with a consequent reduction in milk production in the case of dairy herds. Such a situation cannot, of course, be corrected overnight nor without expense but I am satisfied that any herd can be cleaned up by testing and proper herd management and further, that the expense and trouble are justified in having a clean herd.

I know from personal experience just what it means to have infection in a herd and of the loss that occurs as a result of this. I have a milking herd of more than one hundred animals at the present time. My herd became infected some years ago and it certainly could have been classed as a “problem herd,” as I lost during the time that my herd was infected more animals than I originally had; yet by continuous tests and by slaughtering the infected animals, together with improved herd management, the infection was eliminated. I have not had a reactor in more than three years. I know that in my herd, both production and reproduction have been greatly increased.

While we do not have a very large number of infected herds in North Carolina, we do encounter our share of the so-called “problem herds” and we are working with these herds, as well as with all other herds that we have reason to believe might be infected. We have reached the conclusion that most “problem herds” result from improper management. We are of the opinion that if an owner will use reasonable care in making additions and will practice good herd management, including sanitation, that with the aid of Bang’s test, he can keep his herd free, or eliminate the disease if it does gain entrance, with little financial loss. When one closely surveys the methods used by some herd owners, it is remarkable that they do not have more trouble than they do. Failing to keep breeding records, permitting cows to calve in the pasture or lot with herds, buying replacements from unknown origin, depending upon a single test, and having poor sanitation are a few of the things that may be seen on many farms.

Recently some of our herd owners have become agitated in regard to Bang’s vaccination. I can appreciate this because the farm and other press have given rather wide publicity to vaccination and many opposing views have been expressed. This has created a considerable amount of confusion. I hope that this organization will use every effort to dispel this confusion. Your organization has the best minds in the nation concerning this subject and if you can work out a sound program, you will greatly benefit a very large number of herd owners. We recognize the value of vaccine in calves where it is used under proper supervision and we have recommended this in some of our so-called “problem herds.” However, we do not consider it advisable to use this vaccine in non-infected herds or in mature animals. We know that under the present conditions that it is not possible for us to regulate the distribution of this vaccine and I am of the opinion that we may eventually find ourselves in the same position as we are in reference to hog cholera virus, a condition that I would dislike to see develop. We do not recommend the vaccination of adult cattle for the reason that we do not consider that there is enough sound, scientific information to support this. The fact that many cattle vaccinated as adults be-
come permanent reactors which cannot be distinguished from reactions resulting from natural infection, to me, makes this plan very objectionable. Your group has not shown us by sound experimental evidence that the vaccination of mature cattle is a desirable method of controlling and eliminating Bang's disease.

I believe that this organization, and all other agencies engaged in the control of animal disease, should work towards the complete elimination of Bang's disease rather than to elect to live with it. I am not in a position to evaluate the dangers of this disease to public health; yet from the information that I have, it would seem that it is to some extent a public health hazard. Of course, in the case of dairy products, proper pasteurization will take care of it but I am told that there is considerable danger from man contacting infected animals so that any sound program must take into account the enormous number of farmers, their families, and other workers who may constantly contact infected animals.

If our cattle industry is to be placed on a sound and profitable basis in the post war period, I think that it is imperative that we eliminate Bang's disease, just as we have done in the case of tuberculosis, cattle tick fever, and other diseases. It would certainly be regrettable if we permitted this program to follow the course taken by our hog cholera control program. In my opinion, Bang's disease is still one of the major cattle diseases in the nation and it is up to your organization to work out a sound and workable program for its final elimination.
REPORT OF COOPERATIVE BRUCELLOSIS CONTROL WORK IN THE UNITED STATES

By A. W. Miller, D.V.M.

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Just 10 years ago the announcement was made at the meeting of this Association that, through the enactment by the 73rd Congress of the Jones-Connally Bill, funds had been made available for use in eliminating Bang's disease in cattle. Thus began the Federal-State cooperative program for the control of Bang's disease, based on the testing of herds and slaughter of reacting animals. In the beginning it was not necessary for the States to participate in the payment of indemnity or operating expenses, but, effective May 1, 1939, Congress provided that no Federal payment of indemnity could be made unless it was matched with an equal amount by a State or cooperating agency. This program, so far as the Federal Government is concerned, has at all times been a voluntary one. Interest in this animal-disease-control project was heightened by the fact that brucellosis in cattle was accepted by the medical profession as a factor affecting public health.

EFFECTIVENESS OF TEST-AND-SLAUGHTER AS A CONTROL MEASURE

At the end of the seventh year of test-and-slaughter it was estimated that the incidences of Bang's disease had been reduced about 50 per cent through the removal of over 2,000,000 reactors. The slaughter of Bang's-disease reactors was initially developed as a part of the cattle-reduction program. From a strictly disease-control point of view, however, and this latter viewpoint now must be accepted as our aim, test-and-slaughter was not entirely without just criticism. It did not lend itself well to the beef-type herds under range conditions, the so-called "problem herds" slowed up the program, and breaks in cleaned herds, varying from 2 to 5 per cent, were disturbing.

We must accept the fact, however, that test-and-slaughter is still one of our most useful and practical methods of control. Its use is necessary in dairy herds, the milk from which must, by municipal regulation, be from cows negative to the

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blood test. The test-and-slaughter method is indicated, also, in sections in which
the incidence of Bang’s disease is very low, as in many of the Southern States, and
in the “area plan” when conditions are favorable. And we must not lose sight of
the fact that test-and-slaughter must be the final operation in those herds in which
reacting animals are held until vaccinated replacements become available, and un-
doubtedly in most of those herds in which adult vaccination is practiced.

**STRAIN 19 BRUCELLA ABORTUS VACCINE**

Between 1928 and 1932 Cotton and Buck conducted research on vaccination with
a *Brucella abortus* organism of reduced virulence, Strain 19. At the 1933 meeting
of the Association they made a report on the efficacy of a vaccine prepared from this
strain in immunizing bovines against Bang’s disease. Their several experiments in
calfhood vaccination were so favorable that the Bureau, in 1932, restricted the
licensed production of *Brucella* vaccine to that produced from Strain 19. Based
on this and other work, field trials were begun by the Bureau in 1936 in about 260
heavily infected herds in which calves only were vaccinated and in which the
reacting cows were left to provide exposure. Careful records indicated that only
1.1 per cent of the vaccinated calves in these herds subsequently aborted as a resul-
t of Bang’s disease, determined by the blood test. In view of these results, Dr. John
R. Mohler, then chief of the bureau, at the 1940 meeting of this Association recom-
ended the acceptance of calfhood vaccination as an adjunct to the test-and-slaugh-
ter method to provide, as he stated, a two-fisted attack against this malady. Some
of these herds have been dispersed for various reasons but recently a survey in 13
States to determine the extent to which calf vaccination was still being continued
revealed that out of 220 of the original herds 179 were still in existence. The owners
of 171 of these herds stated that they were continuing vaccination and were well
pleased with the results. Later, the program was modified to permit the retention
of reactors in some infected herds under state quarantine until vaccinated replace-
ments became available.

The foregoing remarks are made in order to show how our brucellosis-control work
in cattle has evolved under the exigencies of conditions during the last 10 years
and how the pendulum has swung from a primary basic test-and-slaughter method
to the inclusion of calfhood vaccination and later test-and-retention of reactors
with calfhood vaccination.

**POLICY ON CONTROL OF BRUCELLOSIS**

The Bureau approved the application of three methods of control:
A. Test-and-slaughter.
B. Test-and-slaughter, with calfhood vaccination.
C. Test-and-retention of reactors, with calfhood vaccination.

In plans A and B indemnities are paid for reactors removed but in plan C indem-
nities are not paid.

The Bureau of Animal Industry has been criticised at times because it has not
assumed a more dominant stand in the control of Bang’s disease and because one
definite plan has not been urged on the various States, as in tuberculosis, foot-and-
mouth disease, and tick eradication. The lack of any proved method of control
that would meet all requirements did not warrant such action on our part at that time, nor has it since.

Pursuing this policy we have made trial tests of various suggested new methods and whenever they have proved valuable have recommended their use, subject to acceptance by the state officials, who, through their familiarity with local conditions, are in a better position to judge the applicability of any suggested changes.

Our aims under present conditions are primarily to hold the advanced line we have established and to push forward the fight against Bang's disease by means of methods most adaptable and applicable at this time. We know now, as we have known since the first few years of our control program, that we cannot hope to succeed by the use of any one method but that success must depend on the use of all our facilities, with probable special stress on one or more under the varying conditions that are encountered in individual herds or in certain areas.

It is evident that under present conditions stress must be placed on vaccination. Let us review briefly what we have learned about strain 19 vaccine in order that we may make logical recommendations as to its use under varying herd conditions.

**Effectiveness of Strain 19 Vaccine**

First of all we should stress that strain 19 vaccine is not a panacea for Bang's disease, or brucellosis which is now judged to be the more appropriate name. It is not 100 per cent effective in immunizing bovine animals against the disease, but it has proved most satisfactory in this respect if the product is pure and viable and if combined with sanitary procedures.

**Control of Purity and Viability of Vaccine**

The purity and initial viability of both Bureau-prepared and commercial vaccine are guaranteed by the rigid requirements of our Bureau. Information has been furnished relative to the various factors affecting its viability. To assure a commercial product of proper viability it has recently been found necessary to reduce the expiration date for its use from 6 months to 3 months. If further Bureau tests within the 3 months' period show that a vaccine is too low in viability, it is immediately ordered withdrawn from the market.

**Safety and Stability of Strain 19**

At the Bureau's Animal Disease Station, Mingle and Manthei have conducted experiments in which they have proved that under conditions which should favor such a change, it has been impossible to increase the virulence of Strain 19. They have also shown that when Strain 19 is injected intravenously into pregnant cows in such large doses as to cause abortion the infection disappears before the next pregnancy, and that if normal pregnant cows have contact with them and are exposed to aborted fetuses, they fail to become infected.

In addition to these two experiments that were conducted under most exacting research procedures there are many other reports of work of a similar nature, and probably hundreds of instances in which calves have been vaccinated in negative herds without spreading infection to other animals. Indications are, therefore, that there is no danger of Strain 19 reverting to an organism of increased virulence.
or that, in its present degree of stability, it can establish disease in vaccinated animals or spread disease to associating animals. So far as we know there is not a single case on record at present in which infection with Strain 19 has occurred through contact with vaccinated animals.

On the basis of these confirmations of the efficacy, safety, and stability of Strain 19, its use was incorporated in the control program in the methods mentioned previously. Let us briefly state the applicabilities of these methods.

**TEST-AND-SLAUGHTER**

Test-and-slaughter, or plan A, is the basis of accreditation in infected herds. Irrespective of the method of control used, test-and-slaughter must be practiced before an infected herd can be officially recognized as being free from brucellosis. We have previously mentioned the types of herds in which this practice initially is necessary or desirable and have referred to its limitations. The present necessity for increased production of calves, milk, butter, and cheese, and personnel shortage in the extension of the control program have had a marked effect on the adoption of this method in many herds.

During the fiscal year ended June 30, 1944, tests and retests for brucellosis were applied in about 386,000 herds containing about 5,235,000 cattle. About 226,000 cattle were classified as positive reactors, or 4.3 per cent. However, about 75,000 of these reactors were not slaughtered but were held in herds where calfhood vaccination was practiced. More testing would have been accomplished if the services of additional veterinarians had been available.

During the last fiscal year there has been a great increase in the use of Brucella vaccine; 392,232 calves were treated under official supervision and a very much larger number, as indicated by the commercial production of this vaccine, were vaccinated without such supervision.

**TEST-AND-SLAUGHTER WITH CALFHOOD VACCINATION**

This combination, called plan B, has proved to be very acceptable. When an owner has gone through the process of having brucellosis eliminated from his herd, which more often than not is accomplished only by persistent and patient effort, he realizes the desirability of having a herd resistant to reinfection. This may be accomplished in a few years by the continued vaccination of calves. We recommend the addition of calfhood vaccination in herds in which test-and-slaughter is being practiced, and especially in herds in which accreditation is being delayed by spread of infection and in localities where there is a relatively high incidence of infection.

**TEST-AND-RETENTION OF REACTORS WITH CALFHOOD VACCINATION**

The admission of negative replacements in herds being freed of this disease has long been recognized as a procedure accompanied by danger. In some instances the residual herd consisting of the more resistant animals would remain free from infection while the replacements for removed reactors would contract brucellosis and abort, thus continuing the disease. To provide for satisfactory control measures in such herds, plan C, or test-and-retention of reactors with calfhood vaccination,
was approved. This permits the retention of productive reactors until vaccinated replacements become available. A valuable factor that has developed in this connection is that some reactors lose their positive blood status in 2, 3, or 4 years and may be retained permanently in the herd. The present need for increased production has been a factor in the increased demand for this type of control. Difficulty in obtaining replacements and their high cost are contributing factors. In some States, notably New York and Vermont, control measures are based on this plan almost exclusively.

**ADULT VACCINATION**

We are frequently asked if vaccination is as effective in adult cows as in calves. Research done by our Bureau indicates that it is. Haring, in a paper delivered at the 1943 meeting of this Association, presented evidence indicating that vaccination was even more effective in adults than in calves. All evidence relating to immunity in other diseases of man and animals indicates that the immunity-producing mechanism is better developed in mature than in immature persons or animals. Other factors being equal, if there is a limit to the persistence of immunity, resistance should be serviceable for a longer period if vaccination is done in adult life. If this is so, why is adult vaccination not advocated under all conditions? The principal reason is that in adult cattle the vaccinal titer tends to persist for indefinite periods, whereas in calves it tends to disappear within 3 to 12 months after vaccination. This persistence of titer interferes with the control program which is based on the agglutination test.

During recent years a few instances have come to our notice in which it has been most difficult to eradicate brucellosis and its resulting abortions by practicing any of our approved methods of control. These cases are usually in large herds. Several such government-owned herds have come under our particular attention and for experimental purposes we have suggested whole-herd vaccination. The results have been variable so far as immediate improvement is concerned. In one herd in which incipient infection was detected, the vaccination of the entire herd of 56 animals undoubtedly stopped the spread of infection. As this herd was maintained for calf-production purposes, the results were most satisfactory. In another herd in which abortions had been occurring for about two years in spite of the application of sanitary procedures, vaccination did not give such satisfactory results. Abortions kept occurring in practically the same ratio as before vaccination for a period of approximately a year. The results in the two herds are extremes in our observation of adult vaccination; in one, this practice was a most satisfactory and immediate solution to the particular needs of the herd; in the other, no advantage could be observed during the year following vaccination but reports covering the second year after vaccination stated that abortions had practically ceased.

During 1943 and 1944 bureau employees on brucellosis work and the cooperating state officials in 11 states made observations of the use of *Brucella* vaccine in adult cattle in 369 herds containing approximately 27,500 cattle. Sufficient time has not elapsed to draw definite conclusions as to the value of this method. On the whole, however, the results have been encouraging. This experiment is being continued and in another year we should be in a better position to evaluate the results.
Haring has mentioned several herds in which brucellosis has been controlled by whole-herd vaccination with the subsequent vaccination of calves. It appears, therefore, that whole-herd vaccination will have beneficial results in infected herds in suppressing infection and abortion.

Another factor on which more evidence has recently come to our attention is that Strain 19 causes abortion in some instances, if administered to cows in advanced stages of pregnancy. This was reported by Haring in his paper previously mentioned and two such cases have come to our attention within the last few months. In one involving approximately 60 negative animals of beef type, the owner decided to vaccinate his entire herd because one of his neighbor's cows had wandered onto his premises. These animals were about 5 to 6 months in pregnancy, and 23 aborted within 1½ to 3 months after vaccination. A culture recovered from one of these aborting animals was sent to our laboratory. While the culture could not definitely be identified as Strain 19, it proved to be an organism of reduced virulence. Clinical evidence also pointed to the fact that the abortions were due to the injection of Strain 19 vaccine. In another herd of 46 beef-type animals in which brucellosis was present and abortions had been occurring for a period of several years, adult vaccination was practiced when the animals were about 5 to 6 months in pregnancy. During the next 3 months two abortions occurred. A culture recovered from the fetus of one of these aborting animals proved to be similar in most respects to Strain 19.

Another factor in adult vaccination, especially in dairy cows, is that there is usually an immediate loss of condition and a drop in milk production persisting for from 1 to 2 weeks.

It is believed that adult vaccination should not be practiced in negative herds. Calfhood vaccination is a much more orderly procedure and if there is no urgency for the vaccination of adults, herd resistance may be established in a few years by calfhood vaccination.

Whole-herd vaccination will restrict sales and interstate shipment for several years, due not only to the retention of infected animals but the persistence of titer in non-infected animals. It is believed, therefore, that the use of adult vaccination in a control program is limited to those herds in which other methods of control do not appear to be applicable. In no case should it be used without giving the owner complete information as to the persistence of vaccinal titers and its effect on future movements of the animals, its effect in milk production, that abortions may be expected for 6 to 8 months after vaccination in animals that are already infected, and that animals 5 months or more advanced in pregnancy may abort from the vaccine.

Specifically, whole-herd vaccination may be recommended as advantageous: in incipient infection; in beef herds in which calf production is the chief herd requirement, if done when cows are open or in early pregnancy; in so-called "problem herds"; and in large, infected dairy herds in which calves are not raised and in which there is a rapid turnover of animals as a result of milk-production demands. In the last-mentioned type of herd, all replacements should also be vaccinated. In all herds in which whole-herd vaccination is practiced calfhood vaccination should be continued.

In summation, we believe that control procedures based on approved plans A,
B, and C are, with few exceptions, capable of combating brucellosis, if efficiently applied, and are preferable to adult vaccination. In our control program adult vaccination must obviously be restricted. We must not lose sight of the fact, however, that much more good than harm will result from whole-herd vaccination, that it is the most simple plan to adopt to inhibit the spread of infection and abortion, and, therefore, that it is better than a do-nothing policy.

**PERSISTENCE OF IMMUNITY IN VACCINATED CATTLE**

The average length of time that immunity resulting from vaccination with Strain 19 will persist has not been definitely established.

In the field trials, previously mentioned, in 260 heavily infected herds the incidence of abortion in vaccinated animals became appreciably lower each year until the trials were stopped in their seventh year. In these herds the infected cattle were not removed except for poor production or other natural causes. The tendency for the lowering of the incidence of abortion in succeeding years may be explained by a decrease in exposure brought about by recovery from the disease or separation from the herd, and the fact that the resistance in the vaccinated animals was undoubtedly augmented by constant contact with the infected animals.

Reports have been received recently of breaks in a few vaccinated herds that have been on a negative status for from 6 to 9 years, herds in which test-and-slaughter was initially practiced and in which the progeny have since been vaccinated. The breaks occurred in the older animals only. These results indicate that vaccinal immunity diminishes, as would naturally be expected. The results also indicate the necessity for research in revaccination with minute doses of vaccine at certain intervals following calfhood vaccination.

It is hoped that experiments now in progress at the Bureau's Animal Disease Station will provide more definite knowledge of the persistence of vaccinal immunity in the absence of intervening exposure. In these tests groups of cattle vaccinated as calves and since maintained free from exposure will be exposed to virulent *Br. abortus* during their second, third, fourth, and fifth pregnancies, respectively, together with an adequate number of controls kept under similar conditions.

**INTRADERMIC METHOD OF VACCINATION**

In 1942 research was initiated at the Maryland State Livestock Sanitary Service Laboratory in cooperation with the Federal Bureau of Animal Industry on the intradermic method of vaccinating cattle against brucellosis. A dose of 0.1 or 0.2 cc. of Strain 19 vaccine prepared for subcutaneous use was injected intradermically. The purpose of this departure from the usual method was to determine whether or not the intradermic method would result in the more rapid disappearance of the vaccinal agglutinin response.

The basic principle underlying intradermic vaccination seemed to justify this work, by analogy with results in other diseases, notably equine encephalomyelitis. In connection with the latter disease, it was shown that 1 cc. of equine encephalomyelitis vaccine introduced intradermically compared favorably with 10 cc. injected subcutaneously.

Preliminary results in the Maryland investigation indicate that in calves vac-
cinated intradermically the vaccinal titer disappears a little sooner than in calves vaccinated subcutaneously, but in adult cattle there is no appreciable difference. A comparative study of the opsonic index was made in calves and adult cattle vaccinated by both methods and the results so far obtained show no difference in the degree and persistence of the opsonic response in the respective groups. Nothing is known as yet of the degree or persistence of immunity resulting from this practice. However, the idea has had considerable appeal, and similar investigations are now in progress at the Bureau's Animal Disease Station and several State experiment stations.

An interesting fact brought out in this work was that in lactating cows vaccinated intradermically there was little or no systemic reaction or decrease in milk production.

STATE REGULATIONS FOR THE CONTROL OF BRUCELLOSIS OF CATTLE

Procedures for the control of bovine brucellosis in the various states have not been uniform and this has been reflected in control regulations. This lack of uniformity in state laws and regulations has resulted in some interference with the interstate shipment of cattle, particularly of vaccinated young stock still holding some reaction to the blood test. Efforts are being made to minimize these differences. We recommend that the interstate movement of animals not more than 18 months of age, vaccinated as calves, be permitted without test if they are properly identified and accompanied by an official certificate of vaccination.

ANSWERS TO SOME COMMON QUESTIONS ON VACCINATION

There are a number of points in connection with the vaccination program on which questions are commonly asked. We will answer a few of these questions.

1. Should a blood test be made of calves prior to vaccination? This practice was discontinued by our Bureau several years ago because it could not be determined that it was an essential requirement.

2. Should a blood test be made in calves subsequent to vaccination? There is no correlation between the agglutinin response and immunity. Agglutinins may disappear but immunity persists. Moreover, killed vaccines incite agglutinin production but only a very moderate degree, if any, of immunity. The only reasonable purpose of a post-vaccinal blood test, therefore, is to prove that the calf was vaccinated, which can be accomplished by proper identification at time of vaccination. In view of the more urgent need for manpower in extending the control program, it is believed that such tests might well be eliminated.

3. Is vaccination in a 4-month-old calf as effective as in an 8-month-old calf, or what is the optimum age during calfhood for vaccination? As previously stated, the immunity-producing mechanism in an animal is better developed in maturity. It has been observed that vaccination in a 1-month-old calf is not so effective as in an older calf. Therefore, it would appear that the older the calf the more effective vaccination should be. However, the older the calf the longer there is a tendency for the vaccinal titer to persist. For general purposes, therefore, it is believed that about 6 months is probably the best age for vaccination of calves.

4. Should calves in brucellosis-free herds be vaccinated? This procedure is
safe and as a matter of insurance could be considered as a desirable practice. It is probable, however, that in a small percentage of such animals the vaccinal titer will be slow in disappearing.

5. Should vaccinated calves be identified? This is a most important procedure to be followed. For purposes of admission into infected herds as replacements, definite information should be known about the previous vaccination of such an animal which can be obtained only if the animal bears some identifying mark or tag. In interstate shipment, vaccinated calves with a blood titer may be admitted to some states, if properly identified.

6. Should bull calves be vaccinated? Yes, if a bull calf is to be retained or sold as a herd sire into an infected herd.

7. If adult vaccination is practiced, should reactors be vaccinated? Strain 19 vaccine has no curative properties and, therefore, there is no necessity for or benefit to be derived from vaccinating an animal already infected.

8. Is it feasible to continue to maintain modified accredited areas under present conditions? Yes, depending on the incidence of the disease and the demand for the work in any given area.

CONCLUSIONS

In the foregoing remarks we have described the official control of bovine brucellosis during the last 10 years, and how it has evolved from the primary test-and-slaughter method to the inclusion of calfhood vaccination as an adjunct to test-and-slaughter and later combined with the retention of reactors. We have discussed the subject of adult vaccination and its applicability in the official program. We have also shown that the present shortage of manpower in our control program has affected its extension and to a considerable degree has offered a challenge to our ability to hold what we have gained.

The various types of herds affected with this disease, the nature of the disease in respect to its varied expression in different herds, the length of time a herd has been affected, the size of the herd and number of animals affected, and the incidence of infection in various sections have made the control of the disease a most complex problem even under normal conditions.

What procedures, therefore, should be advocated during the present emergency to safeguard the cattle industry against the spread of brucellosis?

The elimination of reacting cattle should be continued so far as practicable, as every such animal removed means the prevention of exposure to a number of susceptible animals. The limited manpower available, however, precludes the extensive use of the test-and-slaughter method. It is believed that the area plan of control should not be extended at the present time to counties in which the incidence of infection is relatively high.

We believe that vaccination with Strain 19 vaccine is an extremely useful and timely weapon for the control of bovine brucellosis. Calfhood vaccination offers recognized advantages and it is believed that this practice should be encouraged, especially in areas of heavy infection.

Calfhood vaccination in conjunction with retention of productive reactors to the agglutination test, until vaccinated replacements become available, is a most desirable practice and adapts itself to the necessity for increased production.
With respect to adult vaccination in herds under the Federal-State control program we feel that the practice should be limited to use in those herds in which there is but slight prospect of other methods succeeding, and in herds of the type previously mentioned. The persistence of blood titers in adult vaccinated cattle precludes accreditation for indefinite periods.

In those herds where reactors will be retained until vaccinated replacements become available (plan C), it is believed that heifer calves up to breeding age should also be vaccinated to prevent new foci of infection.

In negative herds, adult vaccination is not recommended. Calfhood vaccination, however, may be advocated as a means of increasing herd resistance.

It is believed that consideration should be given to infected herds not in the official program or on the waiting list for accreditation. From the work done by our Bureau and from the results presented by Haring and the more conservative practitioners it is evident that whole-herd vaccination will, in the great majority of instances, greatly limit abortions from brucellosis within a year and also inhibit the spread of infection. If the vaccination of calves is continued in a herd of this type, the number of reacting animals remaining at the end of a 5-year period should be so low that such herds might then be admitted to the control program.

Whole-herd vaccination, with subsequent calf vaccination, in herds of the kind indicated, is a matter that justifies serious consideration by state officials. The Bureau recognizes the fact that whole-herd vaccination is being performed in many States of the Union without the sanction of the state authorities and in many instances in violation of state regulations. To permit the use of vaccine in animals other than calves, the restriction on labels of vaccine containers will be modified in the near future. It is believed that if adequate information can be made available on the advantages and disadvantages of adult vaccination to owners of infected herds it will result in closer cooperation between herd owners and regulatory officials, and will result in the suppression of infection and abortion in thousands of herds that would otherwise be untouchable so far as supervisory control is concerned.

It is our aim to eliminate brucellosis from our cattle population. To safeguard the progress we have made in the Federal-State program and to extend our services in this connection, we should make use of all methods available. Particularly should we concentrate on practices within the economy of time and manpower that will accomplish greatest results and of a kind that will adapt themselves to the postwar or normal continuation of this work.
FURTHER RESULTS FROM VACCINATION WITH STRAIN 19

BY C. M. HARING, D.V.M., AND JACOB TRAUM, D.V.M.

University of California, Berkeley, California

Strain 19 has been used by the writers for approximately twelve years. To date 411,950 cc. of vaccine have been prepared at the Veterinary Science Laboratory in Berkeley for use on 51,472 cattle in 120 dairy and beef herds whose owners were willing to submit their animals to experimentation. In addition, experiments have been conducted on cattle and other species under controlled conditions at the University.

Laboratory and field work conducted with the assistance of several Agents Cooperative of the United States Bureau of Animal Industry, have involved the examination of 220,860 blood and milk samples, and the inoculation of 14,520 guinea pigs with tissues and discharges of animals. Cultures and other methods to differentiate Strain 19 from virulent Brucella abortus, suis, and melitensis, have also been used. Only a portion of the records in our project are presented in this paper since assistance to correlate, analyze and chart the data accumulated has not been available.

The vaccination of calves in infected herds has been followed by normal calf crops in most cases and in none has any serious break in immunity been reported. For example, in a dairy herd of approximately 2,000 head, which has been the dumping ground for the reactors from a herd discussed later in this paper, data are available which give an indication of what may be expected from animals vaccinated as calves in a rather heavily infected environment. Results of an agglutination test made recently on 1,552 animals of this herd show a total of 364 or 23.5 per cent reactors. Of these reactors 311 or 85.4 per cent had not been vaccinated, while 53 or 146 per cent had been vaccinated—this includes animals vaccinated as adults.

The calving records of animals in this herd which were vaccinated as calves are of interest. Some of these animals have calved as many as six times and there have been 1,493 parturitions as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1,376</td>
<td>92.2</td>
</tr>
<tr>
<td>Abortions</td>
<td>76</td>
<td>5.1</td>
</tr>
<tr>
<td>Stillbirths</td>
<td>41</td>
<td>2.7</td>
</tr>
</tbody>
</table>

To date in this and in certain other infected herds 1,005 parturitions were analyzed. In cows and heifers vaccinated as calves aged 4 to 8 months, we find the following:

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>972</td>
<td>97.7</td>
</tr>
<tr>
<td>Abortions or full term dead calves</td>
<td>33</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Blood tests of the 33 animals made subsequent to the abortions showed 24 negative, 6 suspicious and 3 positive. If it is assumed that the abnormal parturitions in the 6 suspicious and 3 positive cows were due to Br. abortus, the incidence of failure of
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the vaccine to prevent abortions in the 1,005 animals would be 0.9 per cent. This
approximates the 1.1 per cent abortions attributable to brucellosis in cows
vaccinated as calves reported to this Association in 1942, by Wight (1) of the U. S.
Bureau of Animal Industry. Blood tests previous to calf vaccination under this
program of the Bureau as reported by Mohler, Wight and O'Rear (2) showed 29.2
per cent reactors among the 17,000 cattle on the 280 cooperating farms. We make
this comparison of the similarity of results obtained from use of Bureau of Animal
Industry and University of California vaccine in order to emphasize that they were
obtained in herds having a rather high incidence of brucellosis at the time calf
vaccination was started and to lead up to a discussion of less satisfactory results ob-
tained from calfhood vaccination in three California herds free from brucellosis at
the time calf vaccination was begun.

Calf vaccination in herds free from brucellosis is now recommended by veterinarians
at the University of California whenever there is a probability that any of the
animals may be accidently exposed to virulent infection. Eight such herds totaling
about 1,300 adult cattle have been under observation for several years. Previous
to the start of calf vaccination these herds were free of reactors as indicated by
annual or more frequent blood tests conducted during a period of from six to ten
years depending on the individual herd. As the vaccinated animals in such herds
matured in a brucellosis-free environment, their agglutination titers usually de-
creased to less than 1:100. That is, they ceased to be definitely positive reactors.
In many cases, however, agglutinins in titers of 1:25 or 1:50 have persisted over a
year.

In three of these eight herds cases of infection with virulent Br. abortus appeared.
In herd number 1, a pregnant heifer that had been vaccinated as a calf developed
a high agglutination titer. It is believed that this heifer became infected from cattle
on a neighboring farm. She was immediately purchased by the University and
transferred to the Experiment Station where she was isolated and gave birth to a
full term vigorous calf. Br. abortus of virulent type was isolated in cultures from
her colostrum and uterine material. Four years have elapsed without the appear-
ance of any more reactors in the herd from which she was removed.

In herd number 2, after two years of a calf vaccination program, one of the
pregnant heifers, vaccinated as a calf, aborted in November, 1943. Soon several of
the old nonvaccinated animals reacted and some aborted. Vaccine was then used
on all unvaccinated female animals in the herd and losses from abortions are reported
to have ceased.

Herd number 3 was part of an experiment with the effect of time and temperature
on the viability of vaccine. It was found that in six months the viable organisms
decreased from 20 billion to 800 million per cc. in bottles of vaccine kept at 40°F.
Some of the animals were given this low count vaccine and therefore received less
than the recommended number of viable organisms. A reactor appeared among
the old nonvaccinated cows in this herd two years after calf vaccination was begun.
Through carelessness she was allowed to remain in the herd for several weeks during
which time she gave birth to a full term calf. However, a number of the vac-
cinated as well as the unvaccinated animals became positive reactors to the ag-
glutination test. Vaccine was then used on all the cows which were still negative to
the blood test. These were vaccinated whether or not they were open, if not
more than four months pregnant. It should be noted that some of these adult
animals were probably infected at the time they were vaccinated even though they
failed to show positive reactions to agglutination tests.

During the next two years the abortion rate was as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonvaccinated cows</td>
<td>40.9 per cent</td>
</tr>
<tr>
<td>Animals vaccinated as adults</td>
<td>16.9 per cent</td>
</tr>
<tr>
<td>Animals vaccinated as calves</td>
<td>13.9 per cent</td>
</tr>
</tbody>
</table>

These data were mentioned in our paper before this Association last year but are
repeated to support the contention that losses from abortion after exposure to viru-
 lent infection are liable to be heavy in vaccinated animals that have been reared in a
Brucella-free environment.

In herds where occasional positive reactors continued to appear despite frequent tests
and removal of reactors, calf vaccination is especially recommended. In Southern
California there are many unusually large dairy herds, several containing more than
two-thousand animals. In some of these, the test and removal or slaughter method
has been used over a period of years to combat brucellosis, without satisfactory
results, despite frequent testing and removal of animals classified as reactors and in
some herds suspects as well were removed.

Most of the owners of such herds have now resorted to vaccination with Strain 19.
The experience of calf vaccination in one such herd was reported by Dr. Rosenberger
(3) before this Association in 1940. In 1942, a further report on this and two other
herds was presented by Dr. Bonynge (4). These reports give evidence of the
satisfactory results of calfhood vaccination. Data of vaccination results are now
available through 1943 and show that 1,626 animals vaccinated as calves have com-
pleted 3,014 pregnancies with 95 per cent normal calvings, 3.5 per cent abortions and
1.5 per cent stillbirths. This is slightly better than scored by the entire herd.

Since June, 1944, an unexpected number of positive and suspect reactors have
appeared in this herd in both vaccinated and nonvaccinated animals. Milk—and in
some cases vaginal swabs—from thirty-nine such animals was submitted to
laboratory examination. Of these, thirty had been vaccinated as calves and nine
had not been vaccinated. The results of cultures or guinea pig inoculations or both
showed five of the nine (55 per cent) nonvaccinated cows harbored virulent Brucella
abortus, while in the thirty vaccinated animals, Brucella abortus was demonstrated
in two cases (6-2/3 per cent).

No definite explanation is known for the development in the vaccinated animals
of agglutination titers to a point where the animals were classified as positive or
suspects after the titers resulting from vaccination had disappeared. That infection
was present in the dairy is amply demonstrated by the abovementioned laboratory
tests. The vaccinated animals could have developed agglutinins by exposure to
virulent Brucella abortus and have set up a demonstrable infection or a transient
infection with virulent organisms—or perhaps a small focus of latent infection of the
original inoculation with culture 19 could have been reactivated during or soon after
termination of pregnancy, to stimulate transient production of agglutinins. In
either case, active infection with virulent Brucella abortus was apparently held down
RESULTS FROM VACCINATION WITH STRAIN

to the point where only two of thirty vaccinated reactors showed infection, as demonstrated by laboratory tests.

FIFTEEN YEARS EXPERIENCE WITH BOVINE BRUCELLOSIS IN DEL NORTE COUNTY

From 1930 to 1935 a program of blood testing and segregation of reactors was conducted on 130 dairy farms in Del Norte County. A University veterinarian drew blood samples three or four times each year and arranged to have the reactors removed or segregated as thoroughly as possible under the primitive conditions of dairying in that county. The percentage of reactors fluctuated from an initial rate of 16 per cent in 1930 to 12 per cent in 1933 and up again to 14 per cent in 1935, at which time the program was discontinued and no further effort was made to combat brucellosis until 1938, when a few of the dairymen started injecting vaccine obtained from a peddler. No licensed veterinarian lives in the county.

In 1939, forty-seven of the dairymen signed agreements to refrain from the personal use of any vaccine and to permit University veterinarians to experiment with methods of control of brucellosis in their herds. Tests in 1939 and 1940 showed 46.9 per cent positive reactors in the 2,675 milking cows on the 47 farms. The experimental procedure was as follows: In 14 herds, Strain 19 was used on adult cows as well as calves. In 16 herds calves only were vaccinated. In 17 herds no vaccine was used because the herds either contained no reactors or the numbers were so few that the owners were willing to dispose of them. Since 1940 calf vaccination only has been used in 13 of the herds where adult cows were injected. In one herd adult animals brought from other herds were vaccinated as soon as possible after they calved.

During the six years this program has been underway, the results have been highly satisfactory to the owners of the herds where combined-calf and adult-cattle vaccination was practiced. In all such herds the abortions diminished and in several they have been nil. The results have been less satisfactory in some of the herds in which calf vaccination only was practiced. The disease has continued to spread to the non-infected nonvaccinated cows in several of these herds, and losses from abortion did not abate until vaccination of the adults was started. Furthermore, Brucella infection has appeared with disastrous effects in some of the herds that were free of reactors in 1939 and in which no vaccine was used during the first two years of the experiment.

The use of vaccine on adult cattle temporarily increased the number of animals with high blood-serum titers, but despite this, the total number of reactors decreased from 46.9 per cent in 1940 to 9.7 per cent in May, 1944. Probably it would be even lower if all the adult cows of cooperating owners had been vaccinated in 1939 instead of waiting until continued spread of the disease forced vaccination of adult cows in some herds in 1942 and 1943.

It is reasonable to expect continued satisfactory results in Del Norte County. However, if the use of vaccine in calves only should fail to bring about a satisfactory control of the disease, those cattle owners who may experience losses from abortion will probably eventually insist on the revaccination of all the cows in their herds.

The question of revaccination was raised by us in a paper presented before this Association last year. Some veterinarians in California advise the revaccination of
cows whenever losses from abortion become serious in a herd. At present we believe that when an abortion storm breaks all female cattle not positive to blood test and not advanced more than 3 months in pregnancy should be injected with Strain 19 whether or not such animals had previously been vaccinated. That revaccination should be recommended under other conditions in California has not as yet been agreed upon.

**SUMMARY**

1. In herds having a high incidence of reactors at the time calf vaccination was begun, the abortion and stillbirths attributable to brucellosis in animals vaccinated between 4 and 8 months of age, were 0.9 per cent in 1,005 parturitions.

2. Virulent Brucella infection has appeared in three herds that had been free of positive reactors for several years previous to the start of calf vaccination. In the first of these herds no serious loss occurred because the reactor was promptly removed, and in the second all nonvaccinated animals in the herd were injected with Strain 19. In the third herd, delay in removing a reactor was followed by a storm in which abortions or stillbirths occurred in 13.9 per cent of the animals vaccinated as calves, in 16.9 per cent of the animals vaccinated as adults and in 40.9 per cent of the non-vaccinated animals.

3. In large herds, where positive reactors continue to appear occasionally despite frequent tests and removal of reactors, calf vaccination has proved especially useful.

4. In Del Norte County under cooperative arrangements with 47 dairymen owning approximately 3,000 animals, observations have been in progress for fifteen years. A voluntary blood test and segregation program started in 1930, failed to satisfactorily reduce the incidence of reactors or improve the calf crop, and was discontinued in 1935. Since 1939, vaccination has been in progress and no attempt has been made to segregate infected animals. The per cent of positive reactors was 46.9 in 1940 and 9.7 in 1944. Most satisfactory results have been in the herds where heavy losses from abortion were occurring at the start of the vaccination program in 1939 and where adult as well as calf vaccination was used in the first year, followed by calf vaccination only in succeeding years. In herds where dependence was placed on calf vaccination only, the results were less satisfactory, and the heaviest losses were in herds where no vaccine was used but blood testing and removal of reactors was practised. In a majority of such herds calf vaccination is now in use and the results have thus far been highly satisfactory.

**REFERENCES**


STUDIES ON THE ALLERGIC ACTIVITY OF BRUCELLA ABORTUS

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Many methods have been tried in attempts to diagnose brucellosis in man and lower animals. The blood test using agglutination as the criterion has been accepted as the method of choice in cattle, in which species of lower animals, most testing has been done. The blood test has found widespread use and has had great practical value in controlling and eradicating brucellosis from cattle. The blood test has found such wide usage that it has become almost the only method used for diagnosis.

Dependence on the blood test alone as a diagnostic test has been attended with disappointment in some instances. Some herds have remained infected even with repeated blood testing and the removal of reactors. Other herds have been negative and certified and a break occurs. In some such cases no new animals have been introduced and no explanation can be found for such breaks. This has led to a question of the efficiency of the blood test in some quarters and the belief that it cannot be depended upon to remove all infected animals.

The thought that a test possibly to supplement the blood test is desirable and the access we had to sonic vibration, a method of disintegration of organisms different from that commonly used, prompted us to investigate the possibilities of an allergic test. This study has contributed some information and has also pointed out some limitations in connection with such a test.

Suspensions of killed Brucella organisms, filtrates of broth cultures and extract of Brucella, have been used in skin testing with varying results. Hutyra, Marek and Manninger (1), in summarizing the data on intracutaneous tests in cattle, state that in practice the allergic tests have not so far been generally adopted. The method of sonic vibration was used in our work for the preparation of an antigen for skin testing.

It has been shown by Chambers and Gaines (2), Harvey and Loomis (3), and Chambers and Weil (4), that sonically killed bacteria are disintegrated. Chambers and Flosdorf (5) demonstrated that some heat-labile proteins are not denatured by sonic treatment. By using this method, Chambers and Flosdorf (6), further succeeded in extracting from Eberthella typhi the Vi antigen which had not been separated by any other means of bacterial destruction. Mudd et al. (7, 8), subjected streptococci to sonic vibration and found that the bacterial extract thus obtained absorbed antibodies from immune serums.

The sonic filtrate was prepared by growing large quantities of Brucella abortus and subjecting such organisms to sonic vibration. The bacterial suspensions were exposed for one to two hours to vibration. The bacterial suspensions were exposed

1 These studies were supported by funds from the Pennsylvania Department of Agriculture and the Bureau of Animal Industry, United States Department of Agriculture.
for one to two hours to vibration of audible frequency at 9,000 cycles per second. The disintegrated organisms were then centrifuged at high speed to remove debris and any cells not disintegrated. The supernatant fluid was then diluted with an equal quantity of sterile physiological saline solution and passed through a Seitz filter. The filtrate was clear and constituted the sonic filtrate.

Studies were first made on rabbits and guinea pigs. Equal groups of each species were used for infection and for controls. The animals were infected by injection with *Br. abortus* for the purpose of sensitization. Various methods of injection were used. Some were injected intravenously and others intraperitoneally. Some were injected with living cultures of *Br. abortus*, others with heated but not killed cultures, and other animals with phenol-killed cultures. These animals as well as the controls which were not injected were tested by intracutaneous injection of sonic filtrate. The injections showed that the sonic filtrate stimulated an allergic response when injected intracutaneously into sensitized rabbits and guinea pigs. The dilutions of the filtrate used in the skin tests were based upon the protein content, and the fact that the same concentrations in different lots of filtrate produced very similar skin reactions would indicate that the protein constitutes the active allergic substance. The rabbits injected with live *Br. abortus* intravenously developed the best skin sensitivity. Those injected with live culture intraperitoneally and the group of rabbits injected with heated but not killed culture showed variable results. The rabbits injected with phenol-killed culture intravenously were not sensitized to the skin test. Similar results were obtained in guinea pigs.

The sonic filtrate also bound precipitins as shown by precipitative tests. The intracutaneous injections of sonic filtrate stimulated the production of agglutinins in the controls or non-sensitized animals. The agglutinins were highest at about one week following the intracutaneous injection of sonic filtrate and were directly proportionate to the concentration of the filtrate used. The smaller the quantity of filtrate injected, the lower the titer found, and the earlier it disappeared. Such agglutinins disappeared from the blood in a few weeks and had entirely disappeared in eight to ten weeks. There was no evidence of sensitization to subsequent skin tests in control non-sensitized rabbits, retested after 4, 7, 10 and 24 weeks. It appeared from these results that sonic filtrate injected intracutaneously produces a reaction in sensitized animals.

Sonic filtrate has been tried out experimentally in cows that were negative to brucellosis by known methods of test as well as in cows that reacted to the blood test. Cows were selected from herds in which all animals were negative to the blood test and in which there was no history of abortions. Skin tests of such animals have been consistently negative. Repeated tests have been made in a number of animals and as many as 12 retests have been carried out at two month intervals. There has been no indication that the filtrate sensitizes cows to subsequent intracutaneous tests. The intracutaneous injection of sonic filtrate produces agglutinins that may be detected by means of the blood test. The agglutinin does not appear to be in large amounts because the maximum titer, after the injection of a skin test dose, is 1:50 or 1:100, observed in about two weeks. This titer gradually recedes and the blood serum is negative, usually within six to eight weeks. This is one of the limitations of such a test in that it produces a titer in negative animals.
ALLERGIC ACTIVITY OF BRUCELLA ABORTUS

Sonic filtrate has also been tried experimentally in cows that were affected with brucellosis as evidenced by reaction to the blood test. Brucellosis in cattle shows many variations as it is found under natural conditions. It is believed that it occurs in both active and inactive forms, and with many variations of such forms. It follows that there must be variations in the degree of sensitization produced in a disease like brucellosis. Attempts have been made to select groups and individuals in which the infection has been active as manifest by abortions, and also where the infection has been present for some time and termed chronic brucellosis.

The sonic filtrate has been injected intracutaneously into the skin of the tail fold and the vulva as is done in tuberculin testing. Following the injection there occurs a slight swelling believed to be due to the toxic effect of the sonic filtrate. This immediate effect disappears within twenty-four hours in negative animals, whereas a positive reaction remains and may increase in extent. The maximum reaction is obtained in 48 to 72 hours and is the same type of reaction that occurs in tuberculosis from the use of tuberculin.

One herd used in this study comprised 117 cows in which brucellosis had been present for several years. Sixty-three cows in this group had quarantine tags indicating they had reacted some time previously to the blood test and had been in this group 4 years or longer. These were designated as "old reactors." The remaining 54 cows were added more recently, some of which had been suspicious to the blood test when added, and others had been culled from a free herd maintained on a distant premise. The animals were housed in a large barn where they were allowed to run loose. They were driven in small groups into an adjacent room where they were confined in stanchions and milked by machines.

Five blood tests and five skin tests were carried out within one year. Altogether the sera of 41 of the "old reactors" produced complete agglutination of Brucella antigen in 1:100 or higher, in the course of the year, which would class them as positive. Of these, 33 yielded good skin reactions, while in 8 the reactions were doubtful or negative. Seventeen old reactors had blood titers ranging from negative in 1:25 to partial agglutination in 1:100 dilution, were classed as suspicious to the blood test and all reacted to the skin test. Three other cows whose sera did not agglutinate Brucella antigen in the lowest dilution of blood, namely 1:25 gave positive skin reactions. One cow with a suspicious blood titer was negative to the skin tests and one cow was negative to both the serological and skin tests.

According to the results obtained in the course of testing of the above 63 cows, 41 animals were found positive to the blood test, 53 animals to the skin test and by combining the two tests, 61 cows were positive to either or both tests.

Although isolation of Br. abortus would have been the only definite proof that the animals under study were infected at the time of the blood and skin tests, no such proof could be obtained. Milk samples from 48 of the 63 old reactors were cultured, with four positive results, and tissues of 30 of the animals cultured when butchered later were all negative. Such results are not unusual when dealing with chronic brucellosis.

According to the histories obtained of the 63 cows, 30 never aborted, 19 aborted once, 13 aborted twice and one cow aborted four times. Thus only about 50 per cent of the old reactors ever aborted. However, only 6 of the 30 cows which did not
abort escaped another symptom of brucellosis, namely retention of the placenta following parturition.

The other group of 54 cows added within four years to our tests were negative or suspicious when added. In our tests, 35 had blood titers of 1:100 or higher, classed as positive, and of these 33 gave positive skin reactions. Five cows with suspicious titers and 9 cows with negative blood titers reacted to the skin test. Two animals with suspicious blood titers and 3 without any blood titers did not react to the skin tests. Altogether 35 cows in this group were positive to the blood test and 47 cows were positive to the skin test. By combining the two tests, 49 of the 54 cows were positive to either or both tests. Milk samples from 41 of the cows were cultured, with five positive results, and on cultures of the tissues, Br. abortus was isolated from the supramammary lymph gland of only 3 of 24 cows examined. Although no data are available as to when some of these animals became positive to blood tests for brucellosis previous to our experiments, it may be assumed that many of them had been infected for some time due to close-contact with infected animals.

None of these animals, according to their breeding histories had aborted before they were added to the herd of old reactors, but after contact with the infected cows, 19 animals in this group had aborted once, 8 animals aborted twice, and 1 cow aborted 3 times. Thus, as in the findings of old reactors, only about 50 per cent of the animals aborted, while 13 additional animals which did not abort, had a retained placenta following one or more parturitions.

The results indicate that in the majority of instances positive blood titers were accompanied by positive skin reactions. In some cases, however, no skin sensitivity was observed in animals with high agglutinin content of the blood sera, while in others good skin reactions were noted in the presence of a low or negative blood titer.

Similar tests have been made on cows reacting to the Federal-State blood testing program. Most of this work has been done in herds in the process of eradication and certification. The infection has been considered recent in most of these cases. Similar results have been obtained in such tests.

Skin test reactions do not always correspond to blood test reactions. Some cows giving skin reactions do not react to the blood test. Some cows giving good reactions to the blood test do not react to the skin test. Some cows giving slight or suspicious reactions to the skin test give good reactions to the blood test. Others with slight or suspicious blood tests give good skin reactions. The exact status of such animals is not known. It is not possible by means available at present to definitely show whether or not such cows are infected.

Sonic filtrate also has very definite limitations in that it produces agglutinins in injected animals. It does not fit in with the test and slaughter method. It produces temporary but transient reactors. It cannot be used very widely. The fact that it produces reactors to the blood test hampers its use experimentally. Sonic filtrate does not fulfill the requirements of a satisfactory allergic agent for skin testing. Attempts are being made to overcome some of these difficulties and it is hoped studies may be reported sometime later. The study of any substance that may aid in the recognition of brucellosis seems justified and studies are being continued.
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THE STABILITY OF BRUCELLA ABORTUS VACCINE DESICCATED BY LYOPHILIZATION

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The calfhood vaccination program for the control of contagious abortion in cattle is now well established, and it has been amply demonstrated in numerous studies under field conditions that favorable results may be expected from its wide application.

Inasmuch as the efficacy of the present Brucella abortus vaccine depends upon the injection of living Br. abortus organisms of low virulence but high antigenicity into cattle, it is essential that the vaccine arrive at the point of use containing a maximal number of living organisms. The vaccine, as prepared in accordance with the Bureau of Animal Industry regulations, is a saline suspension of living Br. abortus Strain 19 organisms which is adjusted to a standard turbidity and contains at least 10,000 million viable organisms at the time of its release by the Bureau. However, from the date of release to the time of actual use, organisms in this suspension are continually losing viability. Fortunately, this death rate is not as great as with many other bacteria but it is sufficient to reduce materially the viable count of this vaccine so that even when kept constantly refrigerated it has been considered unsatisfactory for use at the end of six months. Information which has been accumulated by the Bureau of Animal Industry has recently resulted in a further reduction in the period for use of this product to three months from the time of manufacture.

Moreover, various factors other than time of storage may effect drastically the viability of the vaccine. Love and Mingle (1) have reported that exposure to temperatures above 45° F leads to accelerated loss of viability, and Mitchell and Moore (2) feel that agitation such as that resulting from automobile transportation also decreases viability. When these factors are considered, the problem of producing a satisfactory vaccine and transporting it to its point of ultimate use is obvious.

It was felt that a more stable form of this product would be highly desirable and it occurred to us that desiccation from the frozen state by means of lyophilization might offer a means of stabilizing this vaccine. Accordingly, experimental work was begun directed toward the development of a desiccated vaccine.

METHODS

Inasmuch as the viable counts of the vaccines produced were considered to be the only practical criteria upon which various techniques could be evaluated, preliminary work was directed toward the development of a counting method which would give reliable results. Comparisons of blood agar, potato glycerin agar, and ‘Difco’ tryptose agar, using both poured plates and spread plates, indicated that in our hands the ‘Difco’ tryptose agar was the most satisfactory medium when used in agar
pour-plates. This medium and plating technique have given consistently higher colony-counts than have the other two media, although the development of colonies is somewhat slower. It was found also that the organisms of Strain 19 show a marked tendency to clump together, resulting in falsely low viable counts. This tendency is increased when a vaccine is desiccated. As a result of the experience gained in the early phases of this work, the following method for making viable counts has been developed.

One ml. of the vaccine is pipetted into 99 ml. of sterile tryptose broth in a 225 ml. bottle containing approximately 100 glass beads. The tightly stoppered bottle containing a 1:100 dilution of the vaccine is then shaken in a mechanical shaker for 15 minutes and then further tenfold dilutions are prepared in 10 ml. volumes. Duplicate quantities of each of the three highest dilutions (usually 1:10 million, 1:100 million and 1:1 billion) are placed in petri dishes to which are added 15-20 ml. of melted tryptose agar, cooled to approximately 50°C. The petri dishes are rocked to obtain even distribution of the sample in the agar, and after hardening are incubated in an inverted position at 37°C. for 5 days. After incubation the colonies are counted and viable count estimations are based on plates having between 10 and 300 colonies.

In most instances, duplicate vials of vaccine were counted and in reporting the results these counts have been averaged.

In the preparation of lyophilized vaccines a uniform procedure of desiccation was used. The vaccines were filled in 6 ml. quantities in 10 ml. 'vacule' ampule vials. The contents of the vials were shell-frozen by rotation in a dry ice-methyl cellosolve freezing bath at approximately -78°C. After freezing they were immediately placed in the drying chambers and subjected to high vacuum for 72 hours. After drying, the vials were stoppered under vacuum and a glass seal was completed over the rubber stopper. At the time of testing the glass seal on the container was broken, thereby exposing the rubber stopper, and the contents of the vial was restored to its former liquid state by the addition of 6 ml. of sterile distilled water. This distilled water was added through the rubber stopper by means of a hypodermic needle attached to a sterile syringe. Gentle shaking aided in the rapid restoration of the desiccated vaccine.

All organisms used in these studies were propagated by the standard methods outlined by the Bureau of Animal Industry. Br. abortus Strain 19 was used in all cases and this was grown in Blake bottles on potato-glycerin agar at 37°C for 48 hours. The growth was washed from the agar and usually adjusted to turbidity four times greater than was desired in the final product. The required amounts of the various added components were incorporated and then the suspensions were made up to the turbidity desired by diluting to four times the volume of the original bacterial suspension.

EXPERIMENTAL

The preservation of bacterial cultures by the lyophile technique has been carried on in our laboratories for many years. During this time is has been a frequent observation that the desiccation of organisms in saline or broth is not very satisfactory for preserving the viability of bacteria. In addition, it has been found that, even though a bacterial culture may be shown to be viable for several years, the number
of viable organisms, immediately after desiccation, is very small compared with the number in the original culture before treatment. We have called this decrease in viable organisms during desiccation "process drop" and have found this to be most marked in saline and distilled water and considerably less in suspensions containing protein and certain other substances. Generally speaking, suspending solutions which reduce "process drop" to a minimum tend to aid in the preservation of viability during the subsequent storage of the bacterial cultures.

These observations were considered in planning experiments which were performed to select a suspending agent which would exert a maximal protective effect on the viability of desiccated *Brucella abortus* suspensions. In addition, the agents selected for trial were either substances which were homologous with the bovine species or which were poor antigens. This was done to reduce the possibility of sensitizing the animals to foreign protein coincidental with Br. abortus vaccination.

For purposes of controlling the pH of the vaccines during desiccation, M/20 phosphate buffer of pH 7.2 was used instead of saline as the diluting agent. Subsequently the buffer pH was reduced to 6.3 to conform to a change in Bureau of Animal Industry regulations.

The stabilizing effects of gelatin, bovine serum, and skimmed milk were studied. Various concentrations of these substances were prepared in phosphate buffer, and to uniform volumes of each were added constant volumes of a suspension of Br. abortus Strain 19. Thus, each suspension contained the same number of organisms suspended in different concentrations of the various stabilizing agents. The suspensions were filled into vials and lyophilized. Samples were kept in the liquid state for control purposes. Plate counts of these samples resulted in the estimates of viable numbers of organisms appearing in table 1. It can be seen from this table that "process drop" is very considerable, being above 50% in all suspensions and as high

<table>
<thead>
<tr>
<th>SUSPENSION</th>
<th>VIABLE ORGANISMS IN BILLIONS PER ML</th>
<th>&quot;PROCESS DROP&quot; IN PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Liquid Suspensions (Average)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Desiccated Suspensions, M/20 Phosphate Buffer 7.2</td>
<td>5</td>
<td>79</td>
</tr>
<tr>
<td>5% Bovine Serum</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>10% Bovine Serum</td>
<td>8</td>
<td>67</td>
</tr>
<tr>
<td>20% Bovine Serum</td>
<td>6</td>
<td>75</td>
</tr>
<tr>
<td>0.2% Gelatin</td>
<td>4</td>
<td>83</td>
</tr>
<tr>
<td>0.5% Gelatin</td>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td>1.0% Gelatin</td>
<td>2</td>
<td>92</td>
</tr>
<tr>
<td>2.0% Gelatin</td>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td>50% Skimmed Milk</td>
<td>11</td>
<td>54</td>
</tr>
</tbody>
</table>
as 96% in some cases. It would appear that the addition of gelatin to Brucella suspensions actually caused a larger process drop than in the unstabilized phosphate buffer alone. Whether types other than the pork-skin gelatin used would also cause this effect was not investigated. This table also indicates that 50% skimmed milk gave much the best stabilizing action of the various agents tested. Subsequent experiments similar to the one herein mentioned confirmed these observations.

Following these trials an extensive experiment was carried out in which the viability of various Br. abortus Strain 19 suspensions were determined during periods of storage at 37–41°F, room temperature, and 98°F. These suspensions were prepared in buffered saline, 20% bovine serum, and 50% skimmed milk, and were adjusted to a turbidity three times that of the standard Br. abortus vaccine. These suspensions were filled into vials; half of each were lyophilized, and the other half were left in the liquid state. After lyophilization had been completed all the vials were glass-

<table>
<thead>
<tr>
<th>SUSPENDING AGENT</th>
<th>VACCINE TYPE</th>
<th>STORAGE TEMPERATURE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>36-41°F</td>
</tr>
<tr>
<td>Buffered Saline</td>
<td>Liquid</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Lyophilized</td>
<td>6</td>
</tr>
<tr>
<td>50% Skimmed Milk</td>
<td>Liquid</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Lyophilized</td>
<td>22</td>
</tr>
<tr>
<td>20% Bovine Serum</td>
<td>Liquid</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Lyophilized</td>
<td>22</td>
</tr>
</tbody>
</table>

sealed. Vials of each suspension, both desiccated and liquid, then were stored at 36–41°F, room temperature, and 98°F. Initial counts on samples taken before storage indicated that the liquid vaccines made up to triple concentration contained about 70 billion viable cells per ml. After lyophilizing, the saline suspension was found to have dropped to 17 billion, whereas the skimmed milk and bovine serum samples had viable counts of 40 and 30 billions respectively. Sample vials of these suspensions were removed from storage after 3, 6, 9, 14, and 22 months for determination of viability. Table 2 gives a simplified summary of these results in terms of the number of months that elapsed before the various vaccines were found to have viable counts below 10 billion organisms per ml. These results clearly show that, with the exception of the saline suspensions, lyophilization contributes dramatically to the maintenance of viability. This effect is even more pronounced when it is recalled that the lyophilized vaccines all suffered some degree of process drop before storage was begun, and therefore began storage with lower viable counts. The resistance of organisms to the destructive influence of higher temperatures, when they are desiccated in the presence of a stabilizing solution, is clearly shown. When stored at room temperature, skimmed milk-desiccated vaccines and bovine serum-desiccated vaccines were found to be below 10 billion only after 22 and 14 months.
respectively, whereas this point was reached by the other preparations in three months.

The superiority of the skimmed milk vaccine over the bovine serum vaccine was quite clear in these experiments. The "process drop" was 43% for the skimmed milk medium compared to 57% for the serum medium; the former was more stable at room temperature, and displayed a marked superiority at 98°F. After nine months at this temperature, the skimmed milk-desiccated vaccine still contained 5 billion viable organisms per ml. whereas all other vaccines contained less than 100 million viable cells after three months.

One other vaccine lyophilized from skimmed milk buffer solution has been stored for 19 months at 36-41°F and room temperature. The data for this lot of desiccated vaccine confirm the foregoing results. These figures are summarized in table 3.

It can be seen that this vaccine exhibited no significant loss during refrigeration and had lost only one-third of its viability at room temperature. Various other lots of vaccine have been prepared using skimmed milk and phosphate buffer. These

<table>
<thead>
<tr>
<th>COUNT AT PRODUCTION</th>
<th>&quot;PROCESS DROP&quot; IN PERCENT</th>
<th>STORAGE TEMPERATURE</th>
<th>COUNT AT 19 MONTHS</th>
<th>PERCENTAGE LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid 36 Billion</td>
<td>Lyophilized 18 Billion</td>
<td>50</td>
<td>36-41°F</td>
<td>17 Billion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Room Temp.</td>
<td>12 Billion</td>
</tr>
</tbody>
</table>

have not been stored for periods sufficient to permit any additional conclusions, but it should be mentioned that all of these vaccines have undergone a process drop of approximately 50%. It would therefore seem that if the vaccines are prepared so that the original density is twice that of the present liquid vaccine, a viable count equivalent to a fresh liquid vaccine is to be expected in the desiccated product.

DISCUSSION

In these experiments it was demonstrated that desiccated vaccines could be prepared satisfactorily. These maintained their viability for long periods of time even under adverse conditions of storage. For the preparation of such vaccines it was found that desiccation from the frozen state, making use of a stabilizing suspending agent, gave excellent results. Of the stabilizers tried, bovine serum in phosphate buffer and skimmed milk in phosphate buffer were found to be the best. These materials showed some beneficial effects in liquid vaccines as well, and confirm the work of Love and Mingle (1), who also found that bovine serum stabilized liquid vaccine. Skimmed milk in phosphate buffer was found to give the most satisfactory results since vaccines prepared with this stabilizer suffered the smallest "process drop" and were resistant to exposure to high temperatures.

It should be pointed out that this is not the first report of the desiccation of Br. abortus Strain 19. Mitchell and Moore (2) found that Brucella abortus vaccine, when desiccated from the frozen state, immediately lost up to 99% of its viability, but the few organisms remaining were viable for several months. Since their work
was done without the use of stabilizing solutions, such a result is not surprising, and is confirmed by the large process drops which are reported in this communication when saline or phosphate buffer alone was used.

*Br. abortus* vaccine desiccated by lyophilization has been used in a limited number of cattle with no untoward local or systemic reactions. It has also been found that the agglutinins produced, when this vaccine is used in cattle, disappear just as rapidly as those produced by the liquid Brucella vaccine now supplied (3). More extensive field trials of the desiccated vaccine are now being carried out through the cooperation of the Bureau of Animal Industry, but it is too early for these reports to be available. The additional stability of the desiccated vaccine at high temperatures would seem to be a very important consideration in the use of this vaccine, since it is frequently impractical to maintain Brucella vaccine under refrigeration at all times during its storage and transportation under field conditions. A desiccated vaccine which is less sensitive to injury than the present liquid suspension might go far to overcome the difficulties encountered in the extensive application of the calfhood vaccination program by ensuring a product of high viability at the time of actual use.

**SUMMARY AND CONCLUSION**

1. Gelatin, bovine serum, and skimmed milk in phosphate buffer were tested for their ability to stabilize the viability of desiccated *Br. abortus* Strain 19 vaccines. Skimmed milk in M/20 phosphate buffer was found to be the most satisfactory.

2. Storage experiments conducted with lyophilized and liquid vaccines stabilized with bovine serum and skimmed milk indicated that both agents aided in maintaining viability and that the lyophilized vaccines were very much more stable than the liquid preparations at all temperatures tested.

3. The vaccines desiccated in the presence of skimmed milk were found to be superior to all other preparations tested because they had the greatest stability to temperatures up to 98°F and suffered the smallest "process drop" during lyophilization.

4. A practical procedure has been developed to increase the stability of Brucella vaccine by desiccation, and thereby insure the desired antigenic potency under actual conditions of use.

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REPORT OF COMMITTEE ON BANG'S DISEASE


Your Committee on Brucellosis finds that there is an increasing interest and marked uncertainty among the livestock owners as to just what policy is best to follow in the control and eradication of brucellosis (Bang's Disease).

As indicated by the United States Bureau of Animal Industry's Annual Report, progress continues to be made in checking brucellosis in cattle, and as previously indicated by this Committee, cattle owners, regulatory officials veterinarians and other persons interested, should not lose a single opportunity to combat this malady. Ample evidence of the possibilities of completely eradicating brucellosis from cattle has been accumulated, and much of the future welfare of agriculture and the future health of the people of this nation depends upon this accomplishment. It must be admitted that in many instances, and in many sections of the country there has been some spread of brucellosis during the year. Briefly, this development may be attributed to (1) the necessary curtailment of effort on the part of all concerned to combat the infection, and (2) to the increased cattle population, the increased price of cattle and the consequent increased amount of interchange of breeding animals. For this situation, the livestock owners and taxpayers must suffer.

It would seem unnecessary for the Committee to analyze this situation further. However, there is a possibility that at the end of the war, a sudden demand may be made by the livestock industry and the American public for the resumption of this program, with greater effort than at any previous time. We must not lose sight of the fact that the final goal is the eradication of brucellosis from the livestock in this country. Furthermore, we need to give serious consideration to the question of whether it is the immediate financial interest of the owner of the individually-infected herd, or whether it is the long-time financial interest of the whole cattle industry and the best interest of public health, with which we are most seriously concerned. Areas and counties in various states in which brucellosis has been reduced to 1 per cent, or less, should be vigilantly maintained in this condition, and the importation of cattle of questionable status into these counties or areas should be guarded against, and the introduction of infected animals should be avoided wherever possible. The immunization of cattle against brucellosis has gone through an interesting cycle covering a period of more than forty years. The dead germ product, or bacterin was advocated for use on pregnant cows, and live germ products for use on open animals. At that time, the nature of the disease was not fully understood, and the use of vaccination brought about some confusion as to its merits, especially in the extensive application as a new measure of control. The partial mastery we now have of brucellosis in cattle has been made possible only through long continued and careful research conducted by investigators of the United States Bureau of Animal Industry, and those in many states and privately-endowed institutions, as well as foreign investigators.
It has been definitely proven that calves vaccinated between the ages of 4 and 8 months, acquire a valuable resistance against the disease in a high percentage of cases, and that the agglutination reaction usually returns to negative within 4 to 8 months, but in some cases persists indefinitely. The resistance acquired by vaccination tends to weaken in some degree as the animals grow older. Animals vaccinated when older than 8 months, maintain their vaccination titer over a much longer period and sometimes indefinitely. Calfhood vaccination properly used, can be made a most effective weapon against brucellosis.

Your Committee recognizes and approves vaccination of calves from 4 to 8 months of age, preferably 6 months, with *Brucella abortus* vaccine, Strain 19, conducted under proper supervision.

Your Committee commends the U. S. Bureau of Animal Industry for its research achievement sheet, "Strain 19, vaccine curbs losses from brucellosis," issued August 15, 1944, and recognizes that the use of Strain 19 vaccine is a valuable asset to combat brucella infection in livestock in this country. Also, the Bureau is to be commended for the effective and careful method which they have developed for the supervision of the manufacture and distribution of Strain 19 vaccine, and it is hoped that by continually improving the manner of handling and administering this product, more uniform results may be obtained in the field. Your Committee recommends that if possible, research be continued for the development of a vaccine superior to Strain 19, for combating brucellosis in livestock in this country.

Motor truck transportation of livestock, and livestock sales came into general use about the time the eradication of brucellosis was undertaken. Such traffic of animals is largely unsupervised and contributes materially to the spread of brucellosis. In every way, and in every place that it is possible, better supervision of truck movements of livestock should be undertaken.

The fundamental considerations regarding all transfer of cattle are found in the status of the herd of origin, as well as that of the transferred individuals. Any animal vaccinated as a calf and failing to react when tested, at a time more than a month subsequent to vaccination, may, we believe, be accorded the same privileges that apply to non-reacting, unvaccinated animals of the same status in other respects.

Livestock owners in this country may have been misled to some extent in that programs to eradicate brucellosis have been liberal, and many cattle owners have not been compelled to contribute a sufficient amount of effort to impress the entire industry with the magnitude of the problem. Indemnities paid by State and Federal Governments have in some cases been liberal on account of lack of sufficient restrictions. No healthy cattle should be added to an infected herd at any place in this country when it is in any way possible to prevent it until the disease in the herd is under control.

Herds of cattle in which calfhood vaccination, with the retention of positive reacting animals is practiced, should be more closely supervised, should be managed under the same restrictions as other types of herds infected with brucellosis. These herds are resulting in the spread of infection to cattle on adjoining farms with a consequent general spread of the disease. The owner of infected animals should be compelled to bear the burden of so maintaining them, as to effectively prevent the spread of the infection.
Promiscuous, unofficial vaccination of adult cattle and calves seriously threatens the entire program to control brucellosis in livestock in this country. Many cattle owners are experiencing unsatisfactory results by this method and are reluctant to use it further, although it might be of benefit in controlling infection in their herd if employed systematically and properly. Promiscuous vaccination threatens to prevent the legal administration of indemnities under the Test-Slaughter method. Whenever possible, the demand for vaccination of calves between 4 and 8 months of age, as well as of adult animals, should be met officially. Careful and thorough supervision should be given to calves as well as to mature cattle officially vaccinated with Strain 19, so as to definitely determine the value of either or both of these procedures. It may be possible in this manner to combat promiscuous, unofficial vaccination, as it is being conducted by cattle owners and others. Further investigation should be made to determine the possibilities of intradermal vaccination.

In states or parts of states where vaccination and/or adult vaccination, are to be made a part of a program to combat brucellosis, greater momentum should be given to such programs by more systematic and thorough use of vaccine. To effectively control or eradicate brucellosis in any area, all cattle therein must be reached, and their status determined by some method. The Committee calls attention to the fact that all known methods of combating brucellosis must be applied, and that the simple vaccination of calves or adult cattle in a herd without regard to proper herd management and a thorough carrying out of sanitary measures, is an abuse of available scientific knowledge, and can only result in further delay and expense to the control of the infection.

Brucellosis in swine continues to act as a source of infection for man, and no satisfactory method for its control has been developed. The veterinary profession and the livestock industry in this and other countries are squarely confronted by this problem, and its solution should be found. Your Committee, therefore, again calls attention to the necessity for further research, including attempts in field efforts to systematically control and eradicate this source of infection.

Your Committee strongly recommends that milk for human consumption and milk for manufacturing purposes produced by infected herds be pasteurized. The Committee further recommends that advice continually be given to livestock owners and their employees in order to protect them from acquiring the infection.

The Committee on Bang’s disease of the 37th Annual Meeting of this Association, recommended rules as a guide for establishing and maintaining brucellosis-free herds of cattle. Not enough was known about calfhood vaccination at that time to incorporate the practice into such a program, and in fact, the use of biologic products in such herds was prohibited.

**BRUCELLOSIS-FREE ACCREDITED HERDS**

1. A herd may be designated as a brucellosis-free accredited herd when all non-vaccinated animals in the herd have passed three semi-annual or two annual agglutination blood tests without evidence of infection, and all vaccinated animals in such herd over 24 months of age are negative to the agglutination test and other necessary requirements have been carried out.

2. A certificate to this effect, valid for one year unless cancelled, may be issued to the owner by the Sanitary authorities.
3. Owners may be listed as having officially an accredited brucellosis-free herd when they have
   (a) Immediately disposed of unvaccinated positive animals for slaughter.
   (b) Carried out other requirements which are listed below.

The requirements to be observed by an officially brucellosis-free accredited herd owner are as follows:
   (a) Provide adequate supervision.
   (b) Identify every animal in a satisfactory manner.
   (c) Dispose of infected cattle in accordance with official requirements.
   (d) Prevent contact of the negative herd with other untested or positive cattle or swine.
   (e) Report immediately to the proper State authorities any abortions or other evidence of brucellosis.
   (f) Permit no additions to the herd except from an officially-recognized brucellosis-free herd, or directly from negative herds in modified accredited-free areas when officially blood tested with negative results within one year of the date of entry, or cattle from herds under Federal-State supervision which were negative to an official test within 3 months of the date of entry, provided the cattle to be added are negative to an official test as follows: If open, not bred, the animal to be added must be held in isolation and tested after 30 days; if bred, the animal shall be held in isolation until an official test is conducted not less than two weeks after calving and before being bred.
   (g) Maintain cattle in premises in proper sanitary condition.

4. A herd officially recognized as a brucellosis-free accredited herd, but in which one animal is subsequently revealed as positive, may be reinstated to the free status after two negative tests within 90 days. These negative tests must be conducted at least 30 days apart.

5. No positive vaccinated animal beyond 24 months of age shall be retained in a brucellosis-free accredited herd in which calfhood vaccination is practiced.
THE CONTROL OF THE RECENT OUTBREAK OF
RABIES IN MARYLAND

BY A. L. BRUECKNER, V.M.D.

Acting Director, Animal Disease Control, College Park, Maryland

Maryland was virtually free of rabies from 1931 to 1942. During four of those years no cases were found, whereas during the other years the number varied from 1 to 8. The latter figure applied to 1936 when 7 dogs and 1 horse were diagnosed as being rabid. In each of these years the appearance of one case of rabies was used as a basis for the placement of a quarantine under the authority of the State Board of Agriculture. Under the quarantine the freedom of all dogs was restricted for a period of 90 days, during which time local officers and veterinarians of the Livestock Sanitary Service worked on enforcement. The efficacy of the procedure was shown by the fact that no extensive outbreak occurred. It is of interest to note that during 1942 only four cases of rabies occurred.

Early in 1943 the disease appeared in Prince George's and Montgomery Counties, adjacent to the District of Columbia. The usual quarantines were instituted at once, and local agencies cooperated in the enforcement of the restrictions. During the summer of 1943 it was apparent that the disease was extensively established in these two counties and that quarantine measures were not proving fully effective in restricting spread. During 1943, 52 cases of rabies occurred in Montgomery—47 dogs, 3 cats, 1 horse, and 1 cow. During the same period there were 50 cases in Prince George's County—45 dogs, 1 cat, and 4 hogs. Two dogs and 3 hogs were found rabid in Anne Arundel County and 1 dog in Wicomico County on the Eastern Shore.

In 1944 the disease continued to be present extensively in Prince George's and Montgomery Counties and was found in Anne Arundel, Frederick, Charles, Washington, Cecil, Garrett, Howard, and Baltimore Counties and in Baltimore City. In all of the counties except Prince George's, Montgomery, and Anne Arundel the disease has been fairly well controlled by the institution of quarantine restrictions.

By the end of May, 74 cases had been found in Montgomery County, and it appeared that the disease might continue to be prevalent for an extended period of time. At the request of local County agencies an arrangement was effected under which rabies vaccine was furnished by the Livestock Sanitary Service and veterinary service was furnished by the County Commissioners for a vaccination program. It was agreed that such a program would not be started without the full cooperation of all enforcement agencies and that the quarantine restrictions would be kept in force for a definite period following treatment. Clinics were arranged in the County, and local veterinarians were employed to inject the vaccine. There were some 40 sites where clinics were held for 1 to 32-hour periods during two successive weeks, May 29 to June 11. The single injection method was used because of practical considerations. Vaccine was purchased from commercial sources on competitive bids. Certificates and tags were furnished to owners of vaccinated dogs.
The response was excellent. During the two-week clinic period approximately 10,000 dogs were injected. Adding the number of dogs injected by veterinarians in their private practices, approximately 11,500 dogs were vaccinated. This would represent about 90 per cent of the dogs in the County.

Early in the outbreak in Montgomery County a dog collection system was set up by the County Commissioners with a pound, collection trucks, and employees paid out of County funds. The use of these facilities had removed a large number of ownerless, unwanted animals, strays, and dogs loose in the quarantined area. Full restrictions on all dogs were kept in force during the period of the vaccination clinics and for two weeks thereafter, at which time vaccinated dogs were allowed freedom. It was felt that this short period following the completion of vaccination was not fully adequate, but consideration was given to the fact that an increased number of ownerless and stray dogs had been picked up during the clinic period and no new cases of rabies were found.

In Prince George’s County similar procedures were used at the request of the County Commissioners and in cooperation with the local law enforcement officers. Arrangements were virtually the same, clinics having been arranged from July 3 to July 14, and local veterinarians were employed to make the injections. Approximately 10,500 dogs were injected during the clinic period. About 1,000 had been previously vaccinated by local veterinarians, to make a total of 11,500. In this County, however, this number would represent only about 75 per cent of the dog population, the number of ownerless and stray dogs being considerably higher in Prince George’s than in Montgomery County. Restrictions in Prince George’s County were not lifted from vaccinated dogs until thirty days after the vaccination period.

Following vaccination in Montgomery County, the number of cases of rabies decreased rapidly. Only two dogs, two cats, and one cow have been found to be rabid during the four succeeding months. Both of the dogs were strays in the County, no identification being found on the animals to indicate ownership or previous vaccination. In Prince George’s County the number of cases of rabies following the vaccination period continued high during the last two weeks of July and during August, a total of 13 being found in those periods—12 dogs and 1 cat. During September no cases appeared, but in October two rabid dogs were found. Of the dogs which developed rabies, four cases occurred in individuals to which rabies vaccine had been administered. One developed the disease five days after vaccination; another showed symptoms three weeks after it had been injected; another had been badly bitten five days prior to treatment. The fourth case was one of two dogs owned by the same woman. The first dog died of rabies on July 18. The other was vaccinated privately with one injection on August 1 and developed rabies in October. Thus, it is possible that this animal was exposed prior to vaccination, although the veterinarian who injected the dog failed to find evidence of recent bites.

The accompanying chart shows the number of cases of rabies in dogs only, prepared on a monthly basis, which occurred in Maryland counties during 1944.

Information received from the Health Department in the District of Columbia advises that rabies was not found in that area in 1942, and that there were 104 cases
during 1943 and 129 cases from January 1 to October 31, 1944. During August, September, and October there were seven cases each month. Information received from the Health Department of Virginia, covering the area of that State along the Potomac River across from the District of Columbia and Maryland, indicated that the number of cases found was at about the same level during April, May, June, and July, but decreased materially during August and September.

All of these figures given above seem to indicate that there has been a tendency for the disease to decrease in virulence and extent during the summer and early fall of this year. Even though this tendency is taken into consideration, there still is sufficient evidence to substantiate the feeling that vaccination in Prince George's and Montgomery Counties had a direct bearing on the prevalence of the disease, since the number of cases so markedly decreased after vaccination had been com-

Report of Rabies in Maryland, 1944

Positive Diagnoses in Dogs

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| Monthly Total.......... | 22  | 30  | 32  | 43   | 33  | 19   | 18   | 17  | 6    | 6   | 226    |

* Vaccination period, May 29 to June 11.
** Vaccination period, July 3 to July 14.

pleted and sufficient time had elapsed for the development of immunity. Reference to the chart will show that the incidence of the disease in these areas had been at a much higher level than in any other sections of the State.

Rabies is of serious public health significance. It is essential that all officials be on the alert in handling the matter. Reports should be given promptly between practicing veterinarians, livestock sanitary and public health officials, so that the best possible control may be attained. In Maryland during 1943 and 1944 about 500 persons were bitten by or exposed to rabid animals. Prompt action on the part of all control officials secured vaccination for these individuals. One case of human rabies occurred in a boy in Prince George's County recently. In this instance the dog was removed for observation and treatment to an adjacent area where it died under peculiar circumstances. The attendant contacted the owner, but was in-formed that no one had been bitten and that no examination was necessary. The
disease developed in the boy 14 months after exposure, which apparently was from contact with saliva. Three deaths occurred from rabies in humans in the District of Columbia during this outbreak, all of the individuals having been given Pasteur treatment promptly after having been bitten.

SUMMARY

1. A widespread outbreak of rabies occurred in Maryland during 1943 and 1944.
2. The greatest number of cases occurred in Prince George's and Montgomery Counties adjacent to the District of Columbia.
3. Quarantine measures failed to control the disease in these counties.
4. Programs inaugurated with local authorities secured the vaccination of approximately 11,500 dogs in each County, representing 90 per cent of the dog population in Montgomery and 75 per cent of the dog population in Prince George's.
5. The incidence of rabies showed an immediate and marked decrease following vaccination in Montgomery County and has remained at a low level for the subsequent five months.
6. The incidence of rabies did not decrease for two months following vaccination in Prince George's, but for the last two months only two cases have been found.
7. Only four cases of rabies in vaccinated dogs have developed, and none of these was clearly shown to have been bitten after immunity should have fully developed.
8. Programs based upon quarantine may logically be supplemented with vaccination.
9. Vaccination without quarantine restrictions should not be depended upon for effective control.
THE HISTORY AND ADMINISTRATION OF DOG LICENSING ACT AND ITS VALUE IN THE CONTROL OF RABIES IN NEW JERSEY

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The decade preceding the enactment of Chapter 151 P. L. 1941, was characterized by a high incidence of rabies in the state which became alarmingly high during the calendar years of 1938 and 1939. It became apparent early in 1932 that the method of rabies control then in use was inadequate to cope with the situation. Although rabies was listed as a disease reportable to local boards of health, there was no requirement that such information be forwarded by local boards of health to the State Department. It was only a natural consequence, therefore, that during 1931 a large area of the state was dangerously seeded with infection without such knowledge reaching the State Department. When the information of the unusual prevalence of the disease was finally received, immediate action was taken aimed at correcting the most outstanding failure of the law as a rabies control measure. At its meeting on April 5, 1932, the State Department of Health passed a resolution requesting each local board of health to notify the State Department of Health of each case of rabies of which the local board of health is notified or has knowledge of occurring within its jurisdiction, such notification to be forwarded within a week.

The law provides that physicians and others are required to report to local boards of health within 12 hours, the names and addresses of persons bitten by a dog or other animal.

During the year reports were received of 222 cases of rabies in animals. More than 80% of these cases were reported by boards of health in five contiguous counties in the northern section of the State. This infection continued at a dangerously high level during 1933, to and including 1937, and during the early months of 1936, and the infection became widespread in 3 contiguous counties in the southern section of the State. There were three human deaths in the interim. Anti-rabies treatment was not given after exposure to infection.

Newspaper comments on the situation were released through the Department. Letters were forwarded to local boards of health in the affected areas, urging the adoption of practical measures designed to control and to reduce the dog population. Meetings of boards of health and other bodies were attended to discuss control
measures. In most communities in the areas, definite steps were taken to reduce the number and to regulate dogs running at large.

During the fiscal year of 1937-38, on recommendation of a joint meeting of representatives of local boards of health in several counties where rabies was particularly prevalent, the Department of Health in the State of New Jersey requested interested organizations in this state, such as the New Jersey Veterinary Society, the New Jersey Medical Society, the S.P.C.I. Humane Society, Dog Owners Assn., local boards of health and others, to appoint members to a joint committee to consider rabies from the broad standpoint of prevention and control. Such a joint committee was functioning at the close of the fiscal year.

During the year 1938, an unusually high incidence occurred in the State of New Jersey with 573 cases of rabies in animals having been reported. Also during the year 1938, two fatal cases of rabies in humans were recorded. Early in February, 1938, a communication was sent boards of health in the northeastern counties, calling their attention to the increased prevalence of rabies and urging local action designed to prevent its spread.

A special joint committee on rabies continued active during the year, and, in addition to a general consideration of the rabies problem, gave much study through a special subcommittee, to changes or additions to existing legislation which might be desirable for a more comprehensive and effective regulation of dogs as part of general rabies control measures. This subcommittee was known also as the Legislative Committee and comprised of three Veterinarians, one representative of the Public Health Association, one member of the Bureau of Local Health Administration, one local health officer, and a representative of the dog owners of the state.

Meanwhile, in view of the continued increase in rabies in the northeastern section of the state, the State Department of Health, at its meeting of February 14, 1939, decided to establish a quarantine for a period of three months in the affected areas of the state to prevent the spread of rabies. This action was taken on recommendation of the Joint Rabies Committee. This was the first time the State Department had attempted to apply on a large scale any order to confine dogs.

Practically all boards of health involved promptly prepared and served the required notices to dog owners, and secured the cooperation of the local municipal governing bodies in catching and disposing of stray unclaimed dogs.

While the prevalence of rabies in the involved area was reduced during the three-month period, at its termination the degree of reduction was not sufficient in the opinion of the department to justify withdrawal of the order. Consequently, the order was extended for another period of three months, and several boards of health in Morris County, where a new focus of infection occurred, were also included within its provisions.

Application of this order revealed two very practical difficulties in the administration of the existing statute. The Act required that a notice by a local board of health to the owner of a dog to confine the animal be served in writing. This necessitates personal service of each notice, and most boards of health do not have sufficient personnel to do this; further, the board of health, as a rule, does not know all persons within its jurisdiction who own dogs. Bringing legal action in a district court as required in the present statute in case of a violation of the order of local board was also found inconvenient by many health officials.
Therefore, an amendment to the present law was prepared and submitted to the Legislature making it possible for a board of health to serve the necessary notice on dog owners by newspaper notification rather than personal service. The amendment also changed the procedure for penalty collection in case of violation.

While these steps were accomplishments in the right direction, they failed in the ultimate objective, because of the absence of a centralized control agency.
The Joint Rabies Committee, after more than a year of study and discussion, recommended a legislative bill designed to lay the basis for effective control of rabies in New Jersey. Admitted to be only the first step toward this end, but essential before a second step can be taken, the bill provided for uniform licensing of dogs throughout the State, for licensing of kennels, pet shops, pounds and shelters, for catching and impounding stray dogs and the destruction of those not claimed by owners. It created a State fund from a small annual registration fee collected with the license plate, for use in enforcing the Act and controlling rabies.

The incidence continued high during 1940, and nearly all cases were found in the northern part of the State and chiefly in the northeastern counties.

Because of this prevalence of rabies, the State Department acting under authority conferred by statute, again notified certain local boards of health to order the owners to confine their dogs.

The affected area was gradually reduced during the year as the lessening in the presence of rabies indicated. At the close of the year, June 30, 1941, however, the order of the State Department still applied to some sections in the northern part of the State.

The Joint Rabies Committee continues to be helpful in conferences regarding the rabies situation in general, and the special Legislative Committee of this group presented for consideration a tentative bill on the subject of dog control. This bill related primarily to the licensing and regulation of dogs, kennels, pounds and shelters, but did not include within its provisions, any proposed amendment to existing laws relating specifically to Rabies.

The tentative Bill proposed by the Committee, after conference and study by the Joint Committee and other groups, was finally proved, presented to the Legislature and enacted as Chapter 151, P. L. 1941, to become effective November 1, 1941.

In the year 1941, rabies in animals was still high, with 308, was less than in recent years. Control of this measure was vested in a new division—the Rabies Control Unit of the New Jersey State Department of Health—toward the close of the fiscal year.

In its final form, the Act consists of 15 regulatory sections, penalty clause, and repeal of existing dog license dogs. The local municipal governing bodies are charged with the duty of enforcing the provisions of the Rabies law. New Jersey's 567 municipalities, have performed the function of licensing dogs, and filing annual census of dogs within their jurisdiction with remarkable completeness. The licensing of dogs constitutes the basic factor in the control of rabies, because it makes possible the control of dogs at large and the elimination of the stray animals.

Since complete licensing of all dogs in the state is the ultimate objective to successful control, it follows that the first attack by the Rabies Control Unit, must be centered on this portion of the program. During the first six months following the setting up of the Rabies Control Unit, there were 316,151 licensed dogs reported. As a result of the licensing, the elimination of stray and unwanted dogs proceeded simultaneously. Two municipalities are outstanding illustrations of this progress, as follows: The City of Bayonne, licensing 3,000 dogs, reported approximately 2,400 animals destroyed annually for 1942 and 1943. The City of Newark, with a licensed dog population of 12,000, reported 7,000 animals destroyed annually for the
past two years. Although the proportion of animals destroyed to those being licensed in well-regulated municipalities is high, it cannot be expected to continue at this level. The figures reveal the serious situation with reference to stray and unwanted dogs that existed at the time the Rabies Control Act became effective, and emphasizes the degree to which, by energetic action, the problem can be overcome.

On several occasions since the enactment of the new dog control law, it has been considered necessary for the State Department of Health, to impose quarantines covering seriously infected areas for a minimum period of three months, subject to extensions, to be determined by the extent and seriousness of the epizootic. In addition to the imposition of state quarantine, local governing bodies both inside and outside of the quarantined areas, have enacted local ordinances confining dogs to substantial enclosures, or on leash when on public property. Two fundamental objectives have been reached by these control measures: viz., valuable dogs have been protected against rabies infection, and the stray and unwanted dogs have been, to a considerable extent, apprehended, impounded and destroyed.

Section 16 of the Rabies Control Law provides for the seizure and impounding of all dogs, the owners of which have not complied with the provisions of the Act, as well as all stray dogs by legally constituted authority in each municipality. This imposes a responsibility on the part of the public to see that all dogs are licensed, if of licensing age, and finally, to see that the license tag is firmly fixed to a collar or harness and worn by the animal at all times. This makes possible prompt notification to the owner when a dog is picked up by the local warden.

Since the public is required by state statute to license all dogs over 7 months of age, it has a right to expect that all animals are given reasonable care while impounded. “Reasonable care,” it would seem, should include humane handling, wholesome food and sufficient quantities at regular intervals, water, clean and well-ventilated quarters so constructed that each animal impounded may be out of contact with all others animals in the pound, thus eliminating the possibility of exposure to disease and parasites. The Act further requires that when dogs are destroyed, it be done in as humane a way as possible. The most popular means now employed is that of the gas chamber into which lethal gas is introduced, properly cooled and the animal is killed without pain.

Any animals not called for by their owners after seven days are immediately destroyed; animals suspected of being rabid are held under observation until sufficient clinical symptoms develop. The provisions of the Act are thus met, which result in advancing materially the fundamental purposes of the Act, i.e., the elimination of rabies within the confines of the State of New Jersey.

The practical administration of the Rabies Control Act includes the following activities: Assisting municipal and township clerks and local police officials in making reports and preparing the dog census, prosecution of delinquents failing to obtain licenses for dogs, attending conferences of local municipal governing bodies, informative talks to interested groups, radio broadcasts, surveying dog pounds, pet shops, kennels and pounds, patrolling areas under State quarantine, and assisting in the prosecution of quarantine offenders and rendering services to authorities in all parts of the State.
It must be borne in mind that the Rabies Control Unit has not had sufficient time to develop all the provisions specified or implied by the Rabies Control Act. The following figures are indicative of the success to date: In 1941 there were 308 cases of rabies in animals; in 1942, 187 cases; in 1943, 42 cases and in 1944, 55 cases in animals and one in a human, showing an overall reduction of approximately 85%. The Rabies Control Unit is cognizant of the fact that there are unpredictable elements which may enter into this program resulting in the disease again assuming alarming proportions. We do believe, however, that by the exercise of the control measures now available and the control measures in process of development, that rabies will cease to be a formidable public health problem in New Jersey.
REPORT OF COMMITTEE ON RABIES


Statistics collected by the Bureau of Animal Industry of the United States Department of Agriculture for the calendar year 1943 have been made available to this committee through the courtesy of the Chief of the Bureau, Dr. A. W. Miller. They show that there were more cases of rabies reported for that year than any previous year since the statistics have been collected by the Bureau. There were a total of 9,690 cases.

Table 1 gives the incidence of rabies in the United States as collected by the Bureau of Animal Industry since 1938.

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<th>YEAR</th>
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<th>HORSES</th>
<th>SHEEP</th>
<th>SWINE</th>
<th>CATS</th>
<th>GOATS</th>
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<th>MAN</th>
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Statistics are not yet available for the calendar year 1944, but from reports received this year it is evident that the disease in many sections is still on the increase. In some sections, epizootics among foxes have been reported. In addition to an actual increase in cases, there also may be a shift in the incidence of the disease in various parts of the country. For example, Maryland, Virginia, and the District of Columbia, a section which has previously had a low incidence of the disease, suffered a severe outbreak in the past two years. The increase here may be offset, to a certain extent, by a decrease in an area in which the disease is on the wane after several years. In other words, the situation, as far as the country as a whole is concerned, is still serious and apparently will continue to be so unless more vigorous steps are taken in the control of the disease.

Effective September 15, 1944, in Ministerial Order 59, the Department of Agriculture of Canada placed certain restrictions on the entry into Canada of dogs from the United States. This order, copied below, is in effect a quarantine against rabies. The effect of this quarantine on the dog-owning public of the United States may be considerable and may bring to general attention the need for more effective action in controlling rabies in the United States:

88
CIRCULAR LETTER TO TRANSPORTATION COMPANIES, DISTRICT AND BOUNDARY VETERINARY INSPECTORS, ETC.

Gentlemen:

Copied below and forwarded for your information is a Ministerial Order which places certain restrictions on the entry into Canada of dogs from the United States of America.

I have the honour to be, Gentlemen,
/s/ M. Barker, Your obedient servant,
Veterinary Director General.

Ministerial Order No. 59

'Under and by virtue of the authority conferred upon me by Section 17 of the Animal Contagious Diseases Act, Chapter 6, R.S.C., 1927, I do hereby order that:
'All dogs for entry into Canada from the United States shall be accompanied by a certificate signed or endorsed by a veterinary inspector of the United States Bureau of Animal Industry certifying that the dogs have been inspected and found free from any symptoms of contagious disease; that the animals have not been exposed to the infection of rabies, and that no case of rabies has occurred within a radius of fifty miles of the place in which the dogs have been kept for a period of six months immediately prior to date of shipment.
'Performing dogs entered for temporary stay and kept under direct control while in Canada shall be exempt from this order.
'This order becomes effective on and after September 15, 1944.
'Dated at Ottawa this twenty-ninth day of August, one thousand nine hundred and forty-four.'

/s/ H. Barton
Deputy Minister
Department of Agriculture.'

In previous reports of this committee, measures for the control of rabies in dogs were outlined. It seems desirable to mention again these measures:

1. The proper disposition of rabid and suspected rabid dogs and the definite diagnosis of the disease in these animals.
2. The destruction of definitely known bitten dogs and the strict quarantining (or destruction) of contact dogs for at least 6 months.
3. Strict licensing of all dogs.
4. The impounding and disposal of stray dogs.
5. Strict general quarantine measures over a sufficiently wide area.
6. The prophylactic vaccination of dogs.

In previous reports of this committee, there has been a discussion of these various measures, and it is suggested that livestock sanitary authorities review these reports. Laboratory and field reports indicate that the prophylactic vaccination of dogs against rabies is of definite value. With the development of the Habel test and the
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<th>SWINE</th>
<th>CATS</th>
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**Remarks:**
- Probably all dogs
- No rabies in past 19 years
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<th>Coyotes</th>
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Total: 8,515 349 35 45 60 316 19 310 41 9,690
requirement of the Bureau of Animal Industry of the U. S. Department of Agriculture that all commercial rabies vaccines marketed must pass the Habel test, it has been possible for biological establishments in recent years to market vaccines of a superior and uniform quality. It is believed that livestock sanitary authorities can make good use of vaccination as one of the means of bringing the disease under control. It must be recognized that vaccination alone cannot control rabies since many dogs, such as strays, will not be vaccinated and the disease will flourish in these animals. All measures possible should be employed to bring about the most successful results.

The papers presented today by Drs. Brueckner and McDaniels should be given very careful consideration in conjunction with this report.

The National Rabies Committee, referred to in previous reports, has not held a meeting since April 25, 1942.

Number of Cases of Rabies Reported in the United States in 1943. Total: 9,690

It is recommended that the Committee on Rabies be continued and that it be empowered to coordinate its activities with the National Rabies Committee, looking to ways and means for the control of rabies on a national basis.

The attached map shows the number of cases of rabies reported by States for the calendar year 1943. The New England States and some of the States in the Northwest have a low incidence or absence of the disease. In the remaining states the disease is quite prevalent.

Table 2 lists the number of cases of rabies in each state by species of animal. According to the reports received by the Bureau on the incidence of rabies for the calendar year 1943, there were 8,515 cases in dogs, 349 in cattle, 35 in horses, 45 in sheep, 60 in swine, 316 in cats, 19 in goats, 41 in man and 310 miscellaneous making a grand total of 9,690 cases.
THE SPREAD OF ANAPLASMOSIS BY CONTAMINATED INSTRUMENTS

BY GEO. W. STILES

Bacteriologist in Charge, Branch Pathological Laboratory, Denver, Colorado,
Bureau of Animal Industry, U. S. Department of Agriculture

Much valuable data on the subject of anaplasmosis in cattle has accumulated during the past 20 years; notwithstanding wide publicity given the subject, the disease is slowly spreading throughout the country. This is in part due to failure to recognize the manner in which the malady is spread and to carelessness of livestock owners.

In this body of men meeting today are representative officials from many sections of the United States vitally interested in saving every animal possible from the ravage of disease, especially those diseases of preventable causes. Our country needs every available ounce of food during these critical days.

With regard to the nature and prevalence of anaplasmosis, many cattle raisers are yet uninformed as to its symptoms, identity, losses, and certain means of prevention. I have been amazed that old timers in the cattle industry never heard of anaplasmosis; however, some recognize it as "yellow jaundice." Perhaps a wider distribution of information on the subject through popular magazine articles and bulletins would enable cattlemen to take advantage of the known facts regarding this scourge.

In veterinary literature many references call attention to the possible dissemination of anaplasmosis from infected instruments during surgical operations. The disease acquired in this manner could properly be styled "man-made" anaplasmosis, and is wholly preventable by observation of sanitary precautions.

CARRIER ANIMALS

Every animal recovering from anaplasmosis should be considered a potential "carrier." Anaplasmosis is caused by a minute, microscopic, protozoan parasite in the body of the red blood cells, and a few of these parasites remain in the blood of cattle that have had an attack of the disease and have recovered. Some known experimental cows have carried the organism in their blood for as long as 13 years. The fully recovered animal does not usually show any outward symptoms of the disease; nevertheless, it may transmit the disease to other cattle.

All recovered animals should be recognized as carriers and sold for slaughter. A tiny bit of blood from a carrier animal on the teeth of a saw or other surgical instruments may carry the germ from the carrier to a healthy cow and cause sickness or death of such animals. Calves under one year in diseased herds may also be carriers, although they seldom show clinical symptoms of the malady. The clinical symptoms and deaths from anaplasmosis are usually seen only in mature cattle.

DEHORNING AND TIPPING

During the 17 years I have investigated outbreaks of anaplasmosis, numerous cases of this disease have been reported in various sections of our country, following
dehorning or tipping of the horns. By far the greater number of mechanically transmitted cases were traced to unsterilized saws or clippers used in dehorning. Nearly all such outbreaks were explosive in character and occurred during cold winter months when flies, ticks and other natural vectors were inactive. The diagnosis of anaplasmosis in many instances was confirmed by microscopic examination of the blood from sick or dead animals, and in a few cases by animal inoculation. An incubation period of from 5 to 6 weeks usually intervened between exposure through faulty technique in dehorning and the appearance of the first symptoms of the disease. In June, 1936, I published a brief paper on the mechanical transmission of anaplasmosis by unclean instruments. Some 555 cases of anaplasmosis developed in 3,000 cattle following some kind of surgery. About half of these cases were attributed to dehorning.

Additional field observations on anaplasmosis losses following dehorning reveal that approximately 700 head of cattle acquired the disease in 3,200 head dehorned, representing 21 herds from various localities, with a death loss of around 30 per cent of the animals that became sick. These losses represent only one man's observation. Doubtless many other herds throughout the nation have been infected in a similar manner, either identified or passed unobserved.

An interesting case of "tipping" the horns of cattle in public stock yards illustrates the possible spread of anaplasmosis by mechanical means. Late in December, 1943, a dealer brought 61 head of two-year old Herefords from an area where anaplasmosis had been diagnosed on a number of occasions. The horns of these animals were tipped at a public stockyard enroute. About one month afterward one animal died of "yellow jaundice." A few days later, six other animals sickened and two more died. Samples of blood examined microscopically, from four of the living animals, showed well developed cases of anaplasmosis. Details of this outbreak were reported to the Bureau under date of February 22, 1944. On February 29, 1944, Dr. A. W. Miller, Chief of the Bureau, issued the following Circular Letter No. 2621:

"TO INSPECTORS IN CHARGE OF PUBLIC STOCKYARDS INSPECTION:

Numerous cases have been brought to the attention of the Bureau in which anaplasmosis has been spread by the use of unclean instruments in performing operations on cattle. Recently it was reported that a lot of cattle passing through a public stockyard apparently contracted this disease by having their horns tipped, in which operation the horns in some cases were cut back so as to cause bleeding.

The Bureau feels that every effort should be made to prevent losses of this kind by advocating the application of necessary sanitary measures that will insure the cleaning and disinfection of the instruments between each individual operation. It is desired, therefore, that inspectors in charge of public-stockyards inspection work bring this to the attention of the stockyards management and all others who may be interested and urge on them the importance of proper cleaning and disinfection of instruments used in dehorning, castration, marking, vaccination, drawing blood or other surgical operations performed at the stockyards."

SPREAD OF DISEASE BY VACCINATION PROCEDURE

In company with a state veterinarian, the writer investigated 8 herds aggregating 826 adult cattle for losses ascribed to anaplasmosis, following the indiscriminate use
SPREAD OF ANAPLASMOSIS

of unclean hypodermic syringes and needles in the hands of laymen. This experience occurred in a locality where anthrax and hemorrhagic septicaemia were endemic and vaccination against these diseases was a common practice. A single needle was used generally during vaccination and the owners reported that a new crop of disease usually followed 5 to 6 weeks after each series of vaccinations. In some instances triple vaccinations occurred after variable intervals, and within about 40 days following each vaccination a new outbreak of illness and death ensued. Laboratory studies proved that many of these losses were in reality anaplasmosis.

DEATHS FOLLOWING INTRAVENOUS INJECTIONS

Early in the investigation of losses in cattle from anaplasmosis, new cases of the disease appeared during the winter in a large herd of fine, purebred Herefords. A number of animals had died from anaplasmosis in this herd the preceding autumn. It was the owner's practice to have his men inject sodium cacodylate into his healthy cattle with the idea of preventing the disease from spreading. A single large needle and syringe was used for this purpose. At that time, it was not generally realized that the disease could be spread mechanically; consequently, aseptic precautions to clean the needle between injections was not observed. It is now understood that many valuable animals in this particular herd were sacrificed because of ignorance and lack of clean surgery. Experiences of this nature have doubtless occurred too often in many sections of our country and the manner in which the disease was spread may have escaped detection.

BLEEDING CATTLE FOR BANG'S DISEASE

Sporadic outbreaks of anaplasmosis have been traced to the use of a single needle where aseptic precautions were not observed in drawing blood for Bang's disease testing. In these modern days, many needles are usually provided for drawing blood and each one is cleaned and rendered safe before using for each individual animal.

MISCELLANEOUS SURGICAL OPERATIONS

The bite of a single tick or other kind of vector, or the prick of an infected lancet can carry infection from sick or anaplasmosis carrier animals to healthy ones. An infinitesimal part of a drop of infected blood can transmit the disease mechanically.

Reports of infected "nose tongs" or restrainers imply that such instruments if not cleaned between animals might carry infection. It is possible that the common sharp-toothed curry comb could cause infection if first used on a sick cow and then immediately on a healthy one. Possibly tattooing needles, infected knives used in slitting the ears, or instruments used in castration or minor surgical operations could transmit infection. In three instances, anaplasmosis was reported about six weeks following the intradermal testing of cattle for tuberculosis. The needle was not cleansed between tests.

PREVENTIVE MEASURES

All clippers, saws, needles, knives, shears, or other instruments should be thoroughly cleaned and sterilized, as routine procedure, before performing any kind of surgical operation. This rule should be strictly observed in vaccinating and in
the drawing of blood for making tests for brucellosis. Bleeding needles and saws should be thoroughly washed in clean water before sterilization. Sterilization can be accomplished by boiling the instruments for several minutes in water containing one per cent of washing soda.

When facilities are not available for boiling, the cleansed needles or other instruments may be immersed for 15 minutes in 2 per cent freshly prepared lye solution. As the lye solution tends to deteriorate on standing, it should be freshly made daily and kept covered. Rinse needles in clear water after removal from the lye solution.

A 3 per cent compound solution of cresol, 70 per cent alcohol, or other suitable disinfectant may be substituted for the lye solution.

**DISCUSSION**

Considering the country at large, the annual cattle loss from anaplasmosis doubtless runs into high figures. Under present values, purebred cattle bring fancy prices. To illustrate, a recent sale of 800 head of registered Colorado Hereford cattle sold for $116,269. The highest price was $410, paid for one heifer. Aside from the actual deaths incurred from anaplasmosis, shrinkage due to illness, loss of milk, and lowered calf crop are items to be considered in compiling losses from this disease. Various estimates of losses from anaplasmosis have been published, but their accuracy would depend on a thorough nation-wide survey. My associates on the anaplasmosis project, located at the Experiment Station, Stillwater, Oklahoma, believe that $100,000 would not cover the damage done during recent years by this disease in the State of Oklahoma alone, which is only one of the 23 states in which the malady has been reported.

Under natural conditions, anaplasmosis is spread by infected ticks, horse flies and mosquitoes. Thus far a specific treatment has not been discovered to wholly prevent or cure the malady. On the other hand, the artificial man-made anaplasmosis caused from unclean instruments is entirely preventable and inexcusable.

The purchase of either young or older stock, especially bulls, from infected herds is a common means of introducing infection into clean herds and localities where the disease has never been known to exist previously.

It is unfortunate that a reliable test is not available for the detection of carrier or infected animals. In buying new stock, the only safeguard now evident is the buying of animals from herds which are known to be free from anaplasmosis.

**SUMMARY**

During the past 20 years numerous cases of anaplasmosis in cattle have been reported throughout the country following dehorning, tipping of horns, vaccinations and other surgical operations where adequate sanitary precautions were not observed. Extreme care should be observed to cleanse properly all saws, knives, clippers, needles, and other instruments used in operations on cattle.

Animals recovered from anaplasmosis become "carriers" of the disease and minute quantities of blood from such bovines is a common source of infection for healthy herds. Cases of anaplasmosis due to careless technique in surgical operations are inexcusable and they can be prevented by observing proper cleanliness and asepsis.
ACKNOWLEDGMENT


BIBLIOGRAPHY


Anaplasmosis has existed in the Southern States for a very long time but for many years was not recognized because it was associated in the same animals with another disease having similar symptoms and lesions. This other disease was at the time called tick or Texas fever but is now known as piroplasmosis. Theobald Smith and his associates in their studies of the so-called Texas or tick fever from 1886 to 1892 discovered that the sole transmitter, in the United States, of what they thought was a single disease, was the tick then called Boophilus bovis, now Margaropus annulatus. They did not know that they were dealing with two diseases one of which could be transmitted by a number of different kinds of vectors.

Smith discovered and described the parasites of both piroplasmosis and anaplasmosis and named the former Pyroplasma bigeminum now called Piroplasma bigeminum and described the latter as the stage of peripheral cocci-like bodies of the former parasite. Though he mentioned the possibility of the cocci-like bodies being the causative agent of some other disease, the evidence available seemed to favor the belief that the bodies were a stage of P. bigeminum. This belief was supported by the fact that both types of the disease were observed in all outbreaks observed at the Experiment Station in Washington from 1889 to 1892. Smith described mild cases of the fever, usually occurring in the autumn in the latitude of Washington, which were characterized by the presence of the peripheral cocci-like bodies in large numbers for a period of from one to five weeks, while the pyriform bodies (Piroplasma) although not entirely absent, were rare. In the acute type of the disease only the Piroplasma were seen.

Sir Arnold Theiler in 1910 separated Smith's peripheral cocci-like bodies as the causative agents of an independent disease. He at first called them "marginal points" and later Anaplasma marginale. He later described another kind of anaplasma which he named Anaplasma centrale. The disease caused by either of these was called anaplasmosis, and was shown to be a different malady than piroplasmosis with which it had been confused.

Tick eradication, exterminated the sole vector (M. annulatus) of piroplasmosis in the United States and this disease disappeared, but anaplasmosis, since it can be transmitted by many vectors and recovered cases of the disease continued to act as carriers for long periods of time, the causative agent of the disease remains together with many vectors, to transmit the disease.

Anaplasmosis has been gradually spreading in the United States for years and still, no doubt, continues to do so. It is now known to exist in at least 23 states scattered from Florida to Maryland, to Ohio, Oregon and California. This wide extension of the malady has probably been caused by the extended movement of cattle and the absence of any practical means of detecting cattle that carry anaplasma in their blood and yet show no evidence of disease.
Unfortunately, recovered animals carry the infectious agent of the disease in their blood for long periods. Furthermore, there are many kinds of ticks widely scattered over the United States that can act as vectors in transmitting the Anaplasma from the carriers to susceptible cattle. Certain flies and mosquitoes may do the same, and in addition to these vectors, the infection may be transmitted by instruments soiled with the blood of carrier animals. There are few if any diseases that can be transmitted by so many agencies and in which it is more difficult to detect reservoirs of infection.

Piroplasmosis in the United States was transmitted by a single vector and hence was limited to that region where this vector (M. annulatus) existed. It was only necessary to get rid of this vector to control and finally eradicate the disease. However, anaplasmosis with its numerous vectors, presents quite a different problem because there is no practical way of detecting the carrier, and too many kinds of vectors, widely scattered, to be exterminated with the knowledge and means at hand.

An Anaplasmosis Conference was held at Manhattan, Kansas, by Dean Dykstra, last March to which some 35 persons were invited. Some of the important suggestions brought out at the conference as supplied by Dr. George A. Rathman, Chief Veterinarian of Kansas, were as follows:

a. Experiments have demonstrated very conclusively that sodium cacodylate and other arsenicals are of no value in checking the occurrence of anaplasmosis in cattle. Although they have curative properties, they will not protect against the disease.

b. As recovered animals are always carriers of anaplasmosis, it is suggested that such animals be removed from the herd and sold for slaughter.

c. It has been demonstrated by research workers that anaplasmosis can be transmitted by flies.

d. There should be a practical method of diagnosing the disease in the immune carrier stage.

e. The testing of remedies that will effectually destroy or eliminate the causative protozoa (A. marginale) from the red blood cells of infected animals.

Summarizing the findings of the conference, much progress has been made in the past with reference to carriers, etc., but there still remains much to be done before anaplasmosis can be controlled. The above is a picture with reference to anaplasmosis as it exists in Kansas and the problem of control as presented to the Livestock Industry Commissioner and various veterinary agencies in the State of Kansas.

Since there are many kinds of vectors that can transmit the disease, combating it by eradication of these would seem to be practically hopeless, and the elimination of carriers, with our present knowledge could hardly be accomplished. It would therefore seem best to direct our efforts largely towards finding some practical way of detecting carriers, and to developing some medicinal or other agents that will destroy all of the anaplasma in the blood. In the meantime prevent as far as possible the movement of animals known to harbor the infection and have them slaughtered where practical. Also take all practical measures to reduce the tick, fly and mosquito populations,
In some foreign countries vaccination is practiced, but since vaccination makes carriers of the animals, it would not seem wise to adopt it in this country, except perhaps on a very limited scale in areas where the disease is very prevalent and causing great losses and then under rigid supervision, and all vaccinated animals permanently marked so that they would be recognized as infected animals.

Your committee desires that the paper presented by Dr. George W. Stiles be made a part of this report.
REPORT OF COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES


The report of this committee is expected to deal with those infectious diseases not considered by special committees. As in previous years, much of this report is based on information which was very kindly supplied by the Pathological Division of the United States Bureau of Animal Industry.

According to the information at hand, the country has successfully passed its second wartime year without any extensive increase of transmissible diseases of livestock. Much of the credit for this favorable situation under wartime conditions must go to veterinarians and livestock sanitary officials who, in spite of reduced personnel, have maintained a careful vigilance over livestock within their respective states.

FOOT-AND-MOUTH DISEASE

On the Pacific Coast we have been especially alert to the danger of foot-and-mouth disease due to the fact that many ships ply between our west coast ports and those in South America where the disease is very prevalent.

According to the information from the United States Bureau of Animal Industry, a malignant form of foot-and-mouth disease occurred in several of the South American countries. The disease was characterized by high mortality in adult cattle.

In England, a considerable number of outbreaks of foot-and-mouth disease occurred during the year. In most instances the original infection was traced to garbage containing raw meat or to contact with packing materials from imported frozen meats from South America.

As was mentioned last year, livestock producers and sanitarians must be ever watchful for any international political agreement which would relax the necessary quarantine regulations controlling importations of meat products.

The most serious outbreak of hog cholera since 1941 occurred this year in the British Isles and here again the source of the infection was considered to be garbage containing pork imported from North America.

The necessity of sterilizing garbage for the prevention of both foot-and-mouth disease and hog cholera was emphasized; and it seems to be the consensus of several communications and articles that the loss occasioned by these diseases in that country exceeded any gain from feeding garbage.

EQUINE ENCEPHALOMYOLITIS

The Bureau of Animal Industry reporting on this disease states:

The 1944 Outbreak did not assume serious epizootic proportions until the first week in August. Most of the more than 10,000 cases occurred during August,
September and early October. There was an almost complete absence of the disease in the States along the Atlantic seaboard, with the exception of Florida, where only 19 cases were reported. A moderately severe outbreak occurred in late August and September and early October in some of the midwestern and southwestern states. As in the past, the outbreak came to a standstill after the coming of frosts. In all, 32 states reported the occurrence of the disease.

This disease never has been so widespread as it was in 1937 and 1938. This is to a large extent due to the vaccination program which we have carried on continuously since that time.

During the year, a serious outbreak of equine encephalitis was reported from Colombia, South America, in which the Venezuelan type virus appears to have been the causative agent. Other outbreaks occurred in the Bahama Islands and in Cuba.

VESICULAR STOMATITIS

The Bureau of Animal Industry reports that outbreaks of vesicular stomatitis occurred among horses, cattle, and swine in several states, notably, Colorado, Kansas and Texas. Its appearance in swine in Kansas raised the fear that vesicular exanthema had “leaked” from the west coast. An extensive study of specimens from the Colorado outbreak was undertaken by the Bureau, and New Jersey type virus was found to be the inciting agent. At last reporting, the disease had subsided.

FOOT-ROT AND INFECTIOUS KERATITIS

In addition, the Bureau reports that so-called foot-rot of cattle was quite widespread again this year, particularly in the mountain and west north central states. The disease affected not only range herds but also feedlot and dairy cattle.

Infectious keratitis or pink-eye of cattle continues to be a serious menace. Outbreaks occurred during the warm months in many areas throughout the country.

VESICULAR EXANTHEMA

Outbreaks of vesicular exanthema among the swine herds in California have occurred consistently during the past year. The California Division of Animal Industry reports 130 outbreaks from January through the month of August. More than half of the cases have occurred in the central part of the state.

Generally speaking, the disease has been of low virulence. Only a few outbreaks can be classified of high virulence. Because of the similarity of the clinical picture to foot-and-mouth disease, each ranch found to be infected is quarantined. Cattle are inoculated with the virus as a check test.

Although several outbreaks have occurred on grain fed ranches, this disease has been observed more frequently among garbage fed hogs. We are of the opinion that shipments of meats to various Army Camps have a tendency to spread the disease throughout the state.

As was mentioned under the possible means of control for foot-and-mouth disease and hog cholera in England, it may become necessary to sterilize the garbage at least for a period of time, in order to break the cycle of infection. Vesicular exanthema has not been reported outside of the state of California.
MISCELLANEOUS TRANSMISSIBLE DISEASES

MASTITIS

Mastitis of dairy cattle as an economic disease has been given prominent consideration during the past year throughout all leading dairy activities of the Nation. Dairymen either will not or find themselves unable to use the general sanitary measures necessary to prevent or to control this disease. Successful handling of mastitis requires keen interest, relentless effort, and whole-hearted cooperation not only on the part of the owner, but of each and every employee in the dairy. This has been exceedingly difficult to obtain under present conditions. Treatments have now been devised which can be considered good, if judgment is used in the selection of cases, and the medication properly administered. But, if the treatment is of a haphazard type, more injury to udder tissue will result, and consequently the entire program may fall in disrepute.

COCCIDIOSIS OF FEEDER LAMBS

Recently we have noticed an interesting report on the use of commercial flowers of sulphur as a means of preventing outbreaks of coccidiosis of lambs. Doses of 0.5 to 1.5 per cent of the feed were reported as having no ill effects after 72 days continuous feeding. Weight gains were as favorable as in the untreated controls.

We were interested in this report since we have observed the effect of feeding flowers of sulphur to poultry for controlling coccidiosis; but in our experience the chickens were found to be highly susceptible to the infection upon the removal of the sulphur from the ration.

GIARDIA INTESTINALIS

In Los Angeles County, we have a small but thriving chinchilla industry which is raising these tiny herbivorus animals for the production of furs. During the past year several of these herds have suffered considerable loss due to a protozan intestinal infection diagnosed as Giardia intestinalis. One of the newer sulfa drugs, sulphathalidine, has been used with considerable success in checking losses. The dosage was purely experimental, but one grain per animal per day for four days was apparently sufficient and satisfactory. In some cases it had to be repeated in three to four weeks.

Without intending to infringe upon the Report of the Special Rabies Committee, we should like to mention a local rabies situation. In Los Angeles County, 649 cases were diagnosed in dogs for the first 44 weeks of this year, or an average of 14.75 cases per week. One human case was reported. In spite of this continuous threat from infected dogs, only five cases developed among our farm stock, viz:—two cattle, two horses and one goat. We believe that the more general use of woven wire fences around corrals and pens, as recommended by the Live Stock Department, has served a very valuable purpose in limiting such spread.

One of the committee has well said, "We attribute the lack of serious outbreaks of diseases to better care on the part of the livestock owners. A great deal of attention has been placed on the raising of livestock for food, and much authentic educational information has been made available. This has been an invaluable aid to the veterinary profession with its presentday shortage of men."

And now, as one of our popular radio announcers would say, "Let us swing around the country and pick up a baker's dozen;"
1. An outbreak of *anthrax* was reported in *Massachusetts*.
2. *Infectious vaginitis* is apparently becoming more widespread from year to year.
3. *Swine erysipelas* was diagnosed in New England States as well as throughout the Corn Belt, but no instances of severe losses were reported.
4. *Fowl typhoid* is reported more frequently, probably because more complete diagnosis of diseases of poultry becomes more necessary in connection with poultry improvement association and accredited hatchery projects.
5. *Hemoglobinuria* of what is apparently non-specific origin was reported in several dairy sections.
6. *Paratyphoid* infection among calves, likewise an occasional scourge in dairy communities, continues to take a heavy annual toll, especially of valuable purebred stock.
7. *Dourine* is apparently smothered again, but continued testing is in progress in these southwest sections where diagnoses have been established.
8. *Anaplasmosis* made its appearance in Oklahoma in several instances. It is more or less commonly encountered in western and midwestern states. Two cases were diagnosed in deer in Los Angeles county.
9. *Johne's disease*, while repeatedly diagnosed, does not seem to be changing much in its geography, nature, cause, or rate of progress in affected herds. A common expression is, "Why don't we have more of it?" We have been agreeably surprised at its non-appearance, except in rare instances, among the hundreds of dairy cattle shipped to the Los Angeles market.
10. *Hexamititis*, or infectious enteritis of turkeys lost ground noticeably in its flock damages, although as many flocks were infected as last year.
11. *Pneumoencephalitis*, recently described by Stover as *Respiratory Nervous Disease*, has been suspected as the cause of losses among turkey poults.
12. *Coccidiosis* affecting mature cattle as well as calves was noted in a few instances.
13. And finally, one that is not contagious but certainly transmissible through carelessness, i.e., *"Hardware disease."* Veterinarians should give frequent warnings on the protection of cattle against the danger of nails, pieces of wire, et al. in the feed and hay. Losses from this cause exceed those from any one contagious disease affecting dairy cattle!

This Committee recommends that in the future a member of the United States Bureau of Animal Industry be appointed as chairman of this committee. Veterinarians in that great representative organization have a considerable advantage in access to available source material. They have a much better opportunity to keep in touch with the situation on transmissible diseases throughout this country and foreign lands than any individual or group of Livestock Sanitary officials.
REPORT OF FURTHER STUDIES OF BRUCELLOSIS IN SWINE

BY L. M. Hutchings, B.S., D.V.M., M.S.

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Brucellosis of cattle and the corresponding disease of man, undulant fever, have received world wide attention during the past twenty-five or more years. During these years of research and control efforts directed towards the effective eradication of brucellosis in cattle, relatively little attention has been given to the disease produced in swine by the last discovered member of the Brucella group, Brucella suis. It is now known that swine brucellosis is often a serious economic problem to the swine breeder. On the other hand, this disease is frequently not of paramount economic importance in the operation of a market hog business. The disease seems to be quite widely distributed in breeding herds and presents a potential menace to the cattle industry, since infected swine may infect cattle. Man is susceptible to the swine type of brucellosis and in many cases where undulant fever in man has occurred, the swine type of infection has been determined to be the causative agent. As an example, Dr. S. H. Damon (1), Director of Laboratories, Department of Public Health, Alabama reports that of 91 human clinical cases from which Brucella cultures were isolated, 69 or 75.8 per cent were of the suis type. These figures are for the last five years, and interestingly enough, originate in a state which is outside the intensified swine raising section of the nation.

The type of disease produced by Br. suis in swine is somewhat different from that produced in cattle, so direct comparisons should not be attempted. Brucella infections in swine are not always easily recognized by swine producers. This is probably due to the more insidious nature of the disease in swine as compared to brucellosis in cattle. The disease in hogs is self-limiting within the individual animal, to a greater degree than in cattle. Frequently there is not a high percentage of observed abortions in infected swine herds. This apparent lack of abortions in some herds, tends to unduly minimize the importance of brucellosis in the minds of swine producers. Despite this self-limiting effect within the individual hog, evidence clearly indicates that the disease has remained in some infected herds for years.

Unlike the calf, the young pig may become actively infected at a very early age (2). In fact, there seems to be little if any difference in the ability of swine of different ages to contract this disease. The natural infection of the pig while young may partially account for the lack of many abortions in some infected herds. In other words, the gilts pass through the active or acute stage of the disease while non-pregnant and develop some resistance against the symptom of abortion, thus failing to abort when pregnancy becomes established. It should be emphasized

1 Published as Journal Series Paper No. 195 of the Purdue University Agricultural Experiment Station. These studies were supported in part by the Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture as a part of a coordinated research program on Swine Brucellosis.
that such gilts are not harmless, immune animals, merely because they are not losing their pigs prematurely. Some of these gilts are active spreaders of \textit{Br. suis} organisms in their milk and uterine discharges.

Abortions produced in swine by brucellosis may occur at any time during pregnancy. Early abortions occur rather frequently and are difficult, if not impossible, to observe under field conditions (3). Here again it is a mistake to attempt to make a direct comparison between brucellosis in cattle and brucellosis in swine. Abortions due to \textit{Brucella} are seldom seen in cattle in less than three to four months after service with the majority occurring during the fifth to the seventh month of pregnancy.

Swine are by nature prolific breeders, hence sterility in the sow has not attracted much attention. Therefore, comparisons between infected and non-infected swine herds from the standpoint of sterility are difficult to make. In \textit{Brucella} infected swine herds, the sterility problem may be the outstanding feature attributed to the disease. For example, one infected herd was composed of purebred swine which had been developed on this farm following about 30 years of commercial hog production. Breeding difficulties were very vivid in the owner's memory; however, it was not until a purebred herd of swine was established on this farm that the owner decided it was time to try to eliminate these losses due to difficult breeding. On the first complete herd test of all breeding stock, there were 75 per cent reactors. Careful survey of the breeding efficiency of this herd indicated approximately 37 per cent of the sows and gilts failed to conceive with the usual case. During a portion of the 30 years of commercial hog production, the owner had been sick with a chronic malady which had not been diagnosed. He had observed several abortions during each farrowing season and at the time of castration, noticed that the testes of some pigs were hard to remove because they were adhered to the scrotum.

Another example, out of eight naturally infected purebred sows kept under observation for two years at Purdue University, only one has been a satisfactory breeder. These sows have been bred repeatedly for two litters per year, which if successful, would have resulted in 32 litters of pigs over the two year period. In this period of time, 15 litters or less than one-half the expected number were produced. The boars used for service on these sows were consistent producers when other sows were bred to them; hence the fault seems to rest with the sows.

The other symptoms observed, seem to be related to the tissues in the body where \textit{Br. suis} reside. In general, \textit{Br. suis} may reside in the blood stream for a variable period of time after the disease becomes established in the hog. For example, of five sows exposed to \textit{Br. suis} by feeding small portions of aborted fetuses and membranes, positive cultures for \textit{Br. suis} were recovered from their blood streams as follows: two at 7 days, four at 14 days, four at 21 days, five at 28 days, five at 36 days, three at 43 days, three at 50 days. Subsequently two of these five sows were destroyed for bacteriological examinations of the tissues and both gave positive cultures for \textit{Br. suis} from many of the tissues.

During and after its appearance in the blood, \textit{Br. suis} may be found in almost any of the body tissues including the bones, joints, liver, spleen, lungs, uterus, mammary glands, testes, ovaries, and regional lymph nodes. It is obvious from
these findings that the infected hog carcass as well as the infected living hog may be a menace to human health. Once more we can see that swine differ from cattle in their response to brucellosis. In the cow, localization of Brucella organisms occurs chiefly in the uterus and mammary tissue, both inedible portions of the carcass. In this connection, Johnson and Huddleson (4) reported, "The data that were obtained from holding naturally infected hog tissues at \(-10^\circ F\) indicate that the viability of \(Br.\ suis\) is little if any, affected over a period of 30 days. There is some evidence that it is reduced in numbers when the tissues are held at the temperature indicated for a longer period."

Diagnosis of brucellosis in swine based on the standard agglutination procedures used for the diagnosis of the corresponding disease in cattle is not without its limitations. This statement is based on evidence which suggests that the agglutination methods, as now employed are adequate as a herd diagnostic procedure, but may not be sufficiently reliable as the basis of diagnosis in individual swine (5). For instance of 170 animals artificially exposed at Purdue University, 25 developed positive cultures for \(Br.\ suis\) in their blood 5 to 69 days prior to the time that a diagnostic agglutination titer was demonstrated in the blood. This represents 14.7 per cent of the animals from which the organisms were actually isolated from the blood stream that were carrying negative or essentially negative agglutination titers at the time of such isolation. The direct importance of this to a control program cannot be adequately measured as yet, but it seems of more importance than the delayed agglutination response in cattle. This feature of the disease, alone, makes it imperative that a complete test of all breeding swine in a herd should be conducted rather than selecting a few individual animals to test as a criterion of determining the status of the herd to brucellosis.

Another point in testing which deserves consideration is the failure of some infected swine to develop an agglutination titer that is considered a positive reaction on the basis of the customary interpretations of such reactions. Not infrequently, swine from which \(Br.\ suis\) may be isolated in their blood or body discharges will react only incompletely at the 1:25 and 1:50 dilutions of their blood serum. Therefore, it seems to be necessary to test swine blood in the 1:25 dilution and to place more emphasis on complete and incomplete reactions in this dilution. Field experience with swine brucellosis in Indiana suggests that in herds having clinical history of infection, any swine showing agglutination reaction in the 1:25 dilution only should be considered as possibly infected. However, good evidence also suggests that such low dilution reactions may be encountered in herds not showing any clinical or bacteriological evidence of brucellosis. Thus, it would seem that in applying the agglutination method as a herd diagnostic procedure, it would be advisable to insist that some of the animals in the herd show definitely positive agglutination reactions in diagnostic dilutions before placing the stigma of suspicion on the herd.

Previous mention has been made of the self-limiting features of swine brucellosis so far as the symptoms of abortion and recession of serum agglutination titer are concerned. It is necessary to know whether these phenomena result from the production of an active acquired immunity or whether subsequent re-exposure to the disease will result in active infection. The re-exposure of 30 previously
experimentally infected sows, whose titers had receded to a negative or nearly negative status, resulted in reinfection of 18 of these sows as measured by an increased agglutination response and recovery of Br. suis from their blood. None of these 30 sows aborted. This might lead some to the assumption that the sows in this experiment were immune. However, if the rigid and correct criterion of active infection is applied, it is evident that these animals did become reinfected, were not immune, and would constitute a possible menace to other swine, cattle and human health.

From the statements just made, it is obvious that the control of swine brucellosis is not easy, particularly in valuable purebred herds. Control at present must be attempted through the use of the agglutination test and prompt, rigid isolation or disposal of reactors. The experiences so far strongly indicate that a system of testing and either removal or isolation of just the reacting animals is not usually successful. Apparently due to the limitations of the test, including the difficulties in interpreting the results of the test, all infected swine are not eliminated. Thus where reactors are found, it seems to be more successful to consider the entire breeding herd as possibly infected; then pigs from this infected breeding herd may be removed from the sows at weaning time and placed on clean premises. It is extremely important to test these pigs frequently up to and during sexual maturity. Here again, the pigs should be considered as a unit rather than as individuals and the entire unit should pass at least three negative tests before breeding or before one considers them to be free of the disease. At this point in the control program, disposal of the old infected breeding herd is desirable. In fact, better results can be expected if the infected herd is disposed of promptly when the pigs are weaned. This eliminates a dangerous source of spread to the pigs.

In the infected market hog herd, the most economical program of control seems to be a complete herd sale for slaughter and re-entry into the swine business with known disease-free stock.

Estimates as to the prevalence of swine brucellosis are based primarily on slaughter house surveys which may not present a true picture of the incidence in breeding swine (6, 7, 8 and 9). These surveys indicate that between one and three per cent of the hogs are affected. If this relatively low incidence is correct, then control of this disease might be accomplished in a relatively short time, particularly at a time when pork prices are not high.

This brief discussion of control for swine brucellosis may be summarized as follows:

In the purebred swine herd—
1. Blood test the breeding stock.
2. If infection is present, do not merely remove reacting sows and boars, but consider the whole unit as infected.
3. Isolate the pigs at weaning time on clean premises and maintain this segregation.
4. Blood test the prospective gilts and boars up to and during the first pregnancy. Breed only those gilts negative at the 1:25 dilution to non-infected boars.
5. Dispose of the infected stock as soon as possible.
FURTHER STUDIES OF BRUCELLOSIS IN SWINE

In the commercial swine herd—
1. The same plan may be followed as in the case of the purebred herd.
2. The most economical plan seems to be a complete herd sale for slaughter and re-entry into the swine business with known Brucella-free stock.

BIBLIOGRAPHY

HEMORRHAGIC DYSENTERY IN SWINE

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Swine dysentery is one of the causes of enteritis, or more strictly speaking, colitis, in swine. It is now generally considered that enteritis is associated with the most important disease conditions in swine. The hog raiser generally recognizes what he calls "necro" as a serious disease problem. It appears evident now that so-called "necro" or necrotic enteritis may result from more than one cause. Hence, the terms necro or necrotic enteritis have limited value and their use should be discontinued as soon as possible.

Swine dysentery was described first at the Indiana Agricultural Experiment Station (1) more than twenty years ago. Thus far it is not as widespread as hog cholera but is already a serious problem in some localities. The death losses from dysentery may vary from a few animals to 50 per cent or more. The average loss is probably about 25 per cent of the affected herds. A high death rate is more likely to occur in young animals than in older ones.

Swine dysentery is an infectious disease caused by some factor present in the colon and the bowel discharge of affected animals. In many, if not all cases, vibrios are present—usually in enormous numbers. A vibrio (2) has been isolated in apparently pure culture, but the technical difficulties encountered in isolating and propagating this microorganism have made it difficult to determine its full causal relationship to the disease. The specific causative factor appears to be limited largely if not entirely to the colon, so far as the various body organs are concerned.

The incubation period in dysentery is commonly from nine days to two weeks, although shorter or longer periods may occur.

The conspicuous symptoms of dysentery are suggested by the names commonly applied to the disease, such as bloody diarrhea, bloody scours, bloody flux and black scours. The symptom first to appear is diarrhea. At first the diarrhea may not be characteristic, but it usually shows the presence of mucus from the start. Within a day or two the bowel discharge usually contains blood in addition to mucus. In young animals the blood in the bowel discharge is usually easily recognized. In older animals the blood may be changed so as to impart a dark color to the stools, hence the name "black scours." Affected animals often appear to lose weight quickly, probably due to rapid dehydration. The flanks or sides of the body soon become sunken; and there is sometimes active switching of the tail. There may be manifest weakness, but usually there is less depression than is seen in most other diseases. The diarrhea is often very profuse in pigs that are on full feed. Death may occur within 24 hours of the onset of noticeable symptoms, or it may be delayed for several days. In animals that survive, relapses are common. Prolonged stunting is rather frequent and contributes to the economic importance of the disease. A good many animals which have apparently recovered develop diarrhea when put on full feed.
The pathologic changes which characterize dysentery are found in the cecum and colon. Pathologically the disease is essentially a cecitis and colitis. A gastritis is also frequently found. Fatty degenerative changes have been observed in the liver of a number of experimental dysentery hogs. However, it is not certain that these liver changes are necessarily due to dysentery. The lesions found in the cecum and colon depend largely on the stage and severity of the cecitis and colitis. Sometimes the entire cecum and colon have a reddish color which can readily be seen when the abdominal cavity is opened.

In early stages of the disease, the cecal and colic mucosa may show only edema, hyperemia, hemorrhage and mucus production. Later there may be diphtheritic exudate present. This latter type of exudate together with desquamated epithelium may become mixed with the colon content, giving it a rice-water appearance. The gross changes in the cecal and colic mucosa in dysentery are usually superficial as contrasted with the deeper infarction and necrosis which occur in hog cholera. Varying quantities of blood in the cecum and colon may occur in hog cholera. This type of cholera lesion in the cecum and colon can usually be distinguished from the lesions of dysentery by the presence of more mucus in the latter disease. The colon lesions of hog cholera and dysentery may occasionally be closely similar. However, a differential diagnosis can usually be made rather easily by taking into account the history and all of the symptoms.

The ways in which swine dysentery spreads are of primary importance in applying measures for the control of the disease. It is now evident that the principal means of dissemination is traffic or trading in diseased and recently exposed feeder hogs. An investigation of a new outbreak of dysentery in feeder hogs usually reveals that hogs from an infected source have been purchased recently. No doubt the disease is occasionally introduced into healthy herds through the purchase of breeding stock from an infected herd. Sales barns are an important factor in disseminating dysentery in localities where the disease exists. Some hog feeders believe that the disease may be brought in with feeder cattle. It is possible, of course, for the infection to be introduced in infectious material carried in improperly cleaned stock trucks or from infected yards, even if the causative agent is not carried in the bodies of cattle. There is some experimental evidence and considerable field evidence indicating that apparently healthy hogs from infected herds may serve as carriers of the infection.

Perhaps there is no disease of swine in which quarantine and other regulatory measures could be made as effective as in swine dysentery. The quarantine and slaughtering of hogs which have been exposed to dysentery should greatly reduce the spread of the disease. Until and unless the free movement of sick and exposed hogs is regulated, dysentery will no doubt continue to be disseminated. Regulatory measures should be applied to prevent hogs from infected herds from going into other feed lots and breeding herds.

REFERENCES
REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE


This Committee has again attempted to collect certain information in regard to the prevalence of the more important transmissible diseases of swine in 1944, limiting it to those parts of the country where the swine population is usually the greatest. This was done by submitting questionnaires to the livestock sanitary officials of the states that comprise the area surveyed.

In connection with the matter of statistical data on infectious and transmissible swine diseases in most states, the committee is mindful of the fact that complete information on their incidence is not available to the livestock sanitary agencies and for this they are deeply regretful. On the other hand, it seems reasonable to expect that the livestock sanitary official of a state should be in the best position to know whether or not a significant increase or decrease of any of the transmissible diseases occurred in his commonwealth during the course of a year. The questionnaire therefore was designed to show trends and especially the trends in 1944 as compared to 1943.

It should be common knowledge to the membership of this Association that the swine population of this country in 1943 was the largest it had ever been. While the population in 1944 is considerably less, nevertheless it was logical to expect that a greater amount of potential and residual sources of disease could have been carried over from the previous year. In other words, we should not have been unexpectedly surprised if one or more of the transmissible diseases prevailed in pandemic proportion during the year now drawing to a close. We are prepared to report that for the geographic territory covered by this report, the swine producing section, the transmissible disease situation as a whole was not a major disease factor.

Thirteen states were surveyed. Eight reported a decrease in the incidence of hog cholera in 1944 as compared to 1943 and two, that the disease was no more prevalent in 1944 than in 1943. Influenza and pox, two other virus diseases were likewise less prevalent in nine of the states reporting.

Five of the states indicated that erysipelas had increased in the past year and five that it had decreased. Two of the reporters stated that little or no change in the incidence of this disease had occurred during the past two years. If we were to draw any conclusions from the reports with regard to erysipelas, it would be that the disease is spreading eastward and southward from the territory in South Dakota and Nebraska where it was discovered to be a troublesome herd ailment in the latter part of the second and first part of the third decades of the present century.

Eight of the reporters indicated that there has been a reduction of the enteritis complex during the year as compared to the incidence the previous year. This includes the bacterial forms of enteritis such as necrotic enteritis and also the form commonly designated “bloody scours.” The transmissible diseases of bacterial
origin which practically all of the reporters said had increased in 1944 was brucellosis. Only one state reported a decrease in this disease for the same chronologic period.

Inquiry was directed to the problem of such internal and external parasitic diseases as ascariasis, pulmonary strongylosis and acariosis. Only two of the states reported a decrease in the occurrence of these important transmissible diseases. Five reported that these conditions are on the increase and three stated that there had been no significant change in 1944 as compared to previous years.

Generally, the transmissible swine diseases have not been a particularly serious problem this present year and we must ever be mindful of the potential power some of them have toward becoming a serious menace to the industry most anytime we relinquish or neglect our efforts on their control and eradication.
To aid in the prompt and accurate diagnosis of vesicular stomatitis, vesicular exanthema, and foot-and-mouth disease, the U. S. Bureau of Animal Industry has prepared a motion picture entitled "Vesicular Diseases of Animals." The film, which shows lesions of these three important virus diseases, was prepared by the Pathological Division. It is designed for showing to veterinarians and other professional groups. It is a one reel, sound, 16 mm. film, in color, and requires about 12 minutes for projection. Representatives of professional groups may obtain the loan of a copy without charge, aside from the moderate cost of return transportation. Copies will be available after December 15, the tentative release date.

Vesicular stomatitis has occurred on numerous occasions in widely separated areas of the United States since about the time of World War I. Exact data as to the extent and identity of the disease have not been available, owing to incomplete reporting and only limited confirmatory diagnoses. Horses and cattle have been involved to about an equal extent, and one serious outbreak was encountered in swine at a licensed veterinary biological establishment in 1943.

Vesicular exanthema has been prevalent in swine on the West Coast for more than a decade. Fortunately, this disease has been restricted thus far to one State. Both vesicular exanthema and stomatitis, which frequently so closely resemble foot-and-mouth disease as to be clinically indistinguishable from it, are established in this country. Foot-and-mouth disease has not occurred here since the last outbreak in 1929, when it was eradicated through prompt slaughter and destruction of affected and exposed susceptible animals. One of the major objectives of livestock sanitarians is to keep this foreign plague out of the country. However, if despite all prophylactic measures the disease should make its appearance here, prompt and accurate diagnosis is essential, in order to prevent spread of the malady and forestall serious economic loss.

The film, "Vesicular Diseases of Animals," places emphasis on the similarity of the lesions in these three virus diseases. It shows how a differential diagnosis may be accomplished through inoculations of test animals. Following is a chart which
appears in the film, summarizing results of inoculations of the different viruses into various species of animals.

### Susceptibility of Species

<table>
<thead>
<tr>
<th>Condition</th>
<th>Horse</th>
<th>Cow</th>
<th>Hog</th>
<th>Guinea Pig</th>
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<tbody>
<tr>
<td>Vesicular stomatitis</td>
<td>+</td>
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<td>Vesicular exanthema</td>
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<td>-</td>
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<tr>
<td>Foot-and-mouth disease</td>
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(+ signifies susceptibility; –, no take; ±, variable result)

Since the inoculation procedures and their interpretation are exacting, only persons with technical knowledge and experience in such matters should assume the responsibility of making final diagnosis. However, the Department urges that every veterinarian become familiar with the symptoms and lesions of the three diseases under consideration, as well as the principles of differentiating them. The occurrence of any vesicular disease should be reported immediately to the State livestock sanitary authorities or to a representative of the U. S. Bureau of Animal Industry.

### SUPPLEMENTARY PUBLICATIONS

Supplementing the motion picture, the following Department publications give further information on vesicular diseases:

- Farmers' Bulletin No. 666, Foot-and-Mouth Disease
- 1942 Yearbook of Agriculture, Keeping Livestock Healthy
- Directions for Employees Engaged in Eradicating Foot-and-Mouth Disease (1943)

Requests for the motion picture should be addressed to the Pathological Division, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C., and should be signed by a representative of a professional group. Requests should reach Washington preferably at least 10 days before the date the film is to be shown.

A SOUND PROJECTOR MUST BE USED FOR THIS FILM
RECENT TRENDS IN THE DIAGNOSIS OF BOVINE TRICHOMONIASIS

BY BANNER BILL MORGAN, PH.D.

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CLINICAL DIAGNOSIS

The clinical symptoms of bovine trichomoniasis, as noted by various investigators, show considerable variation in detail. The infection may run different courses in different outbreaks or individual animals. The clinical picture may be greatly changed or influenced by a variety of concurrent or secondary invaders. A presumptive or tentative diagnosis may be made on the basis of the clinical symptoms or herd history. As a rule, trichomoniasis should be suspected with the following: (1) when several cows must be repeatedly bred (2) when abortions occur often during the early stages of pregnancy, usually between 3 to 16 weeks, although abortions may occur any time during the gestation period. Early abortion may often be manifested only by the sudden recurrence of estrum 2 to 5 months after breeding (3) observation of vaginal or uterine discharges in cases of endometritis or pyometra.

It must be noted that cases of early abortion may never be observed or suspected. The herd owner usually reports the only trouble is a failure to conceive in spite of many repeated services. Vaginal or uterine discharges may be abundant, but are often very scanty. The occurrence of a clear, colorless mucoid discharge containing whitish or yellowish flakes or streaks of pus may be considered somewhat characteristic, although some bacterial infections may produce a similar condition. Recently infected bulls may show a mucopurulent discharge from the prepuce, although as a rule, no definite symptoms are observed.

The occurrence of these symptoms in several cows or heifers in a herd hints very strongly to the existence of trichomoniasis. These facts are further strengthened if there is a history of the introduction of new animals in the herd or if the bull is used for community breeding.

LABORATORY DIAGNOSIS

It must be remembered that a positive diagnosis of bovine trichomoniasis depends upon the demonstration of living, motile Trichomonas foetus in the genital exudate of infected animals, or in the tissues or fluids from infected fetuses. Two methods may be used for demonstrating the presence of trichomonads. If there is a heavy infection, the organisms can usually be seen in direct microscopic examination of the exudate or fetal fluids. If this method gives negative results, it is necessary to prepare artificial cultures and examine for trichomonads after a brief period of incubation. Both methods, in the end, require the use of a microscope and the recognition of the protozan.

1 Published with the approval of the Director of the Wisconsin Agricultural Experiment Station. Project No. 622-V; Trichomoniasis and other reproductive diseases of cattle.
DIAGNOSIS OF BOVINE TRICHOMONIASIS

Materials for diagnosis sent in to or collected by this laboratory include (1) from the cow and fetus: washings from the vulva, vagina and uterus, aborted fetuses, samples of fetal stomach fluid, fetal oral fluid, fetal membranes (usually picked up from the ground or from barn gutters) uterine pus, pieces of placenta, amniotic fluid, allantoic fluid; (2) from the bull: washings from the sheath, seminal fluid, semen.

COLLECTION OF THE SAMPLE FROM THE FEMALE

Andrews and Miller (1) devised a pipette for obtaining samples from the vagina. Samples may be collected by cotton swabs moistened with 0.7 per cent saline either on 12 inch applicator sticks or held in a long hemostat. The writer prefers to collect samples with the following apparatus which has been developed at the Wisconsin Experiment Station and sent free of charge to veterinarians throughout the state. A straight steel rod about ¼ inch in diameter and 18 inches long is grooved at one end and a cotton pledget attached. The cotton may be held in place either by thread or a rubber band. This swab is wrapped in a heavy paper envelope made for the purpose and autoclaved. The second piece of apparatus is a 6 inch long ¾ inch diameter pyrex glass tubing, fire polished on both ends. This small glass speculum is also wrapped in a heavy paper envelope and sterilized by autoclaving.

On use, the glass speculum is placed in the vulva, and the swab moistened in the culture medium, introduced through the speculum up to the cervical region. A circular motion is used to swab the vaginal walls. After withdrawing the swab, it is placed in the culture tube and thoroughly shaken. The swab and glass speculum is returned to the paper envelope, taken back to the laboratory, cleaned and prepared for another time. The purpose of the glass speculum is to eliminate any fecal or other contamination that may be present and accidentally be introduced either in the vaginal tract or the culture medium.

Although the infection may be present in the cow, an examination of the vaginal washings, which is the easiest to obtain, may be negative. Exudate obtained directly from the uterus will, in all probability, be more likely to contain trichomonads. In the case of endometritis or pyometra, samples of uterine material may be collected aseptically with a sterile uterine catheter.

The best time to collect samples from the cow for the diagnosis of bovine trichomoniasis has not been definitely established. From the available literature it appears that the most suitable time to collect samples would be (1) during estrus (2) vaginal and uterine exudate within 48 hours after an abortion (3) aborted fetal fluids (4) genital exudate 2 or 3 days after an infection (acute cases) (5) in pyometra when bacteria are not present (6) stomach contents of aborted fetuses. Recent reports by the Chief of the Bureau of Animal Industry state the highest percentage of positive samples are taken from the vagina between the 10th and 20th day after exposure.

Heat fluid is more likely to contain material from the uterus, the primary site of the trichomonads. During abortions and pyometras, trichomonads are at their highest concentration. The various methods as described above may appear relatively simple, but attempts to demonstrate *T. foetus* in genital exudates are quite frequently unsuccessful. Although trichomonads are more likely to be found
BANNER BILL MORGAN

from vaginal swabs following a trichomonad abortion, there are cases on record where trichomonads could not be found from 24 to 48 hours after abortion. In some of these cases the fetuses were heavily infected.

COLLECTION OF THE SAMPLES FROM THE FETUS

If the abortion is complete, that is, with fetal membranes intact, trichomonads may be demonstrated in the fetal fluids. Morgan (2) obtained pure cultures of *T. foetus* from aborted fetuses in which the fetal membranes were intact. If the fetal membranes are not available, Case and Keefer (3) recommend the swabbing of mucus from around the base of the tongue or the roof of the mouth. Many investigators have reported the finding of *T. foetus* in the abomasum of aborted fetuses. Madsen (4) found trichomonads in the lungs, stomach, and heart blood of an aborted fetus.

COLLECTION OF THE SAMPLE FROM THE MALE

The methods described above for the collection of samples from cows may also be applied for bulls. By inserting the pipette or cotton swab into the prepuce, a sample can be obtained. The bull must be properly restrained. The animal should be secured in a stall and properly restrained by an assistant using a sideline to reduce any exertion to a minimum. The preputial hair may be trimmed, after which the preputial cavity is sampled. The glass speculum is inserted and the swab introduced and moved in a circular motion. The posterior part of the glans penis, and the galea glandis or anterior portion of the penis should be especially swabbed as the two areas have been shown by Hammond and Bartlett (5), and Whitehair and Morgan (6) to be the preferential site of *T. foetus* in the bull. The writer feels that the sampling should be done without epidural anesthesia.

Some investigators state that mating a suspected bull to several virgin heifers is a positive method of diagnosis. Daily examinations of vaginal discharges from the mated animals are made. This method is not too satisfactory as the bull may not infect every cow bred, too little is known about the resistance of the cows, and is too costly. Negative results do not imply that the bull is free from infection. In many chronically infected bulls attempts to demonstrate trichomonads usually result in failure. According to Dikmans (7), this is probably due to the scarcity of the organisms in the prepuce or that they may have located in some inaccessible portion of the genital tract.

In order to make a complete diagnosis of the bull, two other samples should be taken. With the method described by Andrews and Miller, seminal fluid and semen are collected by rectal massage. Miller (8) recommends the incubation of semen at 37°C. for 6 to 8 hours. The spermatozoa by this time will have settled to the bottom whereas the trichomonads, if present, will be found moving about in the supernatant fluid. For immediate examination the mixing of a few drops of 1:500 acetic acid in the semen will stop the motility of the spermatozoa while the trichomonads continue their motility.

MICROSCOPIC EXAMINATION

The identification of *T. foetus* is not a simple matter. The irregular jerky movement of the body and axostyle is often cited as a characteristic recognition
sign. It is true that an experienced protozoologist can frequently recognize a particular species in this way, but few veterinarians and diagnosticians have the necessary microscopic equipment or the protozoological background requisite for making a reliable diagnosis on this basis alone.

In identifying flagellates, it is important to know the number and arrangement of the flagella. This can be done accurately only under the oil immersion lens. It is often necessary to examine more than one organism before all of the flagella are properly extended for accurate observation.

**DIAGNOSTIC MEDIA**

Many diagnostic media have been evolved for the purpose of maintaining *T. foetus* in large enough numbers for a positive diagnosis. All of the present methods of diagnosis fall short of this criterion. A 50 to 60 per cent ability to diagnose bovine trichomoniasis with present methods would be a fair estimate. Better methods need to be worked out.

The writer employs an all liquid medium for diagnostic procedures. It is made up as follows:

- **Ringer’s solution** ........................................ 1000 cc
- **Dextrose** ................................................ 10 grams
- **Cow serum** .............................................. 10 cc
- **Hematin (solution of 1 gram in 400 cc 0.85 per cent saline)** ...... 10 cc

The above solution is distributed in screw-topped high-pressure inulin tubes and autoclaved at 15 pounds pressure for 30 minutes. Cotton plugged tubes are more apt to lose their contents when on a road trip. This type of tube is also useful for mailing suspected material to a central laboratory for examination. Culture material should be examined as soon as possible, preferably 2 or 3 hours after collection. However, if samples are collected with a reasonable amount of aseptic precaution, the organisms may remain viable for several days.

If trichomonads are present in very large numbers they may be found and identified with ease. On the other hand, if they are present in very small numbers they may be found after a prolonged search or not at all. Occasionally, centrifuging of the sample is done, the supernatant drawn off and the sediment examined. A negative finding does not necessarily mean that an animal is not infected; it means more samples and more microscopical examinations. However, the finding of one living motile trichomonad is all that is required for a positive diagnosis. It is unwise to make a diagnosis on the basis of finding dead trichomonads unless the individual is absolutely certain of his identification.

**SEROLOGICAL DIAGNOSIS**

The use of the complement-fixation test for the diagnosis of trichomoniasis has not been used as a routine practice because of non-specific reactions. Kerr and Robertson (9) have applied the agglutination test with some success, however, they stress its limitations. It appears that the presence of positive tests indicates a herd infection. Infected animals do not necessarily react positive, and a negative reaction does not imply freedom from infection. Kerr (10) claims that the agglutination test gives an over-all result of 60 per cent. Approximately 80 per cent may
be found in the clinical groups such as catarrhal endometritis and pyometra. Morgan (11) could not use this test on a practical basis. From tests with 9 injected animals, 400 normal cows, 52 normal bulls, 11 infected bulls and 51 infected cows, it appears that the immobilization-reaction (agglutination) cannot be successfully utilized as a means for the diagnosis of bovine trichomoniasis. This station is now experimenting with the precipitin reaction as a diagnostic test.

REFERENCES

REPORT OF SPECIAL COMMITTEE ON COMMUNITY AUCTION SALES

FRANK CARR, Chairman, Columbus, O.; E. S. BRASHIER, Jackson, Miss.;
JUSTIN CASE, Kansas City, Mo.; C. E. FIDLER, Springfield, Ill.;

Community Sales are an old institution in our country dating back to our early history; however, not many were operating at a given time nor has the idea become widespread until in recent years.

We feel that perhaps as regulatory officials we have been slow in recognizing the importance of the market auction. Today in many states this institution has become an important cog in our marketing machinery. The volume of animals handled by these auctions in some of our central states each week reaches a staggering total. In Ohio, there are single auctions in which the average gross business totals between three quarters and one million dollars per month. It is time that we gave serious consideration to this important phase of the livestock business for these auctions are here to stay. It is important that the abuses and objectionable features be corrected and that the business be so conducted that the livestock industry may participate in the benefits and not be made to suffer the loss caused by the careless and unregulated auctions.

Among veterinarians and regulatory officials it has been common to regard community sales as a nuisance and to feel that the livestock industry would be better off if there were no such sales. We will grant that there are many circumstances to justify this opinion. Let us briefly review some of the arguments on the credit side of the ledger. Changing modes of transportation and travel conditions naturally led to a demand for some changes in livestock marketing. The common use of the truck led to a closing of many way stations along railroad lines and a demand for some other system for concentrating livestock at points where it would be made available for movement to slaughtering centers. The establishment of community sales was the result. In a great many sections these sales have been and are an economical means by which the seller of livestock can contact the buyer with a minimum of travel and time. He knows that on a certain day of the week the auction will be held and that several buyers will be present to place bids on his stock. These markets are of great value in enabling the producer of especially small groups of animals to sell them promptly at the time he desires and enables him to feel certain he is getting a fair price for his livestock.

In no class of stock is this service more valuable to the producer than in the case of veal calves. Under the old system a man with one veal calf for sale usually waited until some calf buyer visited his farm and then he was compelled to accept his offer or keep the calf. Today he has only to take it to the auction, knowing that there will be several buyers present to appraise the animal. There is no doubt that in certain sections, of our state at least, the farmers and dairymen have benefitted largely by having available the services of the auction market in marketing veals.

What has been said about veal calves is equally true of small numbers of fat hogs,
or an occasional beef. It is true that the producers of fat stock in car load lots
was not in need of this service to the same degree and consequently the auction does
not play as important a part in his activities.

We will not take much time to enumerate the counts against the community
sales. They have been a source of spread of hog cholera and other swine diseases;
have probably been the means of disseminating more sheep scab than any other
single source of contamination. In some localities they are playing an important
role in the spread of brucellosis. In some sections are in such bad repute along
sanitary lines that many veterinarians have come to regard them as an absolute
nuisance.

The objective of regulatory officials should be to salvage the good in these auctions
and try to formulate procedure which will correct the evils in the system. With
this thought in mind your committee has conducted a survey of the laws and
regulations in force in the various states. Hoping that a study of the procedure in
the various states might be of value in ridding the community sales of objectionable
features and thus enable them to render a greater service to the industry. The
questionnaire was submitted to some thirty-five states and responses from twenty-
five were used as the basis for this report. The first question was, how many of
these sales are operating in your state? The answers varied from 7 to 173. Iowa
reported 173; Texas 160. We have always felt that in auction markets the difficulty
from a regulatory standpoint increased, as the percentage of the total animals
which were sold to go back to farms increased. With this thought in mind the
second question dealt with this point and the answers varied from 5 per cent to 95
per cent.

It is evident that the danger of spreading disease by the sale of animals from
auctions to immediate slaughter is very slight in comparison to those sold to return
to farms. This great difference in the nature of the business conducted by auctions
shows conclusively that the problem of disease control varies much in different
sections as well as in different states. This being the case it is extremely difficult
to issue uniform regulations which will protect the health of animals sold and not
work a hardship at other markets handling another class of livestock under different
conditions. Fourteen states report having specific laws governing community
sales and four report regulations covering their operation. Fifteen states require that
sales be bonded and one requires a suitable financial statement. Seven states
require that the dealers be bonded.

In regard to veterinary inspection sixteen states have such a requirement, out of
this number in fourteen states the cost of such inspection is borne by the sale. In
practically all cases the auction sale collects from the purchaser such fees. Some
charge a fee on a per head basis. Among those states which provide for veterinary
inspection, most require vaccination of swine sold for purposes other than immediate
slaughter. Many states require the testing for Bang's disease of cattle sold for
purposes other than immediate slaughter, also the dipping of all sheep sold to be
returned to farms. Nearly all states having supervision of community auctions
make use of the quarantine for exposed, diseased, or suspected animals. Returning
animals to the consignors is done under quarantine. Several states require the
cleaning and disinfection of the market before the next sale is held. There are a
few states which accept lay vaccination of swine when accompanied by an affidavit of such vaccination.

The highlights on recommendations for control of disease at community sales include:

1. Concrete floors in pens, alleys, etc., for swine other than immediate slaughter.
2. Cleaning and disinfection after each sale.
3. Veterinary inspectors appointed and paid by the state.
4. The separation of slaughter livestock from livestock going back to the farm.
5. More rigid inspection of trucks including cleaning and disinfection.
6. Inspection of livestock before entering the sale.
7. Uniform regulations requiring the vaccination of all swine leaving auctions, except those for immediate slaughter or serum production.
8. Requiring a uniform bill of lading for all common carriers, thus providing some supervision of truck transportation of livestock.

As before mentioned many states provide that auction markets be bonded to operate in the state and a few require a bond for livestock dealers.

In theory this procedure seems good and may work under certain conditions.

However, it is extremely doubtful if such procedure prevents many failures or serves to check the opening of markets in sections in which there is not a sufficient need for such a market.

In our opinion we doubt if the bonding provision has lessened to any appreciable degree the failures. When failures have occurred the loss has been so large that the bond has served no real purpose even if the face of the bond was paid without litigation. There is a grave doubt in my mind if the fact of a bond being required has not increased the loss sustained rather than prevented loss.

The same statement can be made even stronger in regard to dealers being bonded. In explanation of this statement in regard to the practical value of the bond provision: The knowledge that a bond is necessary may lead some parties to extend credit in circumstances under which it would not be granted were it not for the bond. In short it gives a false sense of security and farmers, dealers, and auction operators may "take a chance."

Another factor that should be given consideration by regulatory officials is providing some means of controlling the number of auctions which may begin operation in a given locality. This is desirable from the standpoint of protecting the farmer and producer of livestock from loss by default or failures if for no other reason.

One state at least has met this problem by viewing these auctions as public service organizations and requiring the establishment of public necessity before opening a new market.

Under the heading of veterinary inspection, it is true that in the majority of cases the inspectors are now paid by the markets. Most comments, however, on the subject favor the veterinary inspectors being in direct employ of the state. We do not want to intrude upon the province of another committee but in any discussion of the problems of market auctions we cannot ignore the part that the truck plays in the business. As has been pointed out previously one of the great needs in order to control the spread of infection in handling livestock to and from community sales is adequate control and supervision of the trucking business. The abuses in this
business cannot be corrected until some system is provided by which a record is kept of truck movement of livestock. This is especially important in interstate movement and long hauls. Trucking lines should be under some regulation similar to railroad transportation and be required to give a receipt for livestock, also have a bill of lading similar to that in use in railroad shipping.

This has been recommended from the standpoint of disease control but it is also very important from the business angle as well. In checking the activities of certain markets it is easy to get evidence to show the destination of cars of livestock moved by rail, but almost impossible to do so in the case of animals moved by truck even if shipped long distances and interstate as well.

A practical illustration of this weakness has come to light in one of our central states. Several thousand hogs seem to have disappeared and there seems no way of tracing these animals to prove that they were received and processed at any given point. This one case alone involves a large number of hogs valued at thousands of dollars. Certainly the industry must demand some system that will provide the farmer, producer, the shipper, and the auction management a receipt for livestock entrusted to a trucking agency, also some system by which it is made a matter of record as to the course taken by such shipments and provide proof of the delivery of the cargo to a definite destination.

Many states have a bond system in force in an effort to protect the farmer and producer against loss by failure to pay for livestock purchased. Certainly an auction management as well as a producer should have some protection against the possibility of some trucker loading livestock and driving away and one never hearing of the driver or livestock again. Under our present lack of supervision it might be possible for a trucker, presumed to represent or haul for a reputable concern, to get a load of hogs to be taken to Pittsburgh and take them to Chicago, sell them, and disappear. To add to the confusion many livestock markets do not keep accurate records as to how animals were shipped from their auctions, whether by rail or truck.

It is the duty of the livestock producer, auction operators, transportation operators and regulatory officials to cooperate to the end that this business be placed on a sound economical basis. The auction market is capable of rendering a real service to the general public but to accomplish this certain objectionable features must be eliminated.
REPORT OF COMMITTEE ON LEGISLATION


Distances are too great for your committee to meet as a committee in Washington and other places of legislation. Therefore, it follows that the legislative committee of the United States Livestock Sanitary Association must carry on its work through correspondence and through the activity of individual members.

Your Committee is pleased to report that it was active in obtaining the approval of Congress to re-classify veterinarians in the employ of the United States Department of Agriculture. This legislation was most desirable as veterinarians had not been re-classified for a number of years and were the lowest paid of any professional group in the services of the United States Government.

Your Committee contacted members of the United States and Congress in behalf of this measure and received a very favorable response from most of the legislators contacted. We are particularly indebted to two members of the Committee who personally gave their time and energy and appeared before congressional committees in behalf of this measure.

Your Committee has been active and still is active in sponsoring the approval of H. R. 5007, a bill which will grant authority to the Bureau of Animal Industry, United States Department of Agriculture, through the Secretary of Agriculture, to suppress and extirpate contagious, infectious and communicable diseases of dogs and other carnivorous animals.

We recommend to the members of the United States Livestock Sanitary Association that they contact their congressmen and get a copy of the 78th Congress Second Session, H. R. 5007 and that they write to their congressmen and senators in behalf of this bill which was introduced by Mr. Rees of Kansas.

Inasmuch as this is an interim year and few legislatures are in session your Committee has not been active in state legislation. We do very respectfully call to the attention of all interested in livestock sanitation that an effort be made to provide their livestock disease-controlling organizations with greater stability and flexibility of action, and with authority to appoint their own executive officers who shall act for the board and perform the duties of state veterinarian.

Your Committee regrets the action that has been taken which segregated the Meat Inspection Division from the Bureau of Animal Industry, United States Department of Agriculture. We realize that in war emergencies action may be taken which appears the proper procedure at the time but which later on proves to have been the wrong procedure. We believe that the segregation of the meat inspection division from the Bureau of Animal Industry, United States Department of Agriculture may be classified as such an action.

Reporting to state livestock disease regulatory officials of disease conditions disclosed at post mortem inspection at abattoirs is most desirable in the control,
prevention and extirpation of dangerous diseases of livestock. It is through the knowledge of disease conditions that are disclosed when animals are slaughtered that many foci of disease are discovered. When disease conditions are immediately reported to the state authorities prompt action may be taken in controlling, preventing and extirpating further outbreaks of that disease.

A definite system of vital statistics on livestock and the reporting of disease conditions disclosed on post mortem at abattoirs under Federal and state supervision are extremely desirable and necessary for highly and effective work in the control of livestock diseases.

We appeal to the Federal administration to review this matter carefully and to give the matter of returning meat inspection to the Bureau of Animal Industry, United States Department of Agriculture, their most earnest consideration.

We also appeal to the Federal administration to provide a method for recording and reporting livestock vital statistics and disease conditions found on post mortem inspection.
REPORT OF COMMITTEE ON BIOLOGICS


Reports of the Committees on Biologics for the years 1941 and 1942 indicate that every effort had been expended in connection with the distribution of live vaccines and viruses. That the situation had been presented to the proper authorities and no tangible results were obtained.

Last year's committee's report contained the following statement—"It would appear that a new interpretation of B.A.I. Order No. 276, or definite congressional action taken changing the basic law, would be needed before change in our present status could be expected. It seemed inopportune to your committee that any change now could be effected under present conditions."

Because the situation remains unchanged, your committee for 1944 concurs in the above statement, but recommends that the committee be continued and instructed to take any measures they deem advisable should an opportunity be presented.
FEDERAL MEAT INSPECTION UNDER WARTIME CONDITIONS

BY M. R. CLARKSON, D.V.M.

Meat Inspection Division, War Food Administration, Washington, D. C.

I am glad of the privilege of being with you today and of the opportunity to tell you some of the things that we in the Federal meat inspection service have been doing since the onset of the present war. The trying conditions brought about by the war and the way these conditions have affected the national meat supply are known to all. It may interest you, however, to learn something about the measures taken by the meat inspection service of the War Food Administration's Office of Distribution, to insure the wholesomeness of meat.

One of the first problems encountered in connection with the war was to develop and produce field rations and other special food items for the Armed services. Before Pearl Harbor the U. S. Army had laid the groundwork for preparing and packaging special foods, and members of our staff had opportunity to perfect the procedure for inspecting and labeling them. These products included the "C Rations" for field use, the "K Rations" and the numerous special items for emergency use by isolated troops, in addition to the many standard items for use in camps and field kitchens. Some of the products, such as meat and vegetable stew, corned beef hash, chili con carne, and Vienna sausage, were the familiar commercial products with various minor changes to suit Army needs. In addition to these products, many new canned ration items were developed, such as beef and gravy, pork and applesauce, pork and gravy, spaghetti with meat, beef and pork steaks, and ham and eggs, to name only a few.

All these products had to be prepared in convenient form and processed to insure their preservation under varying temperature and moisture conditions. This required considerable experimentation in canning methods and our inspectors had opportunity to detect and eliminate faulty operating methods. Such experience was most useful when the expansion of the Armed services and the advent of lend-lease brought about the purchasing of tremendous supplies of meat products. It was possible, with a minimum of delay, to give adequate inspection at the many outlying plants from which Army, Navy, and lend-lease purchases were made. Many of the establishments were inexperienced in the canning of meats and the inspectors had to give the management a lot of help with respect to processing schedules, in addition to making sure of the wholesomeness of the product. It is of interest to note that the amount of meat food products processed by curing, cooking, canning, etc., under Federal inspection increased from 10 billion pounds in 1941 to a little over 16 billion pounds last year—a fact that gives you some idea of the increased work-load brought about through these heavy Government purchases.

You are all familiar with the increase in slaughter throughout the country. Our figures show that during the fiscal year 1941, a little over 82 million head were slaughtered under Federal inspection. Last year the total slaughter under Federal inspection was more than 118 million food animals. This enormous increase
made necessary the addition of new equipment for handling the extra volume of work. Much of the equipment had to be made in the face of insufficient supplies of iron, steel, and other structural materials, which handicap made it difficult to obtain all of the desired sanitary features. Our inspectors in charge of field stations worked closely with construction engineers to use the available supplies to the utmost advantage, so as to obtain basic needs and a construction to which desired additions could easily be made when the scarce materials again became available.

At the same time, inspection was extended to many establishments which had not previously operated under Federal inspection.

The Fulmer Act, approved June 10, 1942, authorized inspection at qualified plants not engaged in interstate commerce so as to enable them to prepare meats for Federal purchasing agencies. After the passage of this act, several hundred intrastate slaughtering and meat processing plants applied for inspection, and it was necessary, within a relatively short time, to appraise the buildings and equipment at each plant to determine whether they were adequately equipped to insure proper handling of the product and conduct of the inspection.

The procedure in such cases, which had been found most useful during many years of experience, was to make these evaluations in Washington on the basis of detailed plans and specifications filed by the applicant. There was no time to follow such formulas, however, so instead trained inspectors were sent to examine the plants, evaluate the acceptability of the facilities, and immediately inform the management of the changes, if any, which would be necessary to meet minimum requirements. Inspectors in charge of many of our larger stations were kept fully occupied with such work for a period of several months. Some of the plants required extensive changes while others were able, with only minor alterations, to meet our minimum requirements. A number withdrew their applications on account of economic reasons having no relation to the inspection. Some others qualified and operated under inspection for varying periods of time and later withdrew, usually because of termination of Government contracts. The over-all picture, however, shows a substantial increase in the number of establishments operating under inspection—from 659 in June of 1942 to 910 or more at the present time. This represents an increase of almost 40 per cent in the number of federally inspected establishments.

It is interesting to note, however, that during the fiscal year 1944, these additional establishments accounted for only 5.9 per cent of the total federally inspected slaughter, and 3.6 per cent of the total processing. As these figures indicate, the establishments to which the inspection was extended were mostly of small or medium size. Consequently, the cost of inspection there has been considerably higher per pound of meat inspected than at the regular interstate establishments. Many of these establishments have acquired considerable interstate business along commercial lines in addition to the Government orders, so it may be expected that a number of them will meet the requirements for maintaining the inspection after the war.

In the fall of 1943, and again early this year, considerable attention was given to “limited” Federal inspection. Arrangements were made at that time to permit slaughtering establishments to prepare dressed carcasses for sale to certain government agencies. The inspection procedures applied at such places are the same as at any other federally inspected establishment. The term “limited” applies only
with respect to the proportion of the slaughter that is offered for inspection, as the inspection is given only to animals and their carcasses, the meat of which is for sale to certain government purchasing agencies. The facilities required for handling the product and the inspection procedure have not been varied, except, of course, that no special equipment is required for those departments of the plant not handling the product under inspection. It is required, however, that the entire plant be kept clean. Not many establishments qualified under this inspection until Food Distribution Order 75.2 required non-federally inspected slaughterers to limit the production of certain grades of beef to not more than 51 carcasses per week. Since that time, 29 slaughtering establishments have been placed under limited inspection.

Limited inspection also has been inaugurated at a number of establishments preparing boneless and chopped beef for the Army. Here, again, the sanitary requirements must be met but the inspections are confined to the product that is prepared and packaged for Army purposes. We have had 27 establishments under this inspection.

The increase in the work load of the meat inspection service has required a substantial addition to the number of inspectors. To keep the service properly staffed during wartime involves additional difficulties since there is considerable personnel turnover—loss of men to the Armed services, and, in the case of veterinarians, resignations to enter private practice. The training of the many new men has imposed a heavy burden on our field stations and has made necessary a rather thin distribution of the older, more experienced employees. These men have responded to the job magnificently, with the result that the day-to-day work of the inspection has been carried on with no let-down in its exacting technical requirements. This has been so despite the fact that in many places the men are required to work 10, 12, 14 hours, or even longer, day after day. In some lines of work long hours do not materially affect efficiency, but in the meat inspection service, the mental fatigue and eyestrain attending long, continuous hours of duty make it rather difficult to maintain a high level of efficiency. On this account, every effort has been made to break up the long shifts by changing assignments among inspectors. Prior to the war, we had considered that an 8-hour day on post mortem inspection, and a 10-hour day on processing inspection should not be exceeded except for emergencies. We will return to such a schedule as soon as conditions permit.

In administering the Fulmer Act, we were fortunate to be able to obtain the services of veterinarians and meat inspectors who had considerable meat inspection experience in State or local services. As the establishments were placed under Federal inspection, the inspectors stationed there were given opportunity for Federal employment at approximately the same salary rate previously paid by the local inspection agency. It is expected that when such establishments return to State or local inspection after the war, the inspectors will be released to resume their former employment if they so desire.

In applying limited inspection to the slaughter of cattle to supply beef for the Army, a procedure has been worked out by which Army veterinarians with previous training in Federal meat inspection have been detailed to and formally authorized by our service to conduct such inspections. This has enabled us to give inspection at some plants where otherwise it would have been impossible.
Some reinstatements of veterinarians and meat inspectors released from the Armed services have already been made. Inasmuch as our veterinary personnel is now considerably below normal strength, it is anticipated that former veterinarians of our service who are now in the Army can be reinstated with little difficulty. The increase of our inspection force, other than veterinarians, will depend largely on the volume of processing operations after the war. In any event, the returning veterans will be given every opportunity to take advantage of the unemployment preferences specified by law.

Although the problems involved in operating under wartime conditions have taken much time in the administrative offices, progress in the application of inspection techniques and procedures has been made. The latest knowledge of disease processes has been constantly reviewed, and in the light of such knowledge, the ante mortem and post mortem regulations have been augmented during the past few months with up-to-date instructions regarding epithelioma of the eye of cattle, caseous lymphadenitis of sheep, and swine erysipelas. The application of our regulations with respect to several other conditions, including anthrax, cysticercosis, and various kinds of degenerative changes, has also come under intensive study, with the result that revision will possibly be made of the regulations if such action is found necessary.

In the processed meat field, too, much work has been done to establish minimum meat content for some of the specialty items in which the tendency has been to reduce the meat content because of the pressure of keen competition and wartime shortages. Some of these products are: Chili con carne with 40 per cent meat; chili con carne with beans 25 per cent meat; tamales, 25 per cent; scrapple, 40 per cent; spaghetti with meat balls and sauce, 12 per cent; and stews, 25 per cent. The liver content of such items as liver sausage, liver loaf, etc., has been set at not less than 30 per cent. The fat content of hamburger is limited to not more than 30 per cent. All such requirements are designed to promote honest labeling by making certain that the products justify the use of trade names which have acquired well recognized consumer understanding.

As an aid to meat packers who intend to apply for Federal inspection, a publication has recently been issued explaining, in convenient form, many of the requirements which must be met in the preparation of the plant and installation of equipment. The industry’s response to this release has been very gratifying, and it is our intention to revise the technical content from time to time, as it is necessary. The publication includes a short statement regarding the purpose of the inspection and a brief outline of the application of the Federal Meat Inspection Act to those engaged in interstate or foreign commerce. There are also a number of diagrams showing the special slaughtering lay-outs and installations of inspection equipment, with the required dimensions to insure maximum usefulness.

Indications point to a pending tremendous building program which has been held in abeyance because of wartime shortages. The detailed work required to review and approve plans for construction at establishments under inspection will place a considerable burden on our architectural engineering section. In an effort to spread out the work somewhat, packers have been requested to get their plans in, well in advance of intended construction. Many are now following this suggestion and will be ready to proceed without delay when materials and labor are more plentiful.
You may wish to know how our organization is set up to handle expeditiously the many problems that arise in regulating operations of the meat industry, which, before the war, ranked with the automobile industry as second only to steel manufacturing in the realm of big business. As you know, the Meat Inspection Division is a part of the Livestock and Meats Branch, of the War Food Administration's Office of Distribution. Harry Reed, Chief of the branch, is known to you, also, as chairman of the War Meat Board. The Meat Inspection Division has in Washington six sections, each with a specified field of operations. These are: (1) the architectural engineering section with responsibility for the review and approval of packinghouse plans and specifications; (2) the inspection operations section with responsibility for the development of proper inspection procedures, including the ante mortem and post mortem requirements; (3) the laboratory section which deals with chemical analyses of meats and products and the ingredients used in their preparation, and with research in the field of processing methods; (4) the special projects section which has responsibility for prosecution of violations of the Meat Inspection Act, the inspection of import meat, the inspection and certification of export meats, the handling of exemptions provided by law for retailers and farmers, and other special work; (5) the trade label section with responsibility for the prevention of false and deceptive labeling, a responsibility that includes the determination of the composition and character of each product to insure that it receives its correct designation; and (6) the meat inspection recording section which compiles statistics of every phase of the Federal meat inspection program, and analyzes them for the information of the various sections and field stations.

We have more than 3,100 inspectors of all grades in the field service, located at some 350 cities and towns throughout the country. For administrative purposes the field work is divided into 166 stations, with an inspector in charge and such assistants at each station as may be necessary. We also have 6 chemical laboratories conveniently located to receive samples of meats, spices and other ingredients, water, packaging materials, etc., from the field stations. The laboratory report forms a basis for acceptance or rejection of such products by the inspectors. Our field station men also have available laboratory service in pathology, bacteriology, parasitology, and related fields to help them in the diagnosis of unusual conditions that are encountered from time to time, and to furnish them with other scientific data based on research.

The meat inspection service is set up to meet the responsibility placed upon it by the Federal law. We are aware of the constitutional limitations on our activities which restrict the application of that law to meat and meat food products in the channels of interstate or foreign commerce. Meat and meat products not within our jurisdiction come under the regulatory authority of State, municipal, and other local governments. To such agencies we are pledged to give the utmost in cooperation, insofar as it may be practicable and mutually agreeable, so as to effect a free exchange of information regarding operating procedures and inspection techniques, and to achieve the common purpose of preventing the use of meat and meat food products which are unsound, unhealthful, or otherwise unfit as food.
THE SCOPE OF VETERINARY PUBLIC HEALTH IN THE POST-WAR WORLD

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One of the traditional responsibilities of Veterinary Medicine is the protection of human life against those hazards which result from contact with diseased animals, consumption of the tissues of diseased animals and animal food products contaminated during the processing and delivery of such foods to the consumer. In the opinion of many, the opportunity for the profession to discharge this responsibility satisfactorily has not been as complete as it should have been. There is no need at this time to seek those factors at fault if the job has been partially done. It may be stated briefly that Veterinary Medicine has not been as aggressive in this field as it could have been; further, organized Public Health agencies have not recognized nor promoted this field as sufficiently as they might. It is much better to survey what has been accomplished in the past, to assay the present situation, and on that foundation build an organization which will serve adequately and completely in the post-war world in that part of the Public Health field which is allotted to Veterinary Medicine.

As a first step, it is essential to scrutinize the living habits of man and to find there the health hazards to which he is subjected by his environment and to assign to different groups the task of removing or minimizing such hazards. Those health dangers which man meets in direct contact with his fellow men are problems of medicine; those with water and sewage are problems of sanitary engineering; those with animals and their products are problems of veterinary medicine; those with all other foods are problems of food technology. All of these together comprise the broad field in which public health operates. This discussion, therefore, will embrace four different functions of veterinary medicine which contribute to public health. These are meat inspection, milk sanitation, animal-food products inspection, and the control of animal diseases directly transmissible to man. These functions we choose to unify under the title—Veterinary Public Health. This title is a new one and I think an appropriate and appealing one. It was first used by the Canadian schools in announcing graduate work in this field.

MEAT INSPECTION

Veterinary Medicine has every reason to be proud of the contributions of the Federal Meat Inspection Division to the general health of the public. Many people do not appreciate the work of this government agency which is recognized as being one of the best meat inspection organizations in the world. Originally formed to protect our exports against the criticism of over-seas markets, it has grown into a forceful mechanism by which the American public is assured a good, safe meat supply. The big objective of meat inspection is to prevent diseased animals and
spoiled meat-products from being used as food. By giving the meat consumer a feeling of security in eating the meat he buys, he eats more meat than he otherwise would. The report of the Chief of the Federal Meat Inspection Division for the fiscal year 1944 shows that there were 55,789 animals condemned on ante-mortem inspection, and 387,774 animals condemned on post-mortem inspection. This is a total of 443,563. In addition to these, certain parts of 1,526,483 animals were condemned because they were unfit for food. Still in addition, the following quantities of meat and meat food products were condemned on reinspection and destroyed for food purposes because they had become sour, tainted, rancid, unclean or otherwise unfit for human food: Beef, 3,755,516 pounds; pork, 9,644,507 pounds; mutton, 169,479 pounds; veal, 83,002 pounds; goat meat, 381 pounds; horse meat, 15,981 pounds; total 13,668,866 pounds. I wish that time permitted a discussion of the various conditions which caused these condemnations and the effects which these conditions might have had upon human health if the food had been sold and consumed.

Yes, we are proud of this contribution to public health, but we must not be complacent about this accomplishment for there is still much to be done before we can claim that the entire meat supply of the nation is adequately protected. Before the war it was estimated that not more than 65 per cent of the meat consumed in the United States and all that exported was inspected by the Meat Inspection Division. The remaining 35 per cent was produced by state operating packers, municipal butchers and farmers. Some of this has been and still is adequately inspected; some is inspected but not adequately, but the great mass of it is non-inspected. During the war a number of state-operating establishments have been extended federal inspection for the duration. Every effort should be made to encourage these plants to make the necessary improvements to entitle them to a federal license after the war.

The big problem in regard to meat inspection is to devise not only ways but to provide means for the inspection of all meat consumed by the public. It will be essential for the various states to pass legislation and make appropriations for the establishment of inspection in those plants operating only within each state. California is the only state which provides for state wide meat inspection. It is the responsibility of each city and town to require the inspection of all locally slaughtered and processed meat. The development of the refrigerated locker system has initiated another problem in meat hygiene. In many instances the local butcher has become the refrigeration-plant operator. In most cases he buys and butchers animals for his patrons. Some of these animals are inspected but the majority are not. In addition to the inspection of meat placed in the lockers, the sanitation of the plant and the medical examination of the workers are in need of supervision.

It is the duty of each city to protect the health of its citizens by requiring such plants to be inspected regularly. If the plant is located out of the jurisdiction of the town or city, it is the duty of the state to supervise its sanitary operation.

The 1944 report of the Committee on Food Hygiene of the AVMA stresses this need by stating, “Compulsory meat inspection laws designed to cover all products sold for human consumption should be vigorously encouraged. The U. S. Public Health Service and other agencies interested in the sanitary handling of food for
human consumption are waging a campaign to enlighten the public. The result is being felt in numerous cities, municipalities and rural districts. Much educational work must be done before other states will rise to the occasion and inaugurate measures, as California has done. This is a mammoth undertaking but is basically sound; the veterinary profession should be taking steps to prepare itself for the responsibilities that will ensue."

Everyone will readily admit that there is dire need of poultry inspection in the United States. There has been a steady increase in the amount of eviscerated poultry inspected by veterinarians in the Dairy and Poultry Division of the Office of Food Distribution, but there still remains a tremendous amount which receives no attention from a professional point of view.

One of the specific public health problems which relates to meat inspection is that of trichinosis. Samples taken from the diaphragm of human cadavers by various investigators have revealed that this disease is more common in man than generally realized. Epidemics of trichinosis have occurred in different parts of the country. Surveys of swine carcasses have shown that the parasite is found more frequently in raw-garbage fed hogs than in those fed on a grain ration. At the present time there is no efficient, economical method by which the presence of this parasite can be detected in swine at the time of slaughter. The federal meat inspection division believes that the methods which it requires for the processing of pork and pork products will destroy all trichinae; furthermore, it is recommended that all uncured pork be thoroughly cooked before consumption. It is believed that trichinosis is perpetuated, as far as man is concerned, by the use of raw pork products in the form of home-cured sausages of various kinds, and by the practice of feeding swine raw-garbage. In view of these facts, it is natural to conclude that the foundation for the control of trichinosis in man and swine rests on the requirement that all garbage fed to swine must be cooked. This recommendation was made years ago to Public Health and Livestock Disease control authorities, but very little has been done toward the adoption of it. While it is true that the war has interfered with the manufacture of massive equipment required for the cooking of garbage, communities and states could have inaugurated regulations for the duration requiring that all raw-garbage fed hogs must be slaughtered and processed at packing plants under federal supervision. That trichinosis has been recognized for years as a public health problem is emphasized by an editorial in the American Journal of Public Health. This editorial reads as follows: "The journal has repeatedly called attention to the risks of feeding raw garbage to hogs. Many of the cities which indulge in this bad practice have adequate food inspection, good milk ordinances, pure water supplies and satisfactory sewerage systems. In other words, these municipalities have provided protection against most of the diseases spread through food and drink, but have failed to guard their citizens against trichinosis. In reality oftentimes the disease is fostered.

The reasons for this situation are apparently almost entirely commercial. Some cities are themselves directly to blame since they maintain hog farms of their own. In others, pressure has been brought to bear against the passage of ordinances designed to protect the citizens against the menace of raw-garbage fed pork. In at least two states legislation to control the feeding of raw garbage to swine has
been blocked by organizations of those engaged in the business. If, as Wright holds and we believe, the hog is the chief source of human trichinosis, little can be accomplished in the way of control until cities and towns refuse to dispose of their garbage in this insanitary and disease spreading fashion. Here is the job for health officers."

**Milk Sanitation**

The value of the contributions of veterinary medicine to milk sanitation is unquestioned. These contributions are in support of the two general objectives of milk sanitation: first, the prevention of the spread of diseases of animal and human origin through the milk supply; second, the production and processing of milk in a sanitary environment in order to preserve its palatability and keeping qualities.

One of the most significant contributions of veterinary medicine in this field has been the eradication of bovine tuberculosis. There is little need of telling this association about this accomplishment. Most of you have been contributors to it. Yet, I think a word of praise by others is appropriate at any time and place. Formerly a disease of significance in dairy cattle, tuberculosis is now of little consequence. Tuberculin reactors have been reduced from a percentage of 3.9 in 1921 to a percentage of 0.18 in 1943. This represents a considerable saving on the part of the owners of cattle and also represents a notable contribution to public health in terms of bovine tuberculosis. Due to this progress, the types of tuberculosis in man in which the bovine strain of tubercle bacillus is incriminated has been notably reduced. Dr. J. Arthur Myers of Minnesota compliments our profession as follows: "In the entire history of tuberculous control, there is no accomplishment which even approaches that of the veterinarians and their allies in the United States. There are not sufficient superlatives in the English language to adequately describe your accomplishments and pay the tribute that you deserve. In reviewing much of the literature by men and women who advocated the control of tuberculosis in cattle, one finds a constant predominating aim; namely, to protect human beings against the bovine type of tubercle bacillus, . . . the rapid decline in the incidence of tuberculin reactors among children of this country in the past ten or fifteen years is probably due more to the protection you have afforded them against the bovine type of tubercle bacillus than any other single factor."

This praise is of little value unless it is accepted as a challenge to continue progress and to complete the task. It is obvious that tuberculin testing of cattle must be continued. All dairy herds in all counties of the United States must be tested once every three years under the modified-accredited area plan. One wonders how rapidly the disease would become established in our herds again if testing should be discontinued. It is certain that no one wishes to find out!

The prevention of brucellosis or undulant fever in man is a definite responsibility which the veterinary profession must share with public health. We must be aware of the fact that this infection is not transmitted through raw dairy products alone, but also by other means, chiefly contact with infected animals and their secretions. However, milk must stand its share of the responsibility. More and more of the towns and cities of our country are requiring that the herds supplying milk to consumers be tested for brucellosis. Diligent application must be made of those methods which are recognized as valuable in the eradication of brucellosis from cattle and swine herds. It must be recognized that living cultures of Brucella
organisms used as vaccines are hazardous to those who handle them, and a recent report emphasizes that care also must be employed in handling vaccine composed of "Strain 19."

It is fortunate for the health of man that he is not susceptible to the majority of the species of bacteria causing bovine mastitis; however, if he were susceptible perhaps more would be done to control this disease. We must be aware of the fact that this disease in dairy cows is a factor in human health because there are species of streptococci and staphylococci which do produce disease in man and also produce bovine mastitis. The quality of milk is considerably reduced by the disease; hence, such milk is not freely consumed. Mastitis diminishes the quantity of milk produced; furthermore, the quantity would be reduced still more if all mastitis milk were discarded instead of being used for food. Let us be assured that there are proven methods available whereby bovine mastitis can be prevented and controlled. Every veterinarian engaged in bovine practice should become familiar with modern methods of diagnosing and controlling this disease and acquaint himself with the information regarding the use of various chemical agents in treating new cases of the disease. Treatment, as an adjunct to sanitation in the milking process, prolongs the milking-life of dairy cows.

Municipal public health departments should require that milk producers must present a certificate testifying that their milking cows have been given a thorough physical examination by their veterinarians before the milk from such animals is used for human consumption. The purpose of this examination is to eliminate all unhealthy animals that are producing milk for human consumption, due to actinomycosis, open abscesses, metritis, mastitis, emaciation, chronic foot rot, tuberculosis, brucellosis, and other conditions that would directly or indirectly affect the quality of milk. Dairy herds and milk sheds where such examination is required, greatly over-shadow other dairies not only in herd health but in increased production. The physical examination also serves to make the dairy farmer more conscious of his responsibility in maintaining herd health, and producing a better quality of milk. It has been the experience of the veterinarians who have been actively engaged in the physical examination of dairy herds, that they have a definite responsibility to assume in educating the dairyman to be a better dairy husbandryman. The veterinarian should keep himself informed regarding the economic factors which affect the dairymen.

The veterinarian is familiar with the process of disease and its transmission. By training he is disease and sanitation conscious, his natural interest lies in the field of disease prevention rather than in production for financial gain. He is capable of interpreting and teaching those procedures whereby the milk supply is kept free of pathogenic bacteria of human origin and the various contaminating bacteria which cause the deterioration of milk and milk products. While he may not be familiar with all of the intricacies in the operation of a pasteurization plant, he does understand and can interpret those sanitary requirements essential for the protection of human health.

ANIMAL-FOOD PRODUCTS INSPECTION

During the past three years many veterinarians have been called to serve their country in the Veterinary Corps of the Army. One of the chief duties of the veter-
inquiry officer is the inspection of animal foods used by our armed forces in all parts of the world. This inspection is done to comply with the specifications of the Quartermaster for such foods. Under this authority great headway has been made in the sanitary operation of plants which sell food for army use. Here lies the greatest challenge of Veterinary Public Health for the future. What will happen when this country goes back to peace-time operation? In order to have protected and pure foods for the American consumer much federal and state legislation would be essential. Furthermore such legislation must be supported by adequate appropriation to insure adequate sanitary supervision of food processing plants. The civilian food consumer should be acquainted with the health hazards found in the food industry by the Veterinary Corps; they should become familiar with the tremendous quantities of foods which were rejected by the Veterinary Corps because such foods were considered unsafe for our boys in the armed services. It must be remembered that these boys will be a part of our citizenry of the post-war era, and it is hoped that they will insist upon pure food. What is to be done about the sanitary supervision of the production and processing of butter cheese, condensed milk, dried milk, meat food-products, poultry, storage eggs, dried eggs, fish and all of the raw ingredients such as cereals and seasonings which go into some of these foods? It bears repeating that herein lies one of the greatest challenges in the field of Veterinary Public Health.

ANIMAL DISEASES TRANSMITTED TO MAN

For many centuries man has been aware of certain health hazards due to his contact with animals. Modern medical techniques have identified many of these specific hazards. A number of them previously have been mentioned as being transmitted by food, but there are numerous diseases which are transmitted to man by his direct contact with animals. The control of these diseases is a definite veterinary public health responsibility. The practicing veterinarian must become familiar with present day knowledge concerning these diseases, and state and federal control officials must know of the methods which may prevent the spread of specific diseases. This knowledge is necessary so that the medical profession may be informed concerning these health hazards and so that we may cooperate with them in control projects. Unless we are above reproach in our knowledge and endeavor we cannot scold our brothers in the medical profession concerning their ignorance about animal diseases. To be sure, some physicians scoff at the importance of bovine tuberculosis. Many do not recognize the menace of brucellosis in rural areas, many minimize the hazards of rabies, and erysipelas infection is frequently unrecognized.

Now that some of the past accomplishments and future scope of Veterinary Public Health have been outlined, it is pertinent that recommendations be made in order to accomplish the tasks assigned to us in this field.

The health department in every small municipality should have the part time or whole time services of a veterinarian. Each county health unit should have a veterinarian as a specific member of the organization. I have been informed that the Committee on Local Health Units, of the American Public Health Association, has recommended that practically all units totaling 1202 for the 48 states and the District of Columbia, shall have one or more veterinarians attached to their staffs,
if the population of the unit totals 100,000. Furthermore, where two adjacent local health units have a combined population of 100,000 to 150,000, it has recommended that they share the services of a veterinarian to be paid part-time, or proportionately by each unit. There are areas too sparsely settled and units of local jurisdiction too small in numbers in the opinion of the committee to afford the services of a full-time veterinarian at local expense. It is presumed that for such small units with health departments on a full-time basis, the indispensable veterinary services will be provided through consultation and advisory functions of the veterinarians employed by respective state departments of health. By such a procedure numerous small towns would be assured adequate service. The state health department should have on its staff a veterinarian who has had considerable experience in the Veterinary Public Health Field. In those states where the enforcement of regulations pertaining to foods is a task of the health department, this man would be the administrative head of this service. In all states there should be close cooperation between the state veterinarian and the state commissioner of health. More veterinarians must be employed by the United States Public Health Service if this service is to accomplish its objectives. There must be cooperative alliances between all pure-food and drug, meat inspection, animal disease control, and public health agencies if the essential legislation and appropriations needed for the protection of the health of the public are obtained.

The young man who will have served in the Veterinary Corps of the Army during this war will be admirably trained to carry on the functions of Veterinary Public Health. From the results of a questionnaire sent to them by the A.V.M.A. Committee on Post-war Planning, it is learned that 165 of these young men desire to enter the public health field upon their return to civil life. Consequently, we are confronted by the fact that here is a job which must be done, here is a group of trained men who can do it, but we are lacking the organizational and financial wherewithal to do it. Some of these young men will desire to take further educational training in public health. This will be possible to a limited extent in the established Schools of Public Health in our country. Unfortunately, none of these schools has seen essential the establishment of training courses for food sanitation. It is obvious that our schools of Veterinary Medicine must establish, as an adjunct to undergraduate professional instruction, graduate training to those who desire to enter the field of Veterinary Public Health. Canadian schools have already announced their offering of this instruction. At Iowa State College we have formulated plans whereby a graduate veterinarian may return and obtain advance work leading to the degree Masters of Science in Veterinary Hygiene. We can fulfill our responsibilities in this field when we can offer to the public intelligent young men who are well trained in the fundamentals of medicine, who are completely familiar with the public health hazards of unsafe food, and who can apply the rules of sanitation to food technology.

In summary the following items must be emphasized:

1. We are emerging upon a broad new era of public health in which the part of Veterinary Medicine is clearly recognized.

2. Numerous young men will return from army life who are trained and qualified to extend the service of veterinary public health to all citizens.

3. Federal and State legislation with the essential financial aid must be obtained
to continue for all our citizens the type of work done by the Veterinary Corps of the army in food sanitation.

4. The value of this service must be acknowledged and included in organized public health agencies.

5. Veterinary Medicine as a profession must accept her public health responsibility in all phases of professional activity.

6. Educational facilities must be provided whereby graduates in Veterinary Medicine may become better qualified to take their place in this broadened public health field.

By fulfilling these objectives the scope of Veterinary Public Health in the Post-war World will be defined clearly and will contribute more abundantly to the welfare of man.
REPORT OF COMMITTEE ON MEAT AND MILK HYGIENE


During the past year, due to the great demand for dairy products and meat products, inspection work has taken on quite a different aspect. It has been necessary in many instances to allow the use of lower grades of milk in the higher channels, which under ordinary conditions would not be allowed, and apparently this condition may prevail throughout the coming year.

As to meat and meat products, great advances have been made in inspection work as inspection has been instituted on a higher plane in areas where inspection was not carried on heretofore. Your Committee strongly recommends that the gains made in meat inspection endeavors be continued rather than allowed to deteriorate at the war's end, and that milk inspection be restored to its previous high plane, or higher, as soon as it can economically be done.

Appreciating that the consumption of food commodities is in direct proportion to the high quality thereof, it is thought that inspection contributes not only to the health and welfare of the consuming public, but also to the economic welfare of the industry involved.
REPORT OF COMMITTEE ON POLICY


Your committee on Policy has not received any requests or recommendations from members for any change in Policy of the Association as heretofore established. Your committee recognizes we are living in times of an evolutionary nature and at this time recommends that the Policy of the Association remain status quo.
MASTITIS PANEL

THE CHAIRMAN: Dr. Ralph B. Little, Rockefeller Institute, Princeton, New Jersey. This committee has been appointed by the Association to answer questions which I will assign to them, regarding various phases of the mastitis problem. This committee consists of men who are engaged in the study of some particular aspect of the mastitis problem. After the discussion is completed, questions from the floor will be entertained, and the committee will be only too willing to remain until six o'clock or later if you are interested in the subject.

Before proceeding with the program, I desire to introduce the various members of the panel.

The panel members were introduced as follows:

Dr. C. S. Bryan, Michigan State College, East Lansing, Michigan
Dr. P. H. Phillips, University of Wisconsin, Madison, Wisconsin
Dr. R. A. Hendershott, New Jersey State Bureau of Animal Industry, Trenton, New Jersey
Dr. G. H. Hopson, The DeLaval Separator Company, New York, New York
Dr. O. W. Schalm, University of California, Berkeley, California
Dr. Charles Palmer, University of Delaware, Newark, Delaware

THE CHAIRMAN: Dr. Hopson, is mastitis of economic importance to the dairy industry?

Dr. Hopson: Mastitis is no doubt the cause of the greatest losses in the dairy industry. If the actual loss in dollars could be estimated, the resulting figures would be staggering and incomprehensible.

I would like to quote from a recent talk given by Dr. Alberts of the University of Illinois: "During the first month of the Illinois mastitis program, a survey of 300 cooperating herds which included over 6,000 dairy cows, revealed that 99 per cent of the herds and 40 per cent of the cows harbored streptococci usually associated with chronic mastitis. The figures of losses based on an estimate of 25 per cent infection and a decrease of 20 per cent in milk production on 1,100,000 dairy cows in Illinois, would show an average decreased production of 265 lbs. of milk per cow, or approximately 290 million pounds per year. The monetary loss figured at $7.50 per cow would be $8,000,000 per year for the dairy industry of Illinois. The loss for the national dairy industry can be compared accordingly."

I am going to ask Dr. Palmer what method of diagnosis should be recognized as the standard method in the diagnosis of mastitis.

Dr. Palmer: Evidence is accumulating that mastitis caused by Streptococcus agalactiae can be controlled and eradicated, yet some of the cows that are infected with this organism do not show clinical evidence of the disease. Therefore we need a highly accurate test to detect the infected animals.

The tests most commonly employed are the Hotis test, the microscopic or breed
smear, and the so-called blood-agar-plate test. Not a great deal of critical work has been done to evaluate these tests. Miller reported the Hotis test to be 85 to 90 per cent as effective as the blood-agar-plate, for \textit{Str. agalactiae}, and only a small per cent of the samples with \textit{Str. dysgalactiae} and \textit{Str. uberis} are positive by the Hotis test. He states that \textit{Staphylococcus aureus} is readily identified by the Hotis test.

In our laboratory, Biddle made a comparative study of the three tests. He found that the blood-agar-plate is 26.82 per cent more efficient than the Hotis test, and about 9.74 per cent more efficient than the breed smear in detecting \textit{Str. agalactiae}. The blood-agar-plate may fail, however, when only a few organisms are present, but this can be overcome by retesting. Furthermore, Biddle found that the Hotis test and the breed smear are of limited value in detecting organisms of mastitis significance other than \textit{Str. agalactiae}, and that the Hotis test and the breed smear give an appreciable number of false positive reactions.

In view of the importance of this question, more work should be done on this subject, and I believe this committee should make a study of this problem.

The Chairman: Dr. Schalm, to what extent should we depend upon the microscopic test in the diagnosis of mastitis?

Dr. Schalm: The microscopic examination of stained smears of incubated milk is an efficient method for demonstrating the presence of streptococci, staphylococci, and leucocytes. However, it is not possible to distinguish between \textit{Str. agalactiae} and other species of streptococci on the basis of morphology in stained smears of milk. This is a serious weakness of the microscopic method, for several species of streptococci are encountered in milk samples. The microscopic method should not be the sole test used in the diagnosis of mastitis.

The Chairman: Dr. Schalm, what place has the Hotis test in the diagnosis of mastitis?

Dr. Schalm: The Hotis test consists of adding a small quantity of a .5 per cent aqueous brom-cresol-purple solution to milk samples and incubating them from 16 to 20 hours at 37°C. The formation during incubation of adherent yellow spots on the sides or bottom of the vial and/or the occurrence of an adherent yellow sediment, are changes which are highly specific for \textit{Str. agalactiae}. These changes have been observed to occur in approximately 85 per cent of milk samples containing this pathogen.

\textit{Str. dysgalactiae}, \textit{Str. uberis}, and saprophytic streptococci have been known to produce yellow adherent spots or sediment in from only 10 to 17 per cent of the samples containing these organisms.

Staphylococci may cause certain changes in the Hotis test, but they are not produced with sufficient regularity to be of value. No information relative to the leucocyte count can be gained from the Hotis test. However, smears for microscopic examination can be prepared directly from the Hotis test samples. Through a combination of the Hotis and microscopic tests it is possible to distinguish presumptively between \textit{Str. agalactiae} and the other species of streptococci, and information relative to the occurrence of staphylococci and leucocytes is also obtained.

We therefore recommend that for field work, for rapid diagnosis, a combination of these two tests should be used.
THE CHAIRMAN: Dr. Hendershott, is it practical for the practitioner to endeavor to conduct tests for mastitis?

DR. HENDERSHOTT: Some of our practicing veterinarians indicated that they are making an endeavor to utilize the microscopic examination of stained milk film. They have their kitchens as laboratories, or some enjoy a large enough dairy practice so that they may employ a technician to conduct these tests for them in their establishments.

Generally, however, the farm veterinarians are entirely too busy to devote their time to technical tests of this nature. When they do so they are pretty much limited to the stained, incubated milk film, and as Dr. Schalm has pointed out, this falls short of providing the necessary information required to guide the veterinarian in the proper treatment that must be applied to infectious mastitis.

Other than this, the veterinarian has at this command, the method of making a physical examination of the udder of the cow, which of course obviously does not provide any bacteriological knowledge. In addition to that he may use the brom-thymol-blue test, which is simply an indication of acidity or alkalinity.

It is our feeling that this necessary service should be provided, either by commercial laboratories or preferably, I believe, by the government-owned laboratories so that the veterinarians in the field of private practice may be in a position to have definite information supplied them with regard to the bacteriological flora of the udders of the cows that they have under treatment.

THE CHAIRMAN: Many veterinarians are of the opinion that all cases of streptococcic mastitis are due to Str. agalactiae. There are other forms of streptococci which are important—possibly not equally important, but very important, nevertheless.

I am going to ask Dr. Palmer to tell us how important are streptococci other than Str. agalactiae as a cause of mastitis.

DR. PALMER: Eighty to 90 per cent of the cows infected with streptococci are infected with Str. agalactiae. The remainder are grouped in Lancefield's serological groups, A, C, D, E and G. That is quite a group, it being found that about 80 per cent are Str. agalactiae, 10 per cent Str. uberis, 8 per cent unidentified streptococci, 1 per cent Str. fecalis, and less than 1 per cent Str. dysgalactiae.

In our laboratory we find about 90 per cent are infected with Str. agalactiae, 2 to 3 per cent with Str. dysgalactiae, 2 to 3 per cent with Str. uberis, 1 to 2 per cent with Lancefield groups G and D, and less than 1 per cent with Lancefield group A. These general averages, although significant and important when considering the problem as a whole, may not apply for individual herds. For example, in one large herd tested in our laboratory all streptococcic mastitis cases were found to be infected with Str. dysgalactiae (Lancefield group C).

The question of the kinds of streptococci present in the herd is important from a control and eradication standpoint. It also explains in a great measure the clinical variations observed in different herds and in individual cows in the same herd. In herds where Str. agalactiae (Lancefield group B) only is found, the chances of controlling and eradicating the infection are quite favorable. As the cow is the chief reservoir of this organism, successful treatment or removal of the infected animals from the herd will control the infection. Infection with the other Lancefield groups
is usually more difficult to control, as these organisms may originate from sources other than the cow (other animals and human beings). In herds that are free of *Str. agalactiae* it is not uncommon to encounter occasional cases of streptococcic mastitis caused by other streptococci.

Clinically it is not possible to differentiate between mastitis caused by Lancefield group B (*Str. agalactiae*) and the other groups. As a general rule, *Str. agalactiae* causes a low-grade infection, producing subclinical or chronic mastitis, acute cases being the exception rather than the rule.

The other groups, A, C, D, E and G, may cause subclinical or chronic mastitis, but very often they cause an acute form of the disease accompanied by a rapid course and severe udder damage. This is true especially of groups C, (*Str. dysgalactiae*), E (*Str. uberis*) and G, streptococci.

From an epizootic standpoint there also is a difference. *Str. agalactiae* often spreads rapidly through the herd, whereas the other streptococci are more prone to spread slowly and produce sporadic cases of disease.

**The Chairman:** Dr. Palmer, how important are staphylococci in mastitis?

**Dr. Palmer:** *Staph. aureus* is a parasite living upon the skin and mucous membrane. It is frequently found in the teat duct and lactiferous sinus, where it may be present in large numbers. Some cows with apparently normal udders may be shedding large numbers of *Staph. aureus*.

Whether or not this organism produces mastitis depends upon whether or not it is a pathogenic strain. It is possible to divide this organism into two groups, A and B, the A being the pathogenic strain. These pathogenic strains are important because they produce a variety of toxins. Just how many is not exactly known; five or six have been described. The most important is the lethal toxin, which is capable of causing sudden death. We sometimes see mastitis accompanied by sudden death of the animal.

There are two hemotoxins, alpha and beta. The dermatoxin is quite important in mastitis, as it produces necrosis and the gangrenous mastitis we see is usually due to this toxin. It also produces fibrinolysin, leukocidin and the enterotoxin, which is of interest since it causes gastroenteritis or what is more commonly known as food poisoning in man.

There is no sharp line of demarcation between these two groups. Perhaps the most valuable tests for detecting the pathogenic strains is the coagulase test. Whether or not the non-pathogenic strains produce irritation is somewhat debatable. Many believe that these so-called non-pathogenic strains are capable of setting up a mild irritation leading to a chronic form of mastitis indistinguishable from that caused by *Str. agalactiae*.

From a practical standpoint in the diagnostic laboratory we believe that cows shedding *Staph. aureus* should be tested by the coagulase test, and in addition to the animals producing this type of organism, those shedding large numbers of the non-pathogenic strain should be treated.

**The Chairman:** In some sections of the United States veterinarians are being called in to treat cases of mastitis in goats. I would like to ask Dr. Bryan if mastitis is a problem among dairy goats.

**Dr. Bryan:** I might counter with a question, by asking, why limit it to goats?
Any animal having a mammary gland is subject to inflammation of that gland, and the goat is no exception.

By appropriate methods we have found that infectious mastitis does exist among our dairy goat population, but in a much lower percentage than among our dairy cattle.

**The Chairman:** Dr. Bryan, are the control methods which are so satisfactory for the control of mastitis in cattle, workable in goat herds?

**Dr. Bryan:** Actually the same stable management and milking procedures that are valuable in the control of infection of cattle are equally efficient in handling the situation in goat herds, and I would caution again in goats, as in cattle, that an early diagnosis is most important.

**The Chairman:** Dr. Schalm, what is gangrenous mastitis?

**Dr. Schalm:** Recent studies on several natural cases of gangrenous mastitis occurring in widely separated areas in California have revealed that a toxicogenic strain of *Staph. aureus* was the primary etiological agent. The disease has been reproduced successfully in three lactating cows with pure cultures of staphylococci injected into the teat canal. The same cultures, however, failed to produce gangrenous mastitis in two dry udders.

The gangrenous process is the result of injury to the vascular system. The lactating udder is more vascular than the dry, and it is probable that this difference renders the lactating udder more vulnerable to the development of a gangrenous process in the presence of an active *Staph. aureus* infection.

*Staph. aureus* occurs quite commonly in certain dairy herds. The infections are persistent and, as a rule, cause a mild form of mastitis. This organism has been isolated from udders giving visibly normal milk and, when introduced into the teat canal of another lactating udder, gangrenous mastitis resulted. This suggests that the strains of *Staph. aureus* commonly found infecting the bovine udder are capable of causing a gangrenous mastitis if circumstances favor their rapid multiplication within the udder.

**The Chairman:** Dr. Phillips, what nutritional factors have been found to be associated with the development of mastitis?

**Dr. Phillips:** The relationship of nutrition to mastitis is an unknown factor. Most of the work that has been done has been largely on the biochemical aspects of the milk produced. There are two or three factors, however, which indicate that they may be associated with mastitis.

In mastitic milk there is a sharp decrease in ascorbic acid, and we have found in our laboratory that ascorbic acid is associated very closely with infections in the bovine. So I feel that this factor may be one of the things that is involved in the flareup of mastitis. It is one of the nutrients or nutritional elements or factors which is necessary to combat infection. It is as much in the picture as vitamin A. Vitamin A itself may be involved, since carotene in vitamin A is sharply increased in mastitic milk.

Then there is the age-old question and problem of heavy feeding. I don’t think this means necessarily protein, but just heavy feeding, whether it be heavy grain or heavy protein. I think we can sum it up by saying heavy concentrate feeding.
THE CHAIRMAN: Dr. Phillips, what nutritional investigations are under way or could be formulated to help prevent or control mastitis?

DR. PHILLIPS: One of the interesting experiments that is now under way, to my knowledge, is the experiment at Kansas State College, where they are planning a definite investigation of the relationship of vitamin A to the mastitis problem. They have a very serious problem in their herd, and they are dividing the herd into two groups, one a control group and the other group will receive vitamin A in large amounts. They are feeding 1,500,000 units (if I am correctly informed) and this should yield, at the end of a year, considerable information on the role of vitamin A in the production or prevention of mastitis. That should answer the vitamin A question.

There is a big field of opportunity to check this ascorbic acid relationship to mastitis. I think those are the two most interesting developments at the moment.

In Wisconsin, some few years ago, we did try to see what we could do to relate mastitis to the hydrogen ion concentration of the gland, but without success. It seems to have had no value. I think we need to undertake an investigation on the relationship of corn or other heavy concentrates in the ration of cattle, and its role in the production of mastitis.

THE CHAIRMAN: In some dairy sections in the United States it is a common practice to milk cows prior to parturition. It is supposed to reduce the edema and control mastitic infections. Dr. Hopson, is it necessary to milk cows prior to parturition in order to maintain healthy udders?

DR. HOPSON: The udders of some cows become so congested before parturition that they never regain their normal pliability. Some dairymen are satisfied that preparturition milking acts beneficially in maintaining udder health. Others express assurance that udders susceptible to breaking away will benefit by this practice. Prepartum milking is not a common practice as yet among dairymen. In general the limited number of dairies following this practice are satisfied that reasonably satisfactory results are obtained. Some research is now being conducted, with special note being taken as to the effect on the cows and the bacteriological picture of the milk.

THE CHAIRMAN: Dr. Hopson, what effect does the new, modern method of rapid milking have upon the health of the udder?

DR. HOPSON: “Better milking,” commonly called “fast milking,” definitely favors udder health. This method of milking completely cooperates with the normal functioning of the milk secreting gland. It consists of proper preparation of the udder, with immediate and complete emptying of the gland.

Proper preparation consists of wiping and massaging the udder with clean towels which have been immersed in hot water of 130°F. until complete “let-down” occurs. This condition is manifested by the udder and teats becoming suddenly distended, due to milk being ejected into the lower gland and teat sinuses as a result of the intraglandular pressure. It is then the appropriate time to perform the milking act, completing it as quickly as possible.

The milking act should continue only as long as there is a flow of milk. Nature has intended that the udder and teats should withstand a certain normal amount
of strain from the nursing or milking act; however, they cannot withstand the abuses that they are subjected to by many milking practices.

There is no doubt that a large percentage of all dairy cows are milked with little or no preparation. The milking act is commenced before “let-down” and continued long after milk has ceased to flow from the udder. Both manual and mechanical milking operations are equally guilty in this alarming situation.

Ten to 15 inches of vacuum applied to the teat during the milk flow will cause no harm. However, when the flow of milk ceases, the continued exposure of the teats and gland to vacuum cannot be considered beneficial. The same is true in the case of continued hand milking, by rubbing the mucous membranes of the teats together after the teat sinuses have been emptied. These practices, carried on over a period of weeks and months, not only cause tissue changes in the gland, but seriously interfere with the normal physiological processes of the udder, ultimately resulting in lowered production, shorter lactation period, and unhealthy udders.

THE CHAIRMAN: Dr. Hopson, is it necessary to handstrip cows in controlling clinical mastitis?

DR. HOPSON: No, it is not necessary to strip all mastitic cows by hand; they may, in many instances, be machine-stripped. Hand-stripping of cows with clinical mastitis does, however, make the caretaker more conscious of the fact that he is dealing with abnormal udders, and he will perhaps give such cows more individual attention.

“Stripping” is a word of broad meaning among dairymen. It is usually thought of as removing the residual milk in the udder by hand. While others remove the residual milk by assisting the machine and do not associate the act as stripping, it is, however, machine-stripping.

Distinction should be made between incomplete milking and normal strippings. If an animal gives more than .5 pounds of strippings it should be considered as incomplete milking—the causes of which may be listed under three general headings: anatomical, pathological, and physiological.

The first condition, in some individual cases, may be corrected by surgery, such as abnormally tight streak canals. The third condition in a large majority of cases may be corrected by instigating better milking practices.

Field observations definitely support the view that if .5 pounds or less of milk is left in physically normal udders, even though Str. agalactiae and staphylococci are present in the udder, it does not necessarily cause clinical symptoms to appear. However, field observation does support the view that if larger quantities of milk are left in the udder with infected glands, it will aggravate the infection, resulting in clinical mastitis.

THE CHAIRMAN: Dr. Schalm, do you consider that milking without stripping is a safe procedure in mastitis?

DR. SCHALM: It is, providing the udders are free from infection with pathogenic bacteria. However, if cows are infected with Str. agalactiae and as little as a quart of milk is left regularly in their udders, the disease in many cases may become aggravated.

The highest incidence of infection with Str. agalactiae is found among the older
cows, and it is also in this group of animals that incomplete milking is most likely to result when rapid milking, without stripping, is first introduced into a herd. Dairymen should proceed with caution when a change to rapid milking without stripping is contemplated in mastitic herds. It is advisable to first initiate a mastitis control program and limit non-stripping to the clean cows.

**The Chairman:** Dr. Hopson, does irritation at the end of the teat, caused by certain milking practices, have an important bearing upon infection entering the teat canal?

**Dr. Hopson:** Irritation of the teat end invariably results in infection traveling up the teat canal. Excessive vacuum or prolonged milking acts by use of the mechanical milker, or by overly harsh and severe hand milkers, will cause a congested and irritated condition of the teat. This usually leads to a thickening of the teat meatus, resulting in a stenosis with pain at milking time, causing, in many instances, improper "let-down" and incomplete milking. This condition, in turn, may aggravate a latent infection already existing in the quarters, causing an active clinical case of mastitis.

More significance should be placed on the teat meatus in its relation to udder health. Each teat has a sphincter muscle at the end of the teat. The part of the teat canal that passes through the sphincter is known as the papillary duct or streak canal. This sphincter muscle and canal prevents the milk in the udder from escaping, until milking commences. The sphincter muscle also tends to prevent bacteria and other foreign material from entering the gland.

It is only reasonable to assume, then, when this protecting door is damaged, that sooner or later infection of the gland will be the result. The vast majority of dairymen give a history of "spider" on the end of the teat as the predisposing factor to infected quarters.

**The Chairman:** Dr. Hopson, can it be definitely proven that dipping of the teat cups between cows is beneficial in mastitis control?

**Dr. Hopson:** No, I do not believe it can be definitely proven. However, you learn much in the field, and wherever you see mastitis under control the farmers are usually dipping the teat cups. Special mention should be made that, when cleaning the teat cups, the milk cock in the milker unit should be left open. Many dairymen go through this operation, but forget to keep that cock open, so that the water and sanitizing solution does not get up into the teat cups.

Some criticize this suggestion due to the fact that the water is not changed frequently enough. I believe if the farmer will carry it out he will get results.

**The Chairman:** The next few questions concern the treatment of mastitis. The first one is: What constitutes a recovery following treatment? This is a debatable and most important question which I am going to ask Dr. Bryan to answer.

**Dr. Bryan:** I'll try. (Laughter) All too often, I think, people assume that all mastitis is caused by infection. This is unfortunate. As far as infectious mastitis is concerned, we usually consider recovery as constituting, first, destruction of the infectious bacteria; second, the production of normal milk.

In this respect one must remember, however, that any and all damage that was done to the udder will remain in the form of fibrosis, which is evidence of previous trouble there. That cannot be avoided.
THE CHAIRMAN: Dr. Schalm, what results can be expected from 5 per cent silver oxide-in-oil when used as a dry cow treatment?

DR. SCHALM: Silver oxide-in-oil, or so-called colloidal silver oxide, is the most irritating of the chemotherapeutic agents commonly used for direct injection into the udder, and therefore it is not the treatment of choice for use on lactating cows. It has, however, proved useful in treatment of the dry udder, and in our experience a greater number of cures followed a single injection of silver oxide in oil into all quarters of each udder than a single treatment with any of the other chemotherapeutic agents.

The probability of producing a cure is influenced by the length of time elapsing between treatment and calving. Thus, twice as many cures have been obtained when 30 to 60 days have elapsed between treatment and calving than with cases treated within the month of calving. It is desirable, therefore, to plan at least an 8-week dry period, and administer the injection as soon as possible after milking has been stopped.

The use of silver oxide-in-oil in the dry udder is not without danger of producing a permanent injury from chemical irritation, for approximately 4 per cent of the quarters treated have developed teat strictures. However, in a badly infected herd the benefits derived from silver oxide treatments will justify the minor losses experienced from teat occlusions.

Studies on production in the lactation following treatment with silver oxide in mineral oil have shown great variation among individual cows; but on an average milk flow increased when a cure resulted.

THE CHAIRMAN: Dr. Palmer, what results can be expected with sulfanilamide-in-oil in the treatment of streptococcic mastitis?

DR. PALMER: The therapeutic value of sulfanilamide in streptococcic infections is determined by three factors: First, the concentration of the drug in the tissues; second, body temperature; third, the susceptibility of the invading streptococci to sulfanilamide.

The concentration of the drug required for the destruction of *Str. agalactiae* at 37°C is .1 per cent to 1 per cent, depending upon the strain of the organism. When the drug is administered by way of the mouth, the limit of tolerance of the animal for it is a blood level of 20 milligrams per cent (.02 per cent). At body temperature (37°C) sulfanilamide in a concentration of 20 milligrams per cent has no bactericidal power against *Str. agalactiae*. However, at 40.5°C most strains will be destroyed.

Satisfactory therapeutic results may be expected in treating cows with streptococcic mastitis when the drug is administered by mouth if the animal has a temperature of 40°C or higher. As most cows infected with *Str. agalactiae* have a normal body temperature, sulfanilamide via the mouth is of little or no therapeutic value. When the sulfanilamide is introduced directly into the udder, it is possible to build up in the mammary tissue a concentration of the drug great enough to destroy many of the invading strains of streptococci.

The invading streptococci show marked variation in their susceptibility to sulfanilamide. Some strains are easily killed, whereas other strains are “drug-fast,” or drug tolerant. About 10 per cent of the strains of *Str. agalactiae* (Lancefield group B) are “drug-fast.” Most strains of *Str. uberis* are readily killed. The strains of
group C (Str. dysgalactiae) associated with acute cases of mastitis are readily destroyed, whereas those associated with chronic mastitis are usually "drug-fast." Group D organisms (Str. fecalis) are very frequently "drug-fast."

The elevated body temperature frequently associated with acute mastitis is favorable to sulfanilamide therapy. The drug resistance of the infecting strain of streptococcus is a very important factor in determining the success of the treatment. In Str. agalactiae infection cures up to 90 per cent may be expected when sulfanilamide is injected into the udder in therapeutic doses.

Animals with acute mastitis and infected with Str. uberis and Lancefield group G streptococci usually respond well to treatment, whereas chronic cases do not. Animals infected with Str. fecalis do not respond well to treatment. In critical experiments conducted in this laboratory intramammary injections of sulfanilamide-in-oil destroyed the infection in 94.7 and 96.6 per cent of the infected quarters. Multiple injections gave better results than single injection.

Swett et al. report sulfanilamide preparations cleared the infecting organisms from 80 per cent of the quarters containing streptococci, 90 per cent of the quarters containing staphylococci, 55 per cent of the quarters containing Pseudomonas aeruginosa, and 83 per cent of the quarters containing coliform bacteria.

The Chairman: Dr. Bryan, what results can be expected from various tyrothricin preparations in the treatment of lactating and dry cows?

Dr. Bryan: When udders of known injection (and I want to emphasize that) are treated with sufficient (and I also want to emphasize that) amounts of tyrothricin, we can expect about 90 per cent recoveries providing the scar tissue present is not excessive in amount.

If there is a moderate fibrosis of the udder, the chances of recovery are less. It is my experience that if there is marked fibrosis or induration of the udder, it is better not to treat them. Very few if any of these cows recover.

In so far as the time of treatment is concerned, I myself prefer to treat them during the end of the lactation period. This allows a confirmation of the freedom from the disease before they go dry, and I prefer that.

On the other hand, treatment during the dry period is also satisfactory. When lactating animals are treated, it is essential to warn the owner of the possible decrease in milk yield and the production of abnormal milk that may occur for varying periods of time.

The Chairman: Dr. Palmer, will penicillin prove to be more efficient than other agents in the treatment of mastitis?

Dr. Palmer: Penicillin has not been available for experimental study. However, some work has been done of a preliminary nature which is quite encouraging.

Using the crude filtrate, we treated 14 cows infected in 23 quarters with Str. agalactiae, of which 21 were cured, or 90 per cent; in 13 cows infected with Staph. aureus, of 27 quarters treated, 16 or 60 per cent were freed from infection.

These crude filtrates, however, are not very satisfactory. With the purified product we have treated 22 cows infected with staphylococci and various types of streptococci, with quite encouraging results. These results are so encouraging that I think this research should be continued.

One of the important factors in the use of penicillin is the expense item, the cost of the product. This has been reduced considerably since it was first put on the
market. I understand the government is now paying $19.50 for 1,000,000 units. It is sold to hospitals for about $35 to $40 a million units, and if the price comes down to around $30 per million units it is quite likely it will prove practical to use in mastitis.

However, the dosage for treating cows infected with mastitis has not been ascertained. It is quite probable that a larger dose will be needed for *Staph. aureus* than for streptococcal infections.

**The Chairman:** Dr. Schalm, what practical recommendations should a veterinarian make to a farmer for the control of mastitis?

**Dr. Schalm:** In brief I have outlined eight points:

1. Feed calves pasteurized milk and prevent them from suckling each other’s teats.
2. Heifer calves, properly raised, will be free of infection with *Str. agalactiae* when they mature and freshen for the first time. To keep them from becoming infected, place them at the head of the milking line. In large herds, develop entire milking strings of heifers.
3. Classify the cows as negative, suspicious or positive for mastitis, and always milk them in that order. The bacteriological tests provide the most accurate means of classification. If it is not possible to have such tests made on the herd, the cows should be classified on the basis of their past history with regard to mastitis, and on the results obtained from frequent examination of the first streams of milk with a strip cup for detection of watery milk or visible particles.
4. Do not reclassify cows on the basis of an apparent recovery, for such animals are usually still infected and are shedding pathogenic organisms in their milk.
5. Milk the positive cows by hand if feasible; or, if they are machine-milked, great care must be taken not to abuse the udder, and complete milking must be practiced.
6. Stable hygiene is important. The floor and bedding must be kept clean and dry. A generous application of superphosphate or lime on the pavement or platforms will be helpful. Do not contaminate bedding, floors or gutters with abnormal milk.
7. Institute sanitary milking practices. A complete program in this respect is as follows:

   (a) Immediately before milking each cow, wash its teats with warm chlorine solution containing about 250 p.p.m. of available chlorine, employing a separate clean cloth for each animal.

   (b) If washing of the teats prior to milking is done by the milker, this will accomplish disinfection of his hands. If, however, this task is done by another person, it will be necessary for the milker to wash his hands in chlorine water or warm soapy water before milking each cow.

   (c) When milking machines are used, dip the cups in a pail of clean water to remove the milk and then dip them into chlorine water containing about 400 p.p.m. of available chlorine before milking each cow. Renew the chlorine solution when it becomes cloudy.

   (d) Apply chlorine solution, about 250 p.p.m., to the teats after milking. Use a cupful for each udder, and discard.

8. Eliminate the infection from the herd as rapidly as feasible by (a) selling for
slaughter all cows in the advanced stages of mastitis; (b) routine treatment of the remaining infected animals. Bacteriological tests should be made on the milk after treatment to determine whether a cure has resulted.

The Chairman: Is the state government justified in rendering a service to the dairy industry in the control of bovine mastitis? Will you answer that, Dr. Hendershott?

Dr. Hendershott: Yes, it seems to me definitely that the state government is not only justified but in fact is obligated to render a service to the dairy industry in the control of mastitis, for the following reasons:

1. Mastitis definitely reduces the quality of the milk. All or practically all of the residents of the commonwealth are consumers of milk and dairy products. Any assistance rendered by the state to control mastitis therefore assists the dairyman in maintaining a quality product, which redounds to the credit of all the citizens.

2. Mastitis is recognized as the costliest disease of dairy animals. Its reduction again provides for more efficient, economic production, in which every consumer is a participant.

3. From the standpoint of state income, a government service could be well justified. Any program that assists the farmer to more efficiently produce milk will mean greater profit to the dairy farmer, and hence more income to the government.

4. Under the laws of most states, the Division of Animal Disease Control is charged with the control of all infectious, communicable diseases of livestock. Mastitis definitely falls in this category and therefore is one of our obligations.

The Chairman: Dr. Hendershott, what is New Jersey doing to assist the farmer in the control of mastitis?

Dr. Hendershott: When chemotherapy came into the picture in the matter of the treatment of infections of mastitis, and when it was known that these chemotherapeutic agents were of value for certain types of infection, it became of paramount importance that if they were to be used intelligently the practicing veterinarian should be supplied with definite information relative to the bacteriological flora of the udders of cows under his supervision.

The Bureau of Animal Industry in New Jersey had previously established a program in state-owned herds with relation to the diagnosis of infections of the udder. It was a short step for us to take to enlarge this already present program to make it available to the entire veterinary profession of the State.

We had a well-equipped laboratory; a dairy bacteriologist who had done considerable research work in mastitis, and all we needed to do was to add a few pieces of glassware, and some boxes to get the tubes out into the field, and back to the laboratory, to render a real service to the dairy industry through the Division.

We designed a tube—I have samples here, and they will be on the table when the meeting is over; I hold one in my hand now. It is a flat-bottomed vial, 160 mm. in length, 15 mm. in diameter, with a screw cap lid and a 13 mm. opening. I might say that some of our practicing veterinarians had an aversion to the 13 mm. opening at the outset. However, it does provide little opportunity for extraneous organisms to fall into the sample of milk.

We send out a set of instructions to the veterinary practitioners relative to the collection of milk samples; also, we send out this mailing box on which we have
pasted instructions relative to the way samples are to be labeled and numbered and how they are to be placed in the box.

We have designed a test chart which is available for use, and which is provided also. Udders are to be washed as indicated by Dr. Schalm, the vial is held in as near a horizontal position as possible, and by placing the screw cap lid in the palm of the hand under the little finger, one can very easily back the threads off, hold the vial in a horizontal position, and express milk into the mouth of the vial.

Having washed the udder and the ends of the teats or wiped them off thoroughly with a pledget of cotton moistened in alcohol—and for the sake of uniformity we number the quarters in the order in which you would read a newspaper were you sitting down at the righthand side of the cow, so that the left hind quarter is No. 1, the left fore quarter No. 2, the right hind quarter No. 3, and the right fore quarter No. 4, the teats are wiped off in 1, 2, 3, 4 order, and the milk samples are collected in reverse order—4, 3, 2, 1—also in going from one side of the udder to the other, one doesn't soil the end of the teat with his coat sleeve or wrist.

I might say that the tube we send to the veterinarian contains brom-cresol-purple so that all he needs to do is to withdraw milk from each quarter up to the bottom of the etched-portion of the vial. They are calibrated to hold a 10 cc quantity of milk at that point. These are then placed in the box, and the charts sent in with them and returned to the laboratory, where they are incubated overnight, and where the next day the bacteriologist makes an examination of the Hotis test, and if necessary he can film out negative or questionable samples and examine them microscopically, this will disclose leucocytes as well as type of bacteria. Where necessary, the milk is plated on ox blood-agar plate and is incubated and examined.

In reporting such a service, the test chart which is filled out by the veterinarian in sending the samples in, has a column for each quarter, and we indicate on that chart the organisms found in each quarter of the udder. Then we have a mimeographed form letter that we send out to the owner so that he feels that he too has been the recipient of a service of the Division which reads as follows:

"Dear Sir: We have today completed a laboratory examination of ______ samples of milk collected and submitted by Dr. ______ from animals in your herd. A detailed report of the result of our examination has been mailed to Dr. ________.

"We would advise that you contact your veterinarian regarding the treatment of infected animals in your herd.

"Very truly yours,
"R. A. HENDERSHOTT
"Chief, Bureau of Animal Industry"

The detailed report of our examination is sent only to the practicing veterinarian. As I stated before, we have had a program for some years in our State institutions and agencies' herds, and we have set up for them a hygiene program or a routine of milk sanitation and must be followed in the barn. I have a copy of that here as well, but since Dr. Schalm has adequately covered the subject matter (I don't know whether he had my program or not) it is hardly necessary to repeat here.

We insist that the institution provide sufficient individual towels so that one may be had for each cow at each milking. These towels are clean and placed in
either chlorinated solution, 200 parts per million, or rocral solution, 1 ounce to 4 gallons of water.

The point made by Dr. Schalm, that the milker in washing the udder of the cow does in fact unknowingly wash his hands, provides that we have clean hands milking our cows. We set up a program whereby udders are washed, and immediately the milk is removed, weighed, the next cow prepared, and in turn milked.

I am going to leave some of this material here for you men who might be interested. You can view this for yourselves. I will have a copy of the letter sent out to the heads of institutions and agencies, and a copy of the form letter which we sent out to veterinarians relative to collecting milk samples.

We advocate that the cows be examined and be stationed in accord with bacteriologic finding. Those that the veterinarian in charge of the herd feels are amenable to treatment, are treated. Those who are giving a potable milk supply, although they are infected, we permit to remain in the milking row until the dry period, at which time they are treated. Then all of our cows go into maternity stalls for freshening, and they do not leave the maternity stalls to enter the milking row until we have examined quarter samples of milk and determined the bacteriologic status of the udders, following which the animal is placed in that fraction of the herd that the examination would indicate it belongs in.

The Chairman: In summation I have a few brief remarks to make regarding the various phases of the mastitis problem.

Bovine mastitis is, without question, one of the most important economic diseases confronting the dairy industry. Although no accurate figures are available, it is apparent that decrease in milk production brought about by udder infections and the necessity of replacing infected cows with healthy stock cost the dairy industry of the United States many millions of dollars annually.

Since pasteurization of milk for human consumption is generally practiced throughout the United States, many dairymen and some public health authorities question whether or not mastitis is still a serious public health problem. I have been told by a Board of Health member that where milk is pasteurized mastitis is no longer a public health problem but rather an economic one. This is an erroneous impression, for pus cells and bacteria in mastitic milk affect its quality. While pasteurization may kill off the mastitis organisms in milk from infected herds, it does not otherwise improve the quality. For these reasons it is essential that milk for human consumption be obtained from udders reasonably free from infection, whether the milk is pasteurized or not.

During the past three or four years many veterinarians and dairymen have been led to believe that the chronic form of mastitis caused by Str. agalactiae can now be eradicated or controlled by udder therapy alone. This is unfortunate, for veterinarians and dairymen should realize the treatment is not the answer to the problem. With the use of various chemotherapeutic agents many infected udders can be salvaged and the usefulness of many cows prolonged, yet chemotherapy is not enough. The real answer to the problem is still, now as before, prevention of infection.

At present none of the chemotherapeutic agents can be regarded as a cure-all.
It is doubtful that a specific panacea will ever be developed for mastitis. The agents now available for udder medication may bring about cures in only about 50 per cent or less of the animals treated in the average dairy herd.

On the other hand, the percentage of cures will be much higher in herds in which an attempt has been made to control the infection by eliminating the acute and clinical cases: 80 to 90 per cent of the affected animals may be freed of their infections. The reason for the greater efficiency in well-controlled herds is that most of the animals presented for treatment have early or light infections which respond more readily to udder medication.

From experience gained during the years in which I have been actively engaged in the study of mastitis, I do not consider that the development of efficient therapeutic agents for udder medication is the greatest single advance in the control of this disease. I believe that the three outstanding contributions are the improvement in cultural methods for diagnostic purposes, the identification of some mastitis streptococci by serological methods, and the demonstration that herds can be freed of the chronic form of streptococcic mastitis without treatment.

Until 1933 the chronic form of streptococcic mastitis was thought to be uncontrollable, a necessary evil that the dairyman must put up with. Throughout the world infected cows were drenched and their udders infused with many different medicinal preparations, but only an occasional cure resulted. Many different control programs were instituted without in any instance developing a practical plan to eliminate the infection.

In 1933 Minett, Stableforth, and Edwards reported that when searching bacteriological tests were applied to the milk from separate quarters of individual cows and all the infected animals thus detected were either evacuated from the farm or quarantined in a separate unit, herds could be maintained free from the infection. As a part of this program it was essential that replacements to the herds be free from infection. First calf heifers, therefore, were the best source of replacement material. The experimental study of Minett and his co-workers without question was the first real demonstration that the chronic form of mastitis can be eliminated in a practical manner. Since then, Schalm in California, Plastridge in Connecticut, Hasting and Beach in Wisconsin, and I, have developed herds free from this infection by simply carrying out this plan. It is a rather expensive program when the incidence of infection in a herd is above 15 per cent.

Now, with the introduction of udder medication, it is possible to conduct a mastitis eradication program in a more practical and less costly manner. Many cows which otherwise would be eliminated from the herd at a considerable loss to the dairyman may now be salvaged through the use of chemotherapeutic agents.

In conclusion I desire to call your attention to a number of pertinent facts regarding the problem of mastitis:

1. When a definite control program is in operation for the eradication of chronic streptococcic mastitis, usually the incidence of other udder infections in the herd will be greatly reduced and the milk produced will be of a better quality.

2. Udder therapy should be employed mainly in those herds where an attempt is being made to develop a *Str. agalactiae*-free herd. In other words, chemotherapy
should be used cautiously by veterinarians only in udders suitable for treatment, in which a diagnosis of the specific infection has been ascertained by some practical test.

Moreover, udder medication should be conducted by a veterinarian. It is a surgical procedure requiring extreme care and cleanliness to eliminate the reinfec-
tion of the quarters treated. McFarlane and co-workers, from England, reported an outbreak of bovine tuberculosis that was attributed to udder irrigation. Twenty-one quarters treated the same day with the same apparatus developed tuberculosis of the udder.

3. In no instance should udder medication be administered to acute cases of mastitis, for the quarter is already irritated, and any material injected may cause further destruction of the secretory tissue. Old line treatment, such as frequent milking, purgatives, massage, and large oral doses of sulfanilamide, may be more beneficial.

4. A veterinarian should realize that in the control of mastitis very little can be accomplished by treatment or with any eradication program unless he has the full cooperation of the owner and each attendant at the dairy.

5. In regard to the treatment of the chronic form of bovine mastitis, if practitioners would give this matter their unbiased consideration they would realize that in their practice the most beneficial results from udder therapy have been rendered in herds in which a constructive eradication program has been carried out with the cultural identification of the infected animals.

The meeting is now open to questions from the floor. This is your meeting, an informal meeting, so do not hesitate to ask questions while we have this group of experts on the same program.

Microphones have been set up in the aisles, so when asking your question please give your name clearly so that the reporter can record it, and state your question so that all in attendance can hear it. In answering the questions, the speakers will be limited to five minutes.

DR. VOGEL (Ohio): May I ask what you call a good dose of tyrothricin?

DR. BRYAN: According to the work I have carried on thus far, involving several hundred cattle, in which the results of the treatment were carefully checked bacteriologically, and in herds where we were interested in getting the highest percentage of recoveries with the fewest number of treatments, which to me seems to be the practical way, 125 or more milligrams of tyrothricin per quarter were used. The same results can be accomplished by smaller amounts repeated more often.

DR. THORNTON (State College, Pennsylvania): Is it the opinion of the panel that in the herds in which you eradicated Str. agalactiae infections, organisms such as Str. uberis and other types of streptococci are also eliminated from the udder of the cow? In other words, do you have any of them left in the udder of the cow?

DR. SCHALM: It is my experience that as Str. agalactiae disappears from the herd, other streptococci such as Str. uberis, dysgalactiae, and saprophytes increase. This merely means that certain udders are susceptible to invasion by streptococci. Apparently Str. dysgalactiae, uberis, and saprophytes are numerous in the environs of the dairy farm and difficult to control. In my experience it is not possible to develop a herd free from streptococci in their udders; the streptococci other than
**MASTITIS PANEL**

*Str. agalactiae* are of little consequence but they do confuse the diagnosis unless proper tests are used. I will admit that occasionally *Str. dysgalactiae* and *Str. uberis* will cause clinical mastitis, but in my experience 80 to 90 per cent of the cows that shed these organisms are mildly infected and rarely show clinical signs of the disease.

**Dr. A. M. Quinn (Kansas City):** Often a type of acute mastitis is seen in beef cattle on the range or pasture, particularly through summer seasons, which is of a gangrenous type, often fatal, and closely resembles the description of the so-called summer mastitis so common in English herds. My understanding is that this type of summer mastitis is due to an organism, *Corynebacterium pyogenes*. Is this infection a problem in any section of the United States, and if so, what suggestions do you have?

A second question is directed particularly to Dr. Bryan: In the practical field handling of intramammary therapy is it practical to treat all four quarters, provided only a single quarter or two quarters show infection? Should all quarters be treated, or should the treatment be limited to the infected quarters only as a practical field treatment?

**The Chairman:** Dr. Bryan, do you care to answer these questions?

**Dr. Bryan:** Just the second question. (Laughter)

**The Chairman:** I will attempt to answer Dr. Quinn's first question. I do not know whether summer mastitis in beef or dairy cattle is an important problem in the United States, but it is in England. At the present time I think that in England they recommend sealing off the teats in the summertime with some antiseptic preparation. The infection is supposed to be carried by flies. This type of infection was reported from Florida. Other than that I am unable to answer your question.

**Dr. Bryan:** We have some odd herds in Michigan differing from the California herds because they have been maintained free from streptococci. In that respect, however, one must call attention to the fact that every human who handles and is around dairy cattle is virtually a test-tube of bacteria which are capable of becoming established in the udder when proper personal and stable hygiene is not enforced.

To answer Dr. Quinn's question, again from my own experience in Michigan, in the diagnosis of mastitis we find it most convenient to run our tests on a cow composite sample. When we have tested individual quarter samples and treated separate quarters, in some instances before recovery infection had spread to other quarters so that it was necessary to subject the cow again to repeated injections. Therefore I like to treat the four quarters of the cow as a unit.

**Dr. Kern (New York City):** I have been greatly interested in this discussion on mastitis because working for the dairy industry of the Dairymen's Producers' Association and 30,000 producers who produce milk for the New York City milk shed, we are vitally interested in the question.

I think I agree with the panel that mastitis, as one of my co-workers once stated, is still as much a disease of the dairyman as it is a disease of the cow. But there is one question I would like to bring forth to the panel, and perhaps some of the learned gentlemen can answer it.

As we all know, in the New York City milk shed we have subjected our dairy
herds to physical examination annually or semi-annually for several years, and I am wondering if this has any influence in controlling the incidence of mastitis in those herds?

Dr. Hopson: I do not understand just what Dr. Kern means. What significance would it have?

Dr. Kern: I mean, in view of the fact that we have made this annual physical examination of these herds, and semi-annually over a period of years, in your judgment has it had any bearing on controlling the incidence of mastitis? Maybe not so much from the treatment factor, but maybe from the standpoint of the educational factor with the dairyman himself?

Dr. Hopson: Yes, Dr. Kern, I think I can fairly well state that wherever a municipality requires an annual or semi-annual physical examination by veterinarians, the mastitis situation is definitely much better than in other municipalities or areas where it is not required.

In fact, field observations have shown that perhaps the highest percentage of incidence of abnormal milk, so to speak, would be about 3 per cent. But when you find they do not have the physical examination, it might be as high as 25, 30 or 40 per cent of the cows who are secreting physically abnormal milk. So I do believe a physical examination plays a very important part.

Dr. T. H. Ferguson (Lake Geneva): I would like to ask if any of the gentlemen have had any experience with infusing the udder with aqueous preparations of sulfanilamide?

Dr. Palmer: In our early work with sulfanilamide we used the aqueous solution. We found it rather objectionable from several standpoints. One was the large quantity of water that is necessary to get the proper amount of sulfanilamide into the udder. Second, there is a tendency for it to crystallize out and form plugs in the teats. So we soon changed to using oil, a very light grade of mineral oil, as the vehicle. We thought that was much more satisfactory than the water solution.

Dr. Caldwell (Wheaton, Illinois): No reference was made to injury excepting as Dr. Hopson mentioned it in regard to too long milking with a machine, or rough handling. I have always thought, and many do, that injury plays a large part. I would like to hear from the Chairman and Dr. Hopson also, as to what influence the stable floor might have in contrast to loafing barns.

The Chairman: I am going to ask Dr. Schalm and Dr. Hopson to answer Dr. Caldwell’s question.

Dr. Schalm: In California we do not stable our cows, so I cannot answer the question. (Laughter)

Our cows are outside all of the time except when we milk them. Our problem is that in the wintertime the cow is exposed to considerable mud, and there is considerable chapping of the teats, which of course is an injury; and we do find that there is a greater tendency for Str. agalactiae to spread during the winter months. Also, there is a greater tendency for other types of streptococci, which live normally in the soil, to occur in udders during the winter months.

I believe that is all I care to say on this question.

Dr. Hopson: I think the question by Dr. Caldwell is a very timely one. I believe that trauma or injury is the underlying cause or the exaggerating cause of
all mastitis. I think there must be some trauma there first. In other words, trauma may be divided into two kinds, mild and severe. The severe is what the farmer sees himself by the cow's teat being stepped on, or some visible evidence of tissue change, whereas the mild form may be just a gradual pinching as a cow lies down on a cold or bare floor, or something like that.

I know that in closely observing cows in milking, the first thing that is called to your attention is that a certain gland perhaps is not milking out quickly or completely. The first thing you want to look at is the end of the teat. Then, if you express it open between your thumb and finger and compare it with the adjacent teat, you will see it is slightly inflamed.

I know that a certain party in an institution told me recently that they have cut down the incidence of mastitis tremendously by just keeping closer watch of the end of the cow's teat. As soon as they notice a little bit of inflammation they inject a bit of sulfanilamide-in-oil into the teat cistern, then put oil on a clean strainer cloth over the end of the teat and attach it with adhesive tape to the hair of the udder.

Near my home a man recently sold 14 cows. He had never thought of considering what the original cause was, but today he will tell you that each one traces back to what he calls a little black speck on the end of a teat, or a "spider" or something like that. I think that is trauma or injury.

DR. CALDWELL: I just wonder if Dr. Schalm will tell us the incidence of teat injury in cows that don't go into stanchions.

DR. SCHALM: Even though our cows are in corrals, or in pasture, we do have stepped-on teats, and we have teats torn by barbed wire, and one can trace many of the cases of infection to a previous injury.

An injury of the teat merely opens the avenue for infection, but it is not absolutely necessary that a teat be injured before the organism can enter. We are often asked whether heredity plays a part in mastitis. If so, I think it is merely in the type of teat that the animal inherits from its dam. If a teat is of a nature so it can be invaded by bacteria readily, it will become infected when those bacteria are being disseminated in the herd. We milk our cows in such an indiscriminate manner that in the lifetime of practically every cow the teat will become infected sooner or later.

DR. BUTLER (Montana): Is this limited to a discussion of cattle and goats, this forum on mastitis?

THE CHAIRMAN: No, indeed.

DR. BUTLER: We have had quite a lot of trouble in range sections with sheep. It is a very serious problem both in Australia and in the western United States, and I would like to know if there has been anything new in mastitis in sheep that has been developed, either as to its cause or its treatment.

DR. BRYAN: Not that I know of.

DR. PALMER: The Chairman will have to answer that question.

The Chairman is unable to answer the question. Perhaps Dr. Schalm may have some information regarding mastitis in sheep.

DR. SCHALM: I have seen a few cases of gangrenous mastitis in sheep from which we have been able to obtain Staph. aureus, but our studies have been limited as far as sheep or goats are concerned.
DR. THORNTON: In our Department of Bacteriology—and I am just speaking for them—we have been examining sheep's milk, goat's milk, and human milk along with cow's milk, and I think I am correct in saying that they found that sheep's milk or the ewe's milk had the largest number of different types of organisms of any of the milks they examined. There seemed to be about everything in it.

DR. STARR (Virginia): I have two short questions I want to ask, one about the proper management in milking practices having to do with the severity of mastitis. Also, I believe, the Bureau recommended the use of sulfanilamide and sulfathiazole. Have any used sulfathiazole-in-oil?

DR. PALMER: The Bureau is the only one that I know of that uses it.

DR. SCHALM: I believe the question is this: What relation has improper milking practices to severity? I am convinced in my own mind that the milker determines the severity of the disease in an infected herd. The manner in which he milks his cows, I mean. Most important in my mind is complete milking. I do not mean that the milker should strip for many minutes after he removes the machine, but he must use milking practices which will remove all of the milk, not leaving more than a pint distributed throughout the udder.

I have in mind two herds, one a prison herd in which milking is carried on by inmates, and the inmates of course are under complete control. The milk is weighed at every milking, and a record is kept on the wall in the prison, and it can be readily determined whether or not a new milker entering the group is getting the milk out of the cows. I would say this herd has a very good milking program.

Another herd, which I might call herd F, is a county poor farm herd. The milkers come in from the outside. No one seems to supervise them. They go about their business of milking as they please, and that is just the way they do it.

I have immediately followed milkers in this herd to see what I could find in the udders, and in many cases I could remove as much as a quart of milk immediately after the milker had finished his cow.

In these two herds we had approximately the same incidence of infection. In a three-year study comparing the two herds, the prison herd had a total of 50 cows infected with Str. agalactiae, and the county herd had 90 cows infected.

Comparing the infected cows we find that in a strip cup analysis the well-managed herd showed only 12 per cent positive strip cup tests on the infected cows. The poorly managed herd showed as high as 45 per cent positive strip cup tests on its infected cows.

Using the brom-thymol-blue test, the well-managed herd showed 30 per cent positive tests, the poorly managed herd 60 per cent positive tests. When we compared the palpation for evidence of fibrosis, the poorly managed herd had 76 per cent infected udders, showing distinct or marked fibrosis; the well-managed herd had 46 per cent fibrosis.

When we look at the slaughter record we find that over the three-year period, in the poorly managed herd, 33 per cent of the infected cows were slaughtered because they were unable to produce milk economically, as compared to only 3 per cent in the well-managed herd.

Therefore, the milker is the one who determines how serious Str. agalactiae infections will be in a dairy herd.

THE CHAIRMAN: Any further questions?
MASTITIS PANEL

DR. ERNEST WILLERS (Hawaii): We have a problem in Hawaii that has been giving us a great deal of trouble in the last few years. It is a form of mastitis in calves and virgin heifers.

Have you gentlemen had any experience with that? We have one dairy organization that will run an average of 800 to 1,000 calves, and if they leave their calf barns at about five months of age, at six, eight or ten months of age the various quarters will break down with an infection. A true abscess does not establish itself, but infection is found there. The organisms found are just the barnyard variety. They range quite a scale in different localities, and we also have this condition in some of our range cattle.

I would like to know if you gentlemen have had any experience with that.

DR. PALMER: In the mastitis in heifers that we have studied, we have encountered chiefly Staph. aureus.

DR. WILLERS: We have found that organisms at times also, C. pyogenes in others, and again in other cases there would be a variety of organisms. The variety we find is usually in one locality, and in another locality there will be a different type of organism. But the examination externally of the animal doesn't show much difference. The pus pocket, as you might call it, will drain to the outside as a rule, open up at the side of the udder.

DR. PALMER: It is quite likely that you would find a different type of infection in different localities. In some places streptococci may be the agent.

DR. WILLERS: I am more interested in learning if you know how to control it.

DR. PALMER: We have found that in the case of streptococcic and staphylococcic infections in heifers, udder infusion is quite satisfactory, provided you can get the cases early. So often, however, they are not observed by the caretakers until a lot of damage has been done to the quarter, with the formation of fibrous tissues. When these heifers do freshen they will calve with blind quarters. But if they can be detected early, when the swelling has just started, and can be treated by intramammary injection of a suitable antiseptic, I think you can save some of them. Quite a few of the heifers we treated, when they came to milk production, were normal.

DR. WILLERS: I would like to bring out one more point. We have found in some of these animals that apparently the causative agent is cow pox. The pox will involve the base of the teat, and it will allow the infection to enter.

Have you gentlemen observed that, and will vaccination with small pox vaccine prevent it? We are going to work on that this coming year.

DR. BRYAN: I cannot answer that except to say that I think your experience would be of interest to this Association next year. However, the few (and it is relatively few) cases of mastitis in preparturient heifers that I have observed have all traced back, as nearly as I could see, to improper management raising procedures, especially allowing the heifers to suckle each other, getting some one quarter opened up and partially secreting. But my experience is very limited.

DR. WITTER (Maine): Of what value is plating the milk samples that come in through state tests, such as Dr. Hendershott spoke of, when the samples have been treated either with brilliant green as a preservative or with the brom-cresol-purple in connection with the Hotis test?

DR. HENDERSHOTT: I don't personally conduct these bacteriological examina-
tions, but the young man who is doing it seems to have no difficulty. There doesn't seem to be any inhibition, apparently, from brom-cresol-purple. Maybe Dr. Bryan will have something to add.

**DR. BRYAN:** I agree essentially. There is a slight inhibition, but we find that we can still go ahead and make our cultural examinations remembering, however, that the storage period may have been at a variable temperature; and so we have incubation and changes due to that incubation in transit.

**DR. WITTER:** Would that include the coliform organisms as well?

**DR. BRYAN:** That is right.

**DR. BILTZ (Pennsylvania):** I would like to ask Dr. Bryan to discuss barnyard seasonal variations of mastitis.

**DR. BRYAN:** I am very glad to have that question brought up, because I think very definitely the answer to our mastitis problem is one involving the practitioner and the client. I am sure also that the two must work together entirely and completely.

We have several instances where good milking and good stable hygiene were practiced, good diagnostic procedures were applied to the herd, everything ideal, and yet no mastitis was controlled until it was observed that the barnyard was in bad shape and efforts were made to remedy the situation.

As Dr. Schalm talked about winter stabling, I have come to mind some of our barnyard situation in Michigan before they freeze up for the winter. In several cases we have found that the difference between having success with these herds, as compared to no success, is about 12 or 20 loads of cinders in the barnyard. I think each herd presents so often a separate proposition, and for that reason I believe the final analysis of our mastitis work is practitioner-client relationship.

**DR. HENDERSHOTT:** I am sorry, but we are past time for the Executive Board meeting. You folks stay and continue your deliberations. I am going to have to ask that our Executive Board retire to the Chicago Room so that we can go on with our business this evening. I don't mean to interrupt this program. The rest of you continue on with it. It is very valuable, and it is our loss that we can't be here with you.

The meeting was continued but in the absence of a reporter no record was kept of further discussion.
THE IMPORTANCE OF GROUP AGGLUTINATION IN PULLORUM DISEASE TESTING PROGRAMS

BY W. R. HINSHAW, D.V.M., Ph.D. AND E. MCNEIL, Ph.D.

University of California, Davis, California

INTRODUCTION

The advances made during the past few years in the classification of Salmonella types according to the Kauffmann-White Schema have done much to clarify certain results obtained in agglutination testing programs for eradication of pullorum disease.

Kauffmann (1), Edwards and Bruner (2), and Bornstein (3) present in detail the technique and include charts showing the antigenic relationships between the various types. Briefly, the method is based on the determination of the antigenic components of the types by use of specific sera in agglutination tests. It has been demonstrated that each Salmonella has several antigenic components, each of which is capable of producing its own agglutinins when injected into animals. Furthermore, motile organisms have both flagellar (H) and somatic or cellular (O) antigens. Salmonellae have been placed in the Kauffmann-White Schema according to the O or somatic antigen content into several groups A, B, C, D, E etc. They are further classified according to their flagella (H) antigen content. Each type has a formula which gives its antigenic structure at a glance. By a comparison of the antigenic formulae of any group of cultures, one can determine if cross agglutination is likely to take place.

Table 1 presents an abbreviated classification of representative Salmonella types, which will serve to illustrate these relationships. It will be seen that the O antigens are represented by Roman numerals, and the H antigens by lower case letters and arabic numbers. Each type in Group B has at least O antigens IV and XII in common; Group C, VI in common, Group D, IX and XII in common, and Group E, III in common. Only the important diagnostic antigenic components are included in this table. Some cross agglutination may be due to minor relationships not included, and in some cases not yet thoroughly studied.

One would expect an animal infected with S. typhimurium to react to any antigen containing I IV V and XII factors or any one of these in common with others. For example such an animal should theoretically react to S. pullorum antigens since S. pullorum contains the XII factor. The degree of such cross reactions will however, depend on the amount of agglutinins for the XII factor present in the blood of the infected animal. It is apparent from our studies that only a portion of the infected animals develop enough of the XII factor to be detected by the pullorum test.

Conversely, an animal infected with S. pullorum would be expected to react to an O type of S. typhimurium antigen to the degree with which the XII factor is present. Similarly, such an animal would react to any O type of antigen containing either IX or XII factors; in fact, any animal infected with any organism containing these factors.
should react in some degree to *S. pullorum* antigens. Since *S. pullorum* is non-motile it has only somatic, or O antigens and would not be expected to react to the H antigens of any *Salmonellae*.

Because of these relationships in antigenic structure it is important that laboratories investigate the possibilities of other *Salmonellae* causing reactions in flocks of chickens or turkeys where there is a history of freedom from pullorum disease. This is especially true in organized programs where flocks are certified, since the real purpose of the pullorum agglutination test is to help diagnose pullorum disease in a flock and not merely to detect reactors. It is the purpose of this paper further to emphasize the need for investigating the cause of agglutination reactions occurring in flocks where there is a history of freedom of pullorum disease. The results of our studies on such reactions made in connection with Salmonellosis project (Hinshaw and McNeil (4) (5), and Hinshaw, McNeil and Taylor (6)) are used to illustrate this need.

### Table 1.—Examples of Antigenic Formulae of *Salmonellae*

<table>
<thead>
<tr>
<th>GROUP</th>
<th>TYPES</th>
<th>O-ANTIGEN</th>
<th>H-ANTIGEN</th>
</tr>
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<tbody>
<tr>
<td><strong>A</strong></td>
<td>S. paratyphi A</td>
<td>(I)* II, XII</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>S. paratyphi B</td>
<td>(I) IV (V) XII</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td>S. typhimurium</td>
<td>(I) IV (V) XII</td>
<td>i</td>
</tr>
<tr>
<td></td>
<td>S. california</td>
<td>IV, XII</td>
<td>g, m, t</td>
</tr>
<tr>
<td></td>
<td>S. derby</td>
<td>(I) IV, XII</td>
<td>f, g</td>
</tr>
<tr>
<td></td>
<td>S. breedeney</td>
<td>I IV, (XXVII) XII</td>
<td>l, v</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>S. cholera-suis</td>
<td>VI, VII</td>
<td>c</td>
</tr>
<tr>
<td></td>
<td>S. bareilly</td>
<td>VI VII</td>
<td>y</td>
</tr>
<tr>
<td></td>
<td>S. newport</td>
<td>VI, VIII</td>
<td>e, h</td>
</tr>
<tr>
<td></td>
<td>S. oregon</td>
<td>VI VIII</td>
<td>d</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>S. typhi</td>
<td>IX, XII</td>
<td>d</td>
</tr>
<tr>
<td></td>
<td>S. enteritidis</td>
<td>IX, XII</td>
<td>g, m</td>
</tr>
<tr>
<td></td>
<td>S. dublin</td>
<td>I IX, XII</td>
<td>g, p</td>
</tr>
<tr>
<td></td>
<td>S. panama</td>
<td>I IX XII</td>
<td>l, v</td>
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<tr>
<td></td>
<td>S. pullorum</td>
<td>IX, XII</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>S. gallinarum</td>
<td>IX, XII</td>
<td>--</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>S. anatum</td>
<td>III, X, XXVI</td>
<td>e, h</td>
</tr>
<tr>
<td></td>
<td>S. meleagridis</td>
<td>III, X, XXVI</td>
<td>e, h</td>
</tr>
<tr>
<td></td>
<td>S. newington</td>
<td>III, XV</td>
<td>e, h</td>
</tr>
<tr>
<td></td>
<td>S. senftenberg</td>
<td>I, III, XIX</td>
<td>g, s, t</td>
</tr>
</tbody>
</table>

* Parentheses indicates that the factor enclosed is variable.

### Salmonella Typhimurium Reactions in *S. Pullorum* Infected Flocks

*Salmonella typhimurium* has the antigenic formula (I) IV, (V) XII : : 1, 2, 3, and *S. pullorum* has the formula IX, XII : -- : -- (table 1). The two organisms,
AGGLUTINATION IN PULLORUM DISEASE TESTING PROGRAMS

therefore, have the factor XII in common, and one would expect some cross reactions in flocks infected with either one. Below is summarized the results obtained by us in turkey and chicken flocks with known *S. pullorum* infection histories and with *S. typhimurium*-free histories. In each instance, an initial dilution of 1–25 was used. All reactors were then reset to determine the end titer of the respective test if enough serum was available. For a detailed discussion on the technique used for making the *S. typhimurium* tests see Hinshaw and McNeil (5).

A total of 6675 birds on 13 ranches were tested in this phase of the studies and 318 (4.8%) reacted to the pullorum test. Fifty-one of the 318 (16.04%) also reacted to the somatic (O) *typhimurium* test and none reacted to the flagellar (H) test. Of the 6675 birds, 6285 were turkeys and 390 were chickens. There were 58 reactors (14.9%) in the chickens and 32 (55.2%) showed a cross reaction. Of the 260 turkey reactors, 19 (7.3%) showed cross agglutination. These results are summarized in table 2.

The 30 available titers of the somatic (O) *typhimurium* reactions due to the common XII factor in the chickens varied from 1–20 to 1–2560 with the following distribution: 1–20, 2; 1–40, 6; 1–80, 5; 1–160, 7; 1–320, 2; 1–640, 6; 1–1280, 3; 1–2560, 1. Fifteen of the 19 cross reactions in the turkeys were set to titer. Thirteen reacted at 1–20 with the *typhimurium* O antigen, one at 1–40, and one at 1–160 while the range for the pullorum titers was 20 to 160. There were no reactors to the H type antigen.

| TABLE 2.—*S. typhimurium* Agglutination in Pullorum Infected Flocks |
|------------------------|------------------|------------------|------------------|------------------|
| NUMBER OF BIRDS        | NUMBER OF REACTORS | REACTION TO S. PULLORUM ONLY | REACTION TO S. PULLORUM AND TYPHIMURUM | REACTION TO S. TYPHIMURUM ONLY | PERCENTAGE OF CROSS AGGLUTINATION |
| 6,285 turkeys.......... | 260 (4.1%)        | 241              | 19               | 0                  | 7.3 |
| 390 chickens........... | 58 (14.9%)        | 26               | 32               | 0                  | 55.2 |
| Total 6,675........... | 318 (4.8%)        | 267              | 51               | 0                  | 16.04 |

1–2560, 1. The titers to the pullorum antigen (IX, XII factors) on the 32 available tests showed the following distribution: 1–20, 2; 1–40, 6; 1–80, 5; 1–160, 7; 1–320, 2; 1–640, 6; 1–1280, 3; 1–2560, 1. Fifteen of the 19 cross reactions in the turkeys were set to titer. Thirteen reacted at 1–20 with the *typhimurium* O antigen, one at 1–40, and one at 1–160 while the range for the pullorum titers was 20 to 160. There were no reactors to the H type antigen.

SALMONELLA PULLORUM REACTIONS IN *S. TYPHIMURIUM* INFECTED FLOCKS

These studies comprise 16,854 tests in 11 flocks known to be infected with *S. typhimurium* and free from *S. pullorum*. These facts were determined by autopsy on poults and adults and by the results of the agglutination tests over a period of several years. There were 418 (2.5%) reactors. Of these, 105 (25.1%) reacted only to the flagellar (H) antigen; 162 (38.3%) only to the somatic (O) antigen; 40 (9.6%) to both flagellar and somatic; 17 (4.1%) only to pullorum antigen; 65 (15.6%) to pullorum and somatic *typhimurium* antigen; 30 (7.2%) to all three antigens. These results are summarized in table 3. Therefore of the 418 reactors 112, or 26.8%, showed some reaction to the pullorum antigen, whereas in the pullorum infected turkey flocks (table 2) only 7.3% showed a cross agglutination. This would indicate that the common XII component is more important in typhi-
murium than in pullorum infected flocks. If one excludes the 105 turkeys which reacted only to the flagellar antigen, there were 313 birds which showed somatic reactions. Since 112 showed some degree of reaction to the pullorum antigen, there was a cross agglutination of 35.8%.

The titers of the pullorum reactors may be seen in table 4. Almost half of them (44.7%) reacted only at 1–20. However, the fact that 45.3% of them reacted at 1–40 or above indicates the importance of investigating such reactors before condemning a flock on the basis of the test alone, especially if there is evidence that pullorum disease should not exist. We have a record of one bird from a pullorum-free flock which reacted at a dilution of 1–80 with pullorum antigen, but showed no reaction to either typhimurium antigen at 1–25 dilution. S. typhimurium was isolated from a lung abscess in this bird, but S. pullorum was not isolated from any organ.

Table 3.—Summary of Types of Reactions in Typhimurium Infected Flocks

<table>
<thead>
<tr>
<th>Number of Tests</th>
<th>Total Reactors</th>
<th>Types of Antigens and Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>H only</td>
</tr>
<tr>
<td>16,854</td>
<td>418</td>
<td>105</td>
</tr>
</tbody>
</table>

Table 4.—Distribution of Typhimurium and Pullorum Reactions According to Titers in Pullorum-Free Flocks

<table>
<thead>
<tr>
<th>Reactions</th>
<th>Antigens and Titers</th>
<th>Typhimurium</th>
<th>O-pullorum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>H</td>
<td>O</td>
</tr>
<tr>
<td>20 40 80 160 320 640 (Total)</td>
<td>20 40 80 160 320 640 (Total)</td>
<td>20 40 80 160 320 640 (Total)</td>
<td></td>
</tr>
<tr>
<td>Number....</td>
<td>13 42 47 35 32 1 171</td>
<td>42 112 73 51 13 1</td>
<td>292 50 32 22 8 112</td>
</tr>
<tr>
<td>Per cent...</td>
<td>7.6 25.2 27.5 20.8 18.7 0.6</td>
<td>14.4 38.4 25.0 17.8 4.5 0.3</td>
<td>44.6 28.8 10.0 7.1</td>
</tr>
</tbody>
</table>

Salmonella Derby Infection in a Pullorum Disease-Free Flock

Another example of infection due to a related type occurred in a flock of 475 turkeys which had a single reactor to the S. pullorum antigen. This flock had a history of freedom from pullorum disease, and from typhimurium infection as well. At the same time, it was also tested for typhimurium infection using both O and H antigens. The single reactor was entirely in the O phase since it did not react to the H antigens. It had a pullorum titer of 80 and a typhimurium O titer of 160. The bird was secured for autopsy, and S. derby was isolated from its intestine. Blood serum collected at the time of autopsy was tested and found to have the following titers: S. pullorum, 160; S. typhimurium O, 320; S. derby O, 320; and S. typhimurium, and S. derby H none.

S. derby has the antigenic formula I, IV, XII; fg. It has (I), IV, XII in common with S. typhimurium and XII in common with S. pullorum. This is an excellent example of why one occasionally gets a single reactor to the pullorum test.
DISCUSSION

The results recorded above were obtained by actual testing of flocks. By a study of the antigenic formula in the complete list of Salmonella types so far reported from turkeys it is evident that many more may be the cause of similar experiences. *S. panama* is a type that might well be the source of many headaches to the testing laboratory personnel. This type, originally isolated from humans, has the formula I, IX, XII; 1:v:1.5. It has IX and XII in common with *S. pullorum*. A carrier of *S. panama* would, therefore, be expected to give an almost equal titer with *S. pullorum*. It has been reported in both chickens and turkeys, and evidence is available that flocks free of pullorum disease, but infected with *S. panama* have been condemned as pullorum infected as a result of testing with *S. pullorum* antigen. In one such instance we were able to trace an outbreak to a hatchery known to have been infected with *S. panama*.

In addition to *S. typhimurium*, *S. derby* and *S. panama* it should be remembered that many others share common components with *S. pullorum*. The following types known to have been isolated from poultry share the somatic XII factor with it: *S. paratyphi* B, *S. chester*, *S. sandiego*, *S. saintpaul*, *S. california*, *S. abortus-equi*, and *S. bredeney*. The following share both IX and XII with *S. pullorum*: *S. enteriditis*, *S. dublin*, *S. berta*, *S. eastbourne*, *S. gallinarum*.

In the case of testing for *S. typhimurium* the problem becomes even more complex. *S. sandiego*, *S. california*, *S. bredeney*, *S. senftenberg*, *S. worthington*, *S. coli 3* and *S. coli 4* share one or more common somatic components. *S. kentucky* shares the specific flagellar component. *S. bredeney*, *S. bareilly*, *S. newport*, *S. give*, *S. anatum*, *S. lexington*, *S. newington*, and *S. newbrunswick* share the non-specific component designated as 1.

These cross agglutinations serve to illustrate the fact that the agglutination test is only one part of an eradication program. A thorough history of the individual flocks should be obtained by autopsy of large numbers of poults. Autopsy of suspicious reactors and of reactors felt to be nonspecific in nature is also extremely important. At least 30 of the birds in typhimurium infected flocks which reacted to the pullorum antigen would have been condemned as good pullorum reactors if the history of the flocks had not been known. It is possible also that part of the remaining 37 would have been questioned, since the *S. pullorum* titers were low and the reactions incomplete in some at a 1–20 dilution.

The use of somatic and flagellar antigens of *S. typhimurium* to check suspicious reactors to *S. pullorum* antigen in flocks which have a history of freedom from pullorum disease will often aid in arriving at a correct diagnosis. Complete titers should be determined in each case, and the interpretation based on the majority of end titers obtained, not on a single test. If a large number of H type reactors are found, one can be fairly certain that at least a mixed infection is present. We have found that it is impossible to obtain maximum results in testing flocks for Salmonellosis unless both O and H antigens are used and the combined results of both tests be considered in evaluating results.

SUMMARY

1. The common antigenic components shared by various types of *Salmonellae* are the principal causes of the cross agglutinations encountered in testing programs.
This paper presents certain reactions caused by the antigenic relationships of *S. pullorum*, *S. typhimurium* and *S. derby*.

2. Of 58 pullorum disease infected chickens, 32 or 55.2% reacted also to a *S. typhimurium* somatic antigen. Of 260 turkey reactors only 19 or 7.3% showed this cross reaction.

3. Of 418 typhimurium infected turkeys, 112 or 26.8% showed a cross agglutination with a *S. pullorum* antigen. This would indicate that the common XII component is more important in typhimurium infected than in pullorum-infected flocks.

4. In one flock a single reactor to the pullorum test was found to be infected with *S. derby*.

REFERENCES

BLUE COMB DISEASE

BY E. F. WALLER, D.V.M.

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For the past two decades the poultry pathologists of the Northeast have repeatedly encountered a disease entity of domestic chickens, and to a lesser extent among turkeys, of unknown origin. It has been referred to as blue comb, pullet disease, summer disease and several other such terms referring to the symptoms exhibited or the conditions or time encountered.

Beaudette, in 1920, first described the disease in adult fowl in New Jersey. Since that time it has been observed in most of the Eastern sea board states, in the Great Lakes area and on the Pacific coast.

In New Hampshire the number of infected flocks and the resulting mortality has definitely increased during the past two years. Investigated outbreaks are usually accompanied by one of the three following histories: (1) affects young birds of both sexes while they are still on the range; (2) affecting only pullets in production soon after they are confined to the laying pens and (3) affecting mature hens throughout the laying period. In the third group only an occasional bird is affected every few days and the disease does not reach epidemic proportions. This type is most often encountered in the winter or several weeks or months after an acute outbreak.

In young birds on the range or in broilers in confinement, blue comb may make its appearance in a number of pens almost simultaneously. The spread is very rapid. Affected birds appear listless, have a bile stained diarrhea, loss of appetite, shanks appear shrunken or withered and the comb becomes congested and cyanotic. The birds look much the same as a flock affected with acute coccidiosis or blackhead. Mortality is, as a rule, under 5 per cent but one extreme case was encountered where 20 per cent mortality was encountered in a group of 4,000 broilers.

Where the disease appears in pullets just coming into production it is not unusual for the first affected birds to be found dead rather than being observed sick. The spread from pen to pen is very rapid and usually all susceptible birds are affected in 3 to 5 days after it is first recognized. The severity of the outbreak and the number of birds lost varies greatly from one flock to another. In some we may observe only a loss of appetite, a drop in egg production and some bile stained diarrhea. At the other extreme we will observe all this accompanied by a mortality of up to 30 per cent. A number of things such as temperature and humidity, existing sanitary practices, per cent of production and feed intake appear to influence the course of the outbreak.

At the start of this work, it was decided to consider each affected flock as an individual problem. As a result of this policy we found diseased flocks presenting a part of the clinical picture of blue comb disease although the birds were actually dying of histomoniasis, subacute coccidiosis, impacted crops and non-specific enteritis.

That part of the syndrome affecting pullets just coming into production at the time of housing was chosen for study. Such pullets are in good flesh. Their comb
and wattles are cyanotic and withered. The shanks are shrunken, and withered. The feathers below the vent may be stained with fecal matter that is a sulphur-colored powder when dry. In the birds that are found dead, or die after a very short illness, the following gross pathological picture is presented. The intestine is inflamed and usually filled with bile-stained mucus with very little ingesta present. The kidneys are swollen and pale. The ureters may be distended with urates. The liver is swollen and may be studded with numerous yellow gray foci of necrosis varying in size from those just visible to the naked eye up to 1 millimeter in diameter. Several such areas may coalesce until a greater portion of one lobe appears necrotic. The blood vessels on the surface of the developing ova are injected and at times rupture, giving rise to small clots in the abdominal cavity. The lungs may be congested or contain ecchymotic hemorrhages. The heart will at times, have a parboiled appearance, in other cases it will be petechiated. The pericardial sac may contain more fluid than normal and in some cases shreds of fibrin will be in the fluid. In some of the subacute cases the pancreas has been observed to have a chalky white appearance. The skeletal musculature is redened and sticky. It has been called fish flesh because of this peculiar stickiness. The crop contents are as a rule very foul smelling and consist of considerable amounts of water. The wall of this organ shows no characteristic changes. The proventriculus may be inflamed. Needless to say, all these lesions are not found in every case. Various combinations will be found and the extent of the lesions in a given organ will vary from one case to the next.

In 1940, Jungherr and Levine published a detailed description of the histopathology of this disease. Our findings do not materially differ.

The course of the disease determines the amount and the severity of the tissue damage. In some of the cases that tend to become chronic, there may be much destruction of the normal tissue and an attempt by the body to repair it with connective tissue. This is especially noticeable in the kidneys and liver. In the kidneys hyaline casts and areas identical with those of uric nephritis are found.

A number of factors have been advanced as the causative agent of this disease. *Escherichia coli* has been isolated from the heart and liver of dead birds by various investigators. Martin, Bottorff, and Cover of this station made numerous attempts to reproduce the disease by injecting or feeding cultures of *E. coli* with negative results. Quigley in 1943 reports negative results from feeding new wheat to pullets in an attempt to produce blue comb disease or as it is called in some areas "new wheat disease." A more detailed report of this work was published in 1944. Jungherr compared experimental uremia and spontaneous "pullet disease." The two conditions have many things in common. However, it is impossible, with our present knowledge, to conceive of all affected flocks being attacked with uremia of non-infectious origin. On the other hand it is conceivable that this whole uremic syndrome might be associated with or follow an infectious condition.

At the start of this work, in 1941, numerous attempts were made to transmit the disease to apparently normal birds by the injection and feeding of tissue suspensions made from organs of birds submitted to the Poultry Laboratory of the Agricultural Experiment Station. These tissues were for the most part taken from birds that had died of the disease. None of the inoculated birds sickened.
Late in the season we encountered a flock suffering from an acute outbreak. Many birds were found dead without being observed to be sick and others were sick for only 3 to 4 hours. The flock history here was significant. This flock was made up of 10 pens containing approximately 2,000 birds. Some of the older birds had been housed for 6 weeks, some for 4 weeks and the younger ones for only 2 weeks. Ten days before the outbreak, Barred Plymouth Rock cockerels were purchased from another poultryman that had just gone through an outbreak of blue comb disease. The cockerels were placed in 4 of the 10 pens. Some of the pullets in these 4 pens sickened seven days later and the mortality was about the same in all pens. The losses were limited to these pens and did not appear in the other 6. A number of sick and dead birds were obtained. From one of the sick ones, blood was collected and used to inoculate chick embryos. Many of the eggs died from this initial inoculation but from those alive at 72 hours we obtained a filterable agent that has been carried through 260 transfers. Since then eight other isolations have been made. This virus when first isolated will, when injected into 12 to 16-week old chickens, produce sickness, but not death, in about 50 per cent of the birds. If older birds are used the number of clinical cases decreases but the severity of the symptoms increases. Such birds will show edema about the head and of the subcutis, there will be petechiation of the skeletal muscles, heart, intestinal serosa and mucosa, and of the periosteum of the flat bones. The liver and kidneys are swollen and congested and there is a catarrhal enteritis. The blood picture is characteristic and consistent. There is a marked leucocytosis characterized by a high heterophile count. The heterophiles in some inoculated birds have increased as much as 250 per cent. The lymphocytes decrease in per cent but show a slight raise in actual numbers. There is also a numerical increase in the monocytes and basophiles. The leucocytosis reaches its peak 96 hours after an intraperitoneal or intramuscular inoculation, and subsides rather rapidly, returning to about 10 per cent above normal within seven days after inoculation. If the infective material is fed it takes 5 days instead of 4 for the leucocytosis to reach its peak. The leucocytic response obtained in turkeys is greater than in chickens. Blood drawn from the inoculated turkey after 96 hours and injected into another turkey produced the same type of blood picture. This was also carried into a third turkey with similar results. Chickens will not respond to a second injection after recovery from the first one.

In the egg a rather consistent type of lesion develops on the chorio-allantoic membrane. The lesion is of one of two patterns. The most usual is a compact central lesion with one or more radiating cord-like processes. The center of the lesion may or may not be necrotic. The other type of lesion is circular as if the growth had arisen from the border of the drop of inoculum. There may be cord-like processes from this circle. Both types of lesions are accompanied by more or less edema of the membranes, a stunting of the embryos and a thinning of the yolk material. Dead embryos show hemorrhage into the skin and body cavity. Sections of the lesions on the chorio-allantoic membrane reveal a papillomatous-like process. The process involves the chorion only and the cells involved usually contain from one to many coccoid bodies in the cytoplasm. None have been observed in the nucleus.

The mortality of chick embryos inoculated at 8 or 9 days averages about 12 per
cent. This is not high and most of it may be due to mechanical injury. The inoculation of turkey and duck eggs at 12 days will produce an embryo mortality of 90 per cent beginning after 48 hours and continuing until hatching time. The greatest number of deaths come 2 to 6 days after inoculation. Lesions produced in turkey and duck eggs were similar to those in chicken eggs except that the edema was more extensive. Chicks that do hatch from inoculated eggs are what we call “wet” or “sticky” chicks. This is also true for turkey and duck eggs.

Infected tissues and infected fecal matter rapidly lose their ability to produce symptoms and leukocytic changes when stored in the refrigerator in an open container. Infected tissue stored in 50 per cent glycerine under refrigeration will be infective for at least 6 weeks. Infected chorio-allantoic membranes dried in vacuum over anhydrous calcium chloride have retained their ability to infect embryos for a year. The dried membranes are capable of producing the characteristic blood picture when injected into susceptible birds as well as producing lesions in inoculated eggs.

In an attempt to find some method of testing birds for susceptibility to inoculation, other than daily blood counts, we have used a modified agglutination technique. Killed, washed pullorum bacilli were suspended in the allantoic fluid of infected chick embryos. This fluid is collected as carefully as possible and then centrifuged to remove any red blood cells before the dead organisms are added. Apparently the organisms adsorb a quantity of the infectious agent, since, when this suspension is used as antigen with serum from inoculated birds, agglutination does take place. It has been impossible to standardize the test since there are apparently variable amounts of the agent present in the fluid of different eggs. Birds that have recovered from natural outbreaks give a much higher agglutination titre than inoculated birds do. Sera from such birds do not give a positive reaction when tested with regular pullorum antigen. Six injections of embryonic membranes into a rabbit over a 3-week period produced a titre of only 1 to 80.

Since we had found that birds injected with dried powdered chorio-allantoic membranes would react to one injection but not to a second given two weeks or more later, it was decided to use this procedure in an attempt to produce immunity against the disease. The membranes are collected 72 hours after the eggs are inoculated. Five membranes are placed in each petri dish and the dish is then placed in the refrigerator at −2°F. for 30 minutes. They are then removed and put in the vacuum desiccator over anhydrous calcium chloride. It was found that if the membranes were frozen first we did not get the bubbling of the tissues when the vacuum was produced. The dried membranes are held until 12 dishes are available.

The membranes are then placed in a sterilized ball mill which is sealed with a rubber gasket. Thirty minutes in this mill will produce a very fine red-gray powder. We have not attempted to find out how small an amount of this material is infective. We found that 5 mg. of it in 1 cc. of physiological saline solution injected subcutaneously would give the desired response and have used that quantity all through the work.

In 1942 this material was used on 2 small flocks, one in which the disease was particularly severe the previous summer and the other one was at the University.
In the birds of the first flock 250 out of 500 early pullets were inoculated and banded. All were permitted to run together. A second group of 500 pullets, 4 weeks younger, were reared on a separate part of the range. At housing time all 3 groups were more or less mixed together in the pens. Blue comb disease did appear in the 500 younger birds only. The fact that none of the older ones were affected was more or less expected. We had found in our work at the laboratory that if we placed a recovered inoculated bird in the pen with the controls, after 2 weeks none of them would respond to inoculations.

The second flock contained only 90 pullets and 6 cockerels. These were kept for 8 weeks in an isolated brooder house with an outdoor screen run. They were then divided in 2 groups and placed on clean ground, in new range shelters and with all new feeders and waterers. One pen was inoculated and one was left as a control. In feeding, the control pen was cared for first. Both groups reached production age without any evidence of blue comb disease. When they were in about 50 per cent production 16 hens and 1 cockerel from each group were housed. Three weeks later both pens were fed ground livers and intestines taken from birds sick with blue comb disease. Three days after being fed, the birds in the control pen sickened. They were depressed and had a diarrhea which contained much bile stained mucus. The feed consumption dropped about one half and egg production from 12 a day to 3. None of the birds died and after about two weeks the production was back to normal and no trouble was encountered throughout the following months. The inoculated birds were not affected by the feeding of the infected tissues.

In 1943 the program was expanded but the work was still limited to farms that had been infected for from 1 to 3 years. Five flocks were used, totalling 17,000 birds. The birds were all vaccinated against fowl pox at the same time. This saved handling the birds a second time and did not appear to affect them unfavorably. In these flocks, roughly one third of the birds were inoculated and banded. Due to a shortage of labor, and at the same time an expanded poultry population on these farms, we could not ask for separation of the two groups. On one farm however, the early hatched birds were kept on one range and the younger stock was placed on a new range some distance away. In this flock only the older birds were inoculated. Three of the five flocks did not show a single bird with symptoms of blue comb disease. In the fourth flock we found one bird dead that presented lesions grossly typical of the disease, but it had been dead too long to use for the inoculation of eggs. It was not an inoculated bird. In the fifth flock 13 inoculated birds in one range shelter sickened and 7 died in about a ten-day period. It did not spread to the other birds using the same shelter or to any of the other 1,600 inoculated birds on that range. From one of the sick birds we re-isolated the filterable agent. Tissues taken at the same time revealed the more or less characteristic histopathological picture of the disease.

Blue comb disease appeared in a greater number of outbreaks and in a more virulent form in 1943 than ever before in the State of New Hampshire. In view of the favorable, though limited results obtained in 1943 we decided to repeat the work this summer. Thus we have under supervision the same five flocks used in 1943 and seven additional ones. They make up a total of 44,000 birds. This time we inoculated every bird on the farm instead of every third bird.
Eight of the 12 farms report no trouble from the disease. One farm reported the “usual outbreak” in 1,300 birds but the report was made two months after the outbreak occurred and no birds were examined. One farm reported one case in 2,500 pullets. Another reported 18 cases over a period of 30 days out of 1,600 pullets housed and the third had 2 cases out of 3,300 inoculated birds. In the first 3 cases, the diagnosis was made on the farms by the owners from symptoms shown and without benefit of an autopsy. The fourth case was confirmed at the laboratory. This case was of more than passing interest in that the disease appeared on this farm in the first two groups of birds housed in July. We were then approached in regard to inoculating the remainder of the flock. This we did, and the two cases mentioned were in a group of pullets that were just starting to lay at that time. The losses occurred within two weeks after the birds were inoculated.

The results obtained so far are encouraging but there is still much work to be done. The number of natural outbreaks encountered in New Hampshire this year was small in comparison to 1943. We expect to inoculate a greater number of birds in 1945 if labor, funds, and travel permit.

**SUMMARY**

Blue comb or pullet disease is an important disease affecting chickens and turkeys on the Eastern seaboard.

Pullets in production and recently housed seem to be the most susceptible.

A filterable agent has been isolated from the blood and livers of acutely affected live birds.

A vaccine prepared from the dried chorio-allantoic membranes of infected embryos apparently gives some measure of protection.

**BIBLIOGRAPHY**


VACCINATION FOR PNEUMOENCEPHALITIS

By J. R. Beach, D.V.M.

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In my discussion (1) of avian pneumoencephalitis before this Association two years ago, favorable results were reported to have been obtained from preliminary laboratory experiments in vaccination for the disease. These experiments were continued with results so consistently favorable that, in the Spring of 1943 and again in 1944, field trials of the vaccine were conducted on a large scale on farms on which the disease had occurred and which were located in districts in which it had been prevalent. This paper is particularly concerned with the results of the field trials of 1944.

THE VACCINE

The vaccine is an emulsion of infected chicken embryos with formalin added to inactivate the virus and diluted with sterile saline to any desired concentration of emulsified embryo. The procedure followed in preparation of the majority of the different lots of vaccine is as follows:

Chicken embryos, 12 days old, are inoculated with the virus and incubated until they are dead. The embryos and the allantoic fluid are then removed and the former emulsified in the fluid by means of a colloid mill or an electric blender. The average yield per egg is approximately 10 cc. After removal of a small quantity for titration of the virus content, 0.4 per cent formalin is added to the emulsion and it is stored in the refrigerator. The virus has been inactivated by the formalin in 3 days, the shortest interval in which a test has been made, and the emulsion rendered bacteriologically sterile in 4 to 7 days. The concentration of virus in the emulsion before formolinizing has always been high enough to produce fatal infection in chickens, 30 to 60 days old, by intramuscular injection of 0.1 cc. of 1:1,000, 000 to 1:100,000,000 saline dilutions. Our practice has been to store the formolized embryo emulsion undiluted. As needed for use, portions of it are diluted with the necessary amounts of saline and 0.2 per cent formolinized saline to provide vaccines with the percentage of embryo desired and 0.2 per cent formalin.

LABORATORY VACCINATION EXPERIMENTS

In these experiments, chickens, ranging in age from 2 to 100 days, were given one or two injections of vaccine and later exposed to the disease by inoculation with large doses of virus or by contact with artificially infected chickens. The embryo content of the vaccines used varied from 1 to 100 per cent; the age, from 8 days to one year. The dosage was 0.1 cc., 0.5 cc., or 1.0 cc. The summarized results of the experiments are as follows:

1. Ninety-six per cent of 1,021 chickens, from 7 to 100 days old, which received two doses of 0.5 cc. or 1.0 cc. of vaccine with embryo content of 5, 10, 20, 25, 40, 50 or 100 per cent, had complete resistance to exposure to the virus by inoculation when tested in 1 to 242 days after the second dose of vaccine.
A single 0.5 cc. or 1.0 cc. dose of these vaccines immunized only half of the 202 chickens which were tested. Of those not immunized, two-thirds were fatally infected by the test inoculation and the remainder showed a high degree of resistance.

2. Two 0.5 cc. or 1.0 cc. doses of vaccine with the embryo content reduced to 1 per cent immunized 52 per cent of the chickens tested. One dose of this vaccine failed to immunize any of them.

3. Subcutaneous, intramuscular and intraperitoneal routes were found to be equally satisfactory for the injection of vaccine, and the latter was adopted for use in laboratory experiments and in the field trials described later.

4. Less than half of the chickens 2 or 3 days old vaccinated with two 0.5 cc. doses of 40 per cent embryo vaccine were refractory to inoculation with virus.

5. Not one of the chickens classed as immunized by vaccination exhibited evidence of infection from inoculation with the virus. The infection in nearly all of those not immunized terminated in death.

6. Five, 7 or 10 days were equally satisfactory intervals between the administration of two doses of vaccine.

7. Contact exposure proved an unsatisfactory method of testing the vaccinated chickens for immunity because less than half of the nonvaccinated control chickens subjected to the same exposure and in the same numbers as the vaccinated, developed clinical manifestations of infection.

FIELD TRIAL OF VACCINE IN 1943

By the Spring of 1943, the amount of data favorable to vaccination that had been obtained in laboratory experiments seemed sufficient to warrant field trials to determine the effectiveness of the vaccine against natural infection. Arrangements were made, therefore, with the owners of 20 poultry farms on which pneumoencephalitis had occurred to vaccinate not more than one-half to two-thirds of the chickens hatched in 1943 and to leave the remainder unvaccinated for controls. The total number of chickens included in the trials was approximately 50,000. The range in age of the chickens when vaccinated was from 2 weeks to 7 months. The vaccine was administered in two doses, 7 days apart. The results of the trials in only one flock will be given because either pneumoencephalitis failed to appear in the others or, for various reasons, the data obtainable were inadequate to evaluate the effectiveness of vaccination.

The one flock which yielded information consisted of 1,600 chicks, 600 of which were given one 0.5 cc. dose of 40 per cent embryo vaccine when they were 2 weeks old, and a second dose 7 days later. Pneumoencephalitis appeared among the 1,000 controls in 57 days after the date of the second dose of vaccine and 18 days later in the vaccinated group. The disease was predominantly respiratory in character but was definitely identified as pneumoencephalitis by isolation of the virus in embryo culture. The total loss from mortality and culls in the control group and vaccinated group was, respectively, 14 per cent and 9 per cent. The severity of the disease appeared to be about equal in both groups. These results show, therefore, that the chicks vaccinated when 2 weeks old were not appreciably protected against natural infection to which they were exposed 75 days later.
Additional information of value obtained from these field trials was, first, that intraperitoneal injection of pneumoencephalitis vaccine has no adverse effect on chickens as young as 2 weeks or on laying pullets; second, that vaccination with pneumoencephalitis vaccine and chicken-pox or laryngotracheitis vaccine at the same time, as was done in several instances, appears to be an entirely safe procedure; and, third, that, with adequate assistance and facilities for catching the chickens, intraperitoneal injections can be readily done at the rate of 700 birds per hour.

FIELD TRIALS OF VACCINE IN 1944

Description.—This year the field vaccination trials were restricted to the spring-hatched pullets on 7 well managed and equipped poultry farms, all in one district. The total number of chickens involved was 28,471, of which 15,170 were vaccinated and 13,301 served as nonvaccinated controls. Four of the farms had more than one age-group of pullets. Each of these was housed separately for the duration of the required period of observation and was treated as a separate flock. This gave a total of 14 flocks in the trials. With one exception (Flock 5A), the vaccinated and control groups were divided into 2 to 7 pens, which made it possible to obtain comparative data concerning different pens of the same flock as well as concerning different flocks and farms. There was a certain unavoidable mixing between pens of vaccinated and control birds in the same house. The numbers of birds were so large, it was impracticable to entirely correct this by individual examination of each bird unless they were being handled for some other purpose. It is not believed, however, that the error from this source was large enough to appreciably affect the data.

Each flock was vaccinated when 3 to 4 months old with two 1 cc. doses of vaccine, given 7 days apart. The embryo content of the vaccine was 12.5 per cent, 25 per cent, or 50 per cent and the age varied from 40 to 509 days. In no instance was any evidence of post-vaccination reaction observed.

All except one (3A) of the 14 flocks have become infected with pneumoencephalitis, the first on July 20 and the last on October 20. The diagnosis in each instance was confirmed by isolation of the virus in embryo culture. The reason for the non-appearance of the disease in flock 3A is not entirely clear, but evidence has been obtained which indicates that this flock may have had infection of a subclinical nature.

The appearance of the disease in 3 flocks was when the birds were 4½ to 5½ months old and was concurrent with or just preceding the beginning of egg production. Seven flocks were 6½ to 9 months old and had been laying for a month or longer at the onset of the disease. Evidence of infection was seen in all pens of both the vaccinated and the controls. The infected chickens in the vaccinated pens showed mild respiratory symptoms alone or in combination with depression and decreased appetite for a few days. In addition, in the majority of the vaccinated pens and in all of the control pens, there was a variable number of birds with definite symptoms of involvement of the nervous system. The loss from the disease was measured by the number of deaths it caused and its effect on egg production during 30 days following its onset.

The mortality in a pen of birds during the 30 day period preceding onset of the
The disease in most instances was less than 1 per cent and did not exceed 2 per cent. It was assumed, therefore, that practically all of the deaths that occurred during 30 days after a pen became infected were due to pneumoencephalitis.

The only information obtainable pertaining to the effect of the disease on egg production of the 3 flocks, in which infection occurred concurrently with or preceding the start of laying, was the actual numbers of eggs laid by the vaccinated and control groups. It was not possible, however, to estimate what the egg yield of either group might have been in the absence of pneumoencephalitis. The data on mortality and egg production of these 3 flocks are given in table 1.

**Table 1.—Data Concerning Field Trials of Pneumoencephalitis Vaccine in Three Flocks of Pullets in Which Egg Production Began Just Prior to or Shortly after the Onset of Pneumoencephalitis**

<table>
<thead>
<tr>
<th>FLOCK NO.</th>
<th>VACCINATED OR CONTROLS</th>
<th>NUMBER OF BIRDS</th>
<th>NUMBER OF BIRDS</th>
<th>AGE OF BIRDS</th>
<th>DEATHS</th>
<th>EGG PRODUCTION IN 30 DAYS AFTER INFECTION</th>
<th>MORTALITY AND EGG PRODUCTION IN 40 DAYS AFTER THE BIRDS BECAME INFECTED</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 C</td>
<td>Vacc.</td>
<td>3</td>
<td>960</td>
<td>3 mo.</td>
<td>1.4</td>
<td>11,854</td>
<td>12.3</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>Contr.</td>
<td>3</td>
<td>1,026</td>
<td>5.5 mo.</td>
<td>7.2</td>
<td>7,093</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 D</td>
<td>Vacc.</td>
<td>3</td>
<td>1,092</td>
<td>3 mo.</td>
<td>0.8</td>
<td>4,179</td>
<td>3.8</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Contr.</td>
<td>3</td>
<td>1,024</td>
<td>5 mo.</td>
<td>9.1</td>
<td>2,175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 E</td>
<td>Vacc.</td>
<td>4</td>
<td>1,352</td>
<td>2.5 mo.</td>
<td>1.0</td>
<td>471</td>
<td>0.3</td>
<td>0.1</td>
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<tr>
<td></td>
<td>Contr.</td>
<td>4</td>
<td>1,308</td>
<td>4.5 mo.</td>
<td>9.5</td>
<td>216</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first egg laid by Flock 1 C was 12 days before the onset of the disease; in Flock 1 D and 1 E, respectively, in 7 and 21 days after onset of the disease. The controls of Flocks 1 D and 1 E began laying as early as the vaccinated, but the rate of increase in egg production of the controls was slower than in the vaccinated.

For determining to what extent pneumoencephalitis influenced the egg yield of the vaccinated and control flocks that were laying at the time of onset of the disease, the actual egg production for a 30-day post-infection period was compared with the minimum number of eggs that the flocks probably would have laid (hereafter termed the minimum normal egg-production expectancy) during the same period if the flocks had remained healthy. The age and quality of the pullets and the time of year when they became infected were such, they could be expected to continue laying at the same or higher rate for 30 days or longer. The average daily production at the onset of the disease multiplied by 30, therefore, was considered to be a
VACCINATION FOR PNEUMOENCEPHALITIS

conservative estimate of the minimum normal egg-production expectancy for a 30-day post-infection period. The average daily egg production at the onset of the disease was the average number of eggs laid per day during a pre-infection period of that number of days which we believed would give the fairest estimate of flock performance. The choice was determined by the length of time a flock had been laying and the trend of production as shown by the daily egg record.

Effect of Pneumoencephalitis on the Vaccinated and Control Chickens.—The disease in the three flocks that became infected concurrently with the start of egg production was of a mild character (table 1). The vaccinated pens showed mild respiratory symptoms only and suffered no deaths that could be attributed to pneumoencephalitis. In the control pens, the disease was also predominantly respiratory but cases of central nervous system involvement were numerous enough to cause death of from 7.2 to 9.5 per cent of the control chickens of the 3 flocks. The appetite of the vaccinated chickens was depressed less than that of the controls and the egg production of the former was approximately twice that of the latter in 40 day period following the onset of the disease. The difference between the effect of the mild type of the disease on the vaccinated and control chickens of the 3 flocks is not great, but it does indicate that vaccination was beneficial.

The disease which occurred in the 10 flocks of laying pullets 3 to 6 months after vaccination varied from extremely mild to more severe than had hitherto been noted. The occurrence of natural infection of a severe type was fortuitous from an experimental standpoint since it provided a critical test of the effectiveness of vaccination and more marked contrasts between mortality and loss in the egg yield of the vaccinated and control groups.

The data pertaining to mortality, arranged so as to compare the total mortality among the vaccinated and control chickens of each entire flock and the pens of each flock having the highest and lowest mortality are presented in figure 1.

Some of the more significant points brought out in these data are as follows:

(1) The character of the disease among the controls of the different flocks and in different pens of the same flock varied from a mild type with relatively few deaths to a very severe type which resulted in heavy mortality. This is illustrated by comparing (a) flock 2A, in which the mortality was 3 per cent of 1,281 controls, with flocks 5B in which 75.6 per cent of 783 controls died; (b) flocks 2A and 2B, two age-groups on the same farm in which the numbers of deaths among the controls amounted, respectively, to 1.4 per cent and 29.3 per cent; and (c) a mortality of 70.4 per cent in one and 2.7 in another of two pens of controls in flock 2B.

(2) The mortality among the vaccinated portions of the different flocks varied between the relatively narrow limits of 1.4 per cent and 10.7 per cent and was uniformly less than occurred in the corresponding groups of controls. The greatest loss in any group was 15.2 per cent of the birds of one vaccinated pen of flock 3, and this was relatively small in comparison with the mortality of 81.8 per cent in a corresponding pen of controls. Infection in a vaccinated group was always manifested by respiratory symptoms. In addition, in some pens a majority of the birds showed marked depression and complete loss of appetite for a few days, but a relatively small number of them developed the involvement of the central nervous system which is responsible for most deaths from pneumoencephalitis. These
results show that vaccination, although not preventing the occurrence of the disease, enabled the chickens to withstand exposure to a highly virulent type of natural infection with relatively small loss from death.

![Diagram showing mortality from pneumoencephalitis in 30 days after the onset of the disease in vaccinated and control chickens of 10 flocks.](image1)

**Fig. 1.** Mortality from pneumoencephalitis in 30 days after the onset of the disease in the vaccinated and control chickens of 10 flocks.

![Diagram showing loss or gain in egg production from the minimum normal egg-production expectancy of the vaccinated and control chickens of 10 flocks in 30 days after the onset of pneumoencephalitis. (For method of estimating the normal egg-production expectancy, see text.)](image2)

**Fig. 2.** Loss or gain in egg production from the minimum normal egg-production expectancy of the vaccinated and control chickens of 10 flocks in 30 days after the onset of pneumoencephalitis. (For method of estimating the normal egg-production expectancy, see text.)

Figure 2 presents the data pertaining to egg production arranged to compare the loss from decreased egg yield of the vaccinated and control groups during 30 days.
VACCINATION FOR PNEUMOENCEPHALITIS

after the onset of pneumoencephalitis. These data show that the actual egg production of the nonvaccinated portions of the different flocks was 55.1 per cent to 79.7 per cent less than the minimum normal egg-production expectancy. In contrast, the maximum loss from decreased egg yield of the vaccinated portion of any flock was 28 per cent; in two flocks there was a slight gain rather than a loss in egg yield, and the decrease in egg production of a vaccinated group was uniformly appreciably less than in the corresponding control group.

It would appear, therefore, that while vaccination of these flocks of laying pullets did not prevent them from becoming infected, the depressant effect of the disease on egg production was alleviated to the extent that vaccination was worthwhile from that standpoint alone.

The Relation of Age and Embryo Content to the Effectiveness of Vaccine.—Seven different lots of vaccine were used in the field trials. As stated earlier, the age of the vaccine when it was injected varied from 40 to 509 days and the embryo content was 12.5 per cent, 25 per cent, or 50 per cent. The results indicate that all vaccines were equally effective, regardless of age or embryo content. For example, in flock 5B, in which vaccine 436 days old was used, the mortality in the vaccinated and control birds was, respectively, 3.5 per cent and 75.6 per cent. The vaccinated birds of flock 5B, which received vaccine with 25 per cent embryo content, were protected against infection slightly better than those of flock 5A in which vaccine with an embryo content of 50 per cent was used. Similar results were obtained in 2 flocks on the same farm in which vaccine with embryo content of 12.5 per cent and 25 per cent were compared.

SUMMARY

(1) This paper reports the results of extensive laboratory and field tests of avian pneumoencephalitis vaccine. The vaccine consisted of emulsions of infected chicken embryos, with formalin added to inactivate the virus, and diluted with saline.

(2) In the laboratory tests, 96 per cent of 1,021 chickens which ranged in age from 7 days to 100 days and were given two intraperitoneal injections of 0.5 cc. or 1 cc. of vaccine with embryo content varying from 5 per cent to 100 per cent, were refractory to subsequent inoculation with large doses of cultured virus.

(3) Field vaccination trials, involving approximately 50,000 chickens, which were conducted in 1943 yielded definite information concerning the effectiveness of vaccination in protecting chickens against natural infection in only one flock. This flock consisted of 1,600 chicks 2 weeks old, 600 of which were given two 0.5 cc. doses of vaccine with embryo content of 40 per cent, and 1,000 of which were non-vaccinated controls. Pneumoencephalitis occurred in the flocks 2 months after vaccination and affected the vaccinated group as severely as the controls.

(4) Field trials conducted in 1944 involved 14 flocks consisting of 28,471 pullets. Fifteen thousand, four hundred and seventy of these were given two 1 cc. doses of vaccine at intervals of 7 days, when they were 3 to 4 months old, and 13,301 served as nonvaccinated controls. Pneumoencephalitis of a severe type occurred in 13 of the flocks in 3 to 6 months after vaccination and infected all vaccinated and control groups. The vaccinated groups of chickens, however, were uniformly affected less severely than the controls. It is believed that the results demonstrate that
vaccination gave a high degree of protection against natural infection with pneumoencephalitis and from an economic standpoint was decidedly worthwhile.

(5) No difference in the effectiveness of vaccines with an embryo content of 12.5 per cent, 25 per cent, or 50 per cent was demonstrated.

(6) Vaccine was effective after storage for as long as 509 days.

(7) Further studies should be made of means by which the effectiveness of the vaccine can be enhanced to the point that it will confer complete protection against natural infection with avian pneumoencephalitis and can be used for preventing the disease in young chicks.

(8) Studies should also be made to determine if vaccination is effective for the prevention and control of pneumoencephalitis in turkeys.

REFERENCE

AVIAN MONOCYTOSIS, SO-CALLED PULLET DISEASE:

BY ERWIN JUNGHERR, D.M.V. AND L. D. MATTERSON, PH.D.

Storrs Agricultural Experiment Station, University of Connecticut, Storrs, Connecticut

During the last ten years or so pullet disease, for which the scientific term avian monocytosis is proposed here, has become the most-talked-of poultry disease in the northeastern section of the country, in spite of the scarcity of scientific reports on the subject. Although the infectious or non-infectious nature of the disease has not been determined conclusively, it is hardly possible to administer intelligently sanitary regulations for the control of known infectious and communicable poultry diseases without due regard to the existence of this mystifying condition covered by the term pullet disease. It is therefore with pleasure that the writers accepted an invitation from the Chairman of your Committee on Transmissible Diseases of Poultry to present a discussion of the present-day concept of pullet disease. The problem is not one created by the whims or idiosyncrasies of research workers, but actually exists in the midst of the country’s best poultry flocks and—due to its economic importance in both war and peace—requires intensive study and consideration. The material collected at the Storrs Station during the past fifteen years should offer a definite contribution to the pathologic definition of the disease from both the morphologic and functional points of view, with some consideration of the rational of therapeutic measures. The unraveling of the true cause of pullet disease, together with practical plans for its control, awaits further study and observation.

HISTORICAL

Without going into detailed historical reminiscences on the development of our knowledge of pullet disease, which has already been done in a previous communication (12), the following milestones may be of interest. In 1929 Beaudette (1), under the term “X disease,” briefly described a disorder of adult fowl which was characterized by cyanosis of the head, catarrhal enteritis and scattered hemorrhages on the internal organs. The disease resembled fowl cholera save for the presence of a demonstrable bacterial or filterable agent. In 1940 Jungherr and Levine (15), on the basis of nine years’ data, expressed the belief that the variable field syndrome going by such popular names as blue comb, summer-, housing-, unknown, X or XX disease represented essentially one pathologic entity which is characterized by hepatonephrotic lesions associated at times with fish-flesh-like (dystrophic) changes in the skeletal muscle and chalky appearance of the pancreas. In the same year (3) and again in 1944 (4), Bullis separated the field syndrome into two entities, namely “pullet disease” on the one hand and “unknown disease” or “blue comb” on the other; according to him the former was largely recognized by its occurrence

1 The studies of the authors have been supported in part by grants from the Eastern States Farmers’ Exchange and The Big Y Foundation.
in young laying birds, absence of natural transmission, focal necrosis of the liver, and hemorrhages, while "blue comb," which affected both sexes at almost any age, appeared to spread, and was characterized by sour crop and renal obstruction. In 1942 Waller (26) reported the isolation and cultivation of a filterable virus from chickens affected with the acute form of the disease, which observation so far has not been confirmed in the literature. Among recent contributions are featured the suggestions, a) by Selye (22) that—on the basis of the production of nephro-sclerosis in chickens by prolonged salt water feeding—excess sodium chloride may be causally related to pullet disease; b) by Quigley (19) that feeding of certain kinds of whole wheat not characterizable by chemical differences, may bring about a pullet disease-like syndrome; and c) by Scott, Jungherr and Matterson (21) that the feeding of extra potassium may be beneficial in ameliorating the after-effects of pullet disease.

OCCURRENCE

According to published reports, pullet disease seems to have been established in Massachusetts (3), Connecticut (15), New York (2), New Jersey (1), Michigan (20) and California (11); and outside the United States, in Ontario (29). Non-documented reports suggest that a similar condition occurs in most of the Atlantic seaboard states, particularly in the northeastern poultry producing centers. The disease affects primarily young sexually mature chickens and occasionally turkeys, but the age limits vary widely between about 2 and 18 months. Although all common breeds and both sexes seem to be susceptible, females of heavy breeds in the early stages of egg production are especially prone to attack. Pullet disease may occur throughout the year, but there is a definite concentration of the incidence during the warm season, with a peak (in Connecticut) in August (chart 1). Cases may occur on a sporadic endornithic or epiornithic scale, with individual cases taking an acute (2–4 days) or a subacute (5–16 days) course. No definite evidence is available as to the recurrence of the disease in recovered flocks, but successive clinical flare-ups in the same flock are not uncommon.

In view of the lack of country-wide statistics on poultry morbidity and mortality the Connecticut diagnostic data for the four calendar years 1940–43 are given for the purpose of exemplifying the incidence of the disease. Of 333 case lots of chickens 3 months of age or older received in 1940, 17 per cent were diagnosed as pullet disease; of 299 in 1941, 23 per cent; of 253 in 1942, 17 per cent; and of 269 in 1943, 35 per cent, or a four-year average of 23 per cent. The 1944 data on incidence are still incomplete, but suggest a marked reduction, as compared with those of 1943, which were the highest on record. During the four-year survey the morbidity in the affected flocks ranged from 0.1 per cent to 100 per cent, with an average of 15.4 per cent; and the mortality from 0.08 per cent to 37.5 per cent, with an average of 5.2 per cent.

Diseases of known etiology are scientifically diagnosed by the demonstration of the specific causative agent. Since the field syndrome of pullet disease is apparently not caused by a bacterial or readily demonstrable filterable agent, the recognition of functional and morphologic alterations constantly associated with pullet disease assumes paramount importance in establishing this entity. The following discus-
sion tends to point out the range of characteristic pathologic features of pullet disease, their resemblance to or co-occurrence in other well recognized diseases, and particularly the diagnostic limitations of ordinary gross pathologic and bacteriologic examinations. To assure progress it is necessary to take a critical midline course between the two perils of making "pullet disease" a diagnostic dumping ground for all unknown poultry troubles, and of being skeptical of the existence of such an entity, which attitude is definitely out of line with the experience of the poultry industry.

CHART 1. Average Monthly Incidence of Principal Diseases in Connecticut Chickens, 3 Months of Age or Older, 1940 to 1943.

SYMPTOMATOLOGY

If a considerable portion of a flock is affected, as is often the case, the signs and symptoms of pullet disease are quite definite and helpful from the diagnostic angle. The condition usually begins suddenly with anorexia often accompanied by polydipsia and whitish mortar-like or watery diarrhea. The vent feathers appear soiled and the crop is filled with doughy ingesta. The head and its appendages are cyanotic, the face hollow, and the shanks are markedly dehydrated so that the metatarsal veins stand out prominently. Severe cases may exhibit fever, gasping and trembling, the latter particularly on excitation. In laying birds there is always a marked drop in egg production of from 10 to 60 per cent, which continues for some time beyond the usual duration of the flock syndrome of 1 to 3 weeks.
(Photomicrographs of hematoxylin-eosin stained histologic sections from various cases of avian monocytosis in chickens)

Fig. 1. Liver showing a large (arrow) and a small focus of coagulative necrosis. \( \times 75 \).

Fig. 2. Pancreas showing large areas (arrow) of cloudy swelling in the acinar tissue staining eosinophilically. These changes are responsible for the grossly recognizable whitish spotting or 'chalky' appearance of the pancreas.
AVIAN MONOCYTOSIS

PATHOLOGY

Typical pullet disease-affected birds are usually in good flesh and fail to show any changes on the body surface except those noted under symptoms. The breast muscle often shows marked dehydration with ladder-like injection of capillaries or welldefined whitish "fish-flesh-like" somewhat turgid areas which, according to the microscopic picture are due to interstitial edema and Zenker's degeneration. The heart is usually in systolic contraction and shows sometimes microscopic myocardial necrosis. In acute cases the liver is the most important organ, from the standpoint of recognizing the disease. There are noted at times poppy-seed sized yellowish-gray foci, usually widely and regularly spaced and interspersed with hemorrhages of similar size. There is no marked enlargement of the organ, although rib impressions are not uncommon. Large pale confluent areas, particularly near the margin, often take the place of the scattered foci. Dead birds undergo rapid decomposition, so that the foci may fade. Under such conditions the liver often appears pale red and the adjacent organs show an unusual amount of hemorrhagic imbibition.

Sacrificed as well as dead birds may be grossly negative, so that histologic examination is necessary for the recognition of the specific lesions. In the liver these consist of simple coagulative necrosis of hepatic cord cells (figure 1). Either groups of a few cells, roundish foci or anastomosing bands of eosinophilic karyolytic cells may be present, all without any definite relationship to the architecture of the liver lobule. Necrobiotic foci of apparently prolonged standing may exhibit sparse infiltration with heterophiles and proliferation of bile duct cells, preparatory to repair. Clinically normal birds with a history of pullet disease have at times been found to show specific focal necrosis, which in itself is apparently compatible with life and amenable to repair. The bile ducts in the portal areas often show dilatation with papilliform infolding of the epithelium and inspissated secretion. Ordinarily lymphocytic foci are not considered a part of the histologic picture of pullet disease, although a large number of them suggest a reactive process to some previous injury. In the acute form the serous surfaces, particularly the pericardium, visceral surface of the sternum and the abdominal fat depots may show scattered petechiae, the occurrence of which has been responsible for the term 'cholera-like' disease. Cases with definite kidney involvement frequently exhibit whitish deposits of urates. The spleen is ordinarily small and pale; its microscopic picture is characterized either by atrophy or, more rarely, by necrosis, of adenoid sheaths which may contain crystalloid urate deposits. The pancreas often shows fine whitish areas which give the organ a chalky appearance. This lesion is probably due to extensive eosinophilic cloudy swelling of the acinar tissue around the Langerhans islets, according to histologic studies (figure 2). Many cases of pullet disease occur in laying birds and, therefore, the ovary normally reflects this functional state. However, the ovarian follicles are commonly found to be irregular and flabby in outline, while others are broken, so that fresh yolk material is present in the abdom-

Fig. 3. Ileum showing numerous cystic crypts (arrow) containing inspissated mucus. The Y-shaped unstained spaces delimit the surfaces of the swollen intestinal villi.

Fig. 4. Kidney showing dilated convoluted tubules (lower arrow), some of them with hyaline casts (upper arrow). The tubular epithelium is flattened and degenerated.
anal cavity. Fibrinopurulent peritoneal exudate is rare. The kidney lesions have the same diagnostic importance in the subacute form as do liver lesions in the acute form. Grossly they vary from no recognizable changes, paleness, accentuated lobulation to marked hypertrophy with or without whitish discoloration, as seen in uric nephrosis or visceral gout. The microscopic picture is essentially characterized by obstructive phenomena, namely dilatation of tubuli in the proximal portion of the nephron (figure 4) or in the medullary rays, and by hyaline or more rarely heterophile cast formation. Cases of prolonged standing show typical "gout rosettes" or calcifying casts. Glomerular changes are usually not conspicuous, and may consist of dilatation of the Bowman's spaces and loculation or hyaline thrombosis of the tuft capillaries. Numerous observations on normal birds suggest that tubular pyknosis without associated lesions cannot be evaluated diagnostically.

The crop and gizzard are often filled with sour smelling or fibrous ingesta, and the ileum appears ordinarily pale and contracted, and contains tenacious mucus. Histologically there is evidence of catarrhal enteritis, as is indicated by desquamation of epithelium and distention of the goblet cells, round-cell infiltration of the villous reticulum and particularly by small cystic transformation of intestinal crypts (figure 3), strikingly similar to superficial cystic colitis of human pellagra (7).

HEMATOLOGY

That the blood picture in pullet disease often shows a relative and an absolute leukocytosis has been noted previously (15). Waller et al (28) considered leukocytosis 24 to 96 hours after experimental transmission indicative of takes. In a recent hematologic study with Gifford and Gill (14) it was found that in 76 cases, later shown to have specific histologic liver and/or kidney lesions, the relative monocyte count averaged 24 per cent, as compared with a normal of 8.9 for females and 10.2 for males, given by Olson (18). The heterophile count was also increased to some extent and accompanied by a corresponding bone marrow hyperplasia. Forty-four clinically affected birds, derived from the same outbreaks as the above cases, but failing to show histologic lesions, had an average monocyte count of 18 per cent. The range of the monocyte counts and their distribution by cases is given in table 2. The average absolute leukocyte count was likewise increased in both the pathologically verified and in the clinical cases, when compared with the normal of 19,800 per mm$^3$ (18), but rarely reached subleukemic (100,000) levels (table 1).

When the data for birds showing either liver or kidney lesions alone were analyzed separately (table 1) it was found that birds having kidney lesions made the main contribution to the high average of the relative monocyte and absolute leukocyte counts, while birds with liver lesions alone showed usually a moderate increase of the relative monocyte count, but a low absolute leukocyte count. These hematologic characteristics of pullet disease stand out very prominently, when compared with those of control birds, but somewhat less so when compared with the average blood picture in other diseases (table 1). It is probably not fair to average the leukocyte counts of a variety of diseases, but by doing so it becomes very apparent that some other diseases may have a blood picture simulating pullet disease, and that the diagnostic value of any test for pullet disease is enhanced by the exclusion of other disease factors.
AVIAN MONOCYTOSIS

Table 1.—Average Leukocyte Count

<table>
<thead>
<tr>
<th>Differential (%)</th>
<th>Absolute</th>
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<tr>
<td></td>
<td>No. Birds</td>
</tr>
<tr>
<td>Avian Monocytosis, Liver...</td>
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</tr>
<tr>
<td>Avian Monocytosis, Kidney...</td>
<td>30</td>
</tr>
<tr>
<td>Avian Monocytosis, Liver and/or Kidney...</td>
<td>70</td>
</tr>
<tr>
<td>Clinical Avian Monocytosis...</td>
<td>40</td>
</tr>
<tr>
<td>Other Diseases*...</td>
<td>60</td>
</tr>
<tr>
<td>Controls...</td>
<td>29</td>
</tr>
</tbody>
</table>

* Coccioidiosis 23, lymphomatosis 25, respiratory 16, coccosis 3, pullorum 6, blackhead 3, T.B. 3, parasites 7, miscellaneous 3.

Table 2.—Range of Differential Count of Monocytes and Heterophiles

<table>
<thead>
<tr>
<th>Monocytes</th>
<th>Heterophiles</th>
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<td>11-20</td>
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<tr>
<td>Avian Monocytosis, Liver...</td>
<td>31*</td>
</tr>
<tr>
<td>Avian Monocytosis, Kidney...</td>
<td>13</td>
</tr>
<tr>
<td>Avian Monocytosis, Liver and/or Kidney...</td>
<td>14</td>
</tr>
<tr>
<td>Clinical Avian Monocytosis...</td>
<td>23</td>
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<tr>
<td>Other Diseases...</td>
<td>45</td>
</tr>
<tr>
<td>Controls...</td>
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* Per cent of cases (total number of cases as in Table 1).

Table 3.—Average Blood Chemistry Values

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<thead>
<tr>
<th></th>
<th>Hemoglobin</th>
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<th>Whole Blood</th>
<th>Chlorides</th>
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<tbody>
<tr>
<td></td>
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<td>gm. %</td>
<td>No. birds</td>
<td>mgm. %</td>
<td>No. birds</td>
</tr>
<tr>
<td>Avian Monocytosis, Liver and/or Kidney...</td>
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<td>15.1</td>
<td>69</td>
<td>12.5</td>
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<td>Clinical Avian Monocytosis...</td>
<td>23</td>
<td>12.5</td>
<td>52</td>
<td>7.9</td>
<td>15</td>
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<tr>
<td>Other Diseases...</td>
<td>8</td>
<td>9.5</td>
<td>10</td>
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<td>14</td>
</tr>
<tr>
<td>Controls...</td>
<td>22</td>
<td>7.7</td>
<td>13</td>
<td>5.0</td>
<td>14</td>
</tr>
</tbody>
</table>

Blood Chemistry

High average values for non-protein nitrogen, uric acid and perhaps glucose, normal values for phosphorus, magnesium and total ketone bodies, and usually low values for calcium, were reported in previous communications (15) (12). The
blood chemistry studies have been extended, and it is planned to carry them through several seasons. The present picture has been summarized in table 3. It will be seen that average total hemoglobin, as determined by the method of Evelyn and Malloy (8), appears to be definitely higher in pullet disease cases than in controls. This would be in line with the clinically observed feature of hemoconcentration. On the other hand, Cook and Harmon (5) observed a wide normal range for hemoglobin in birds, with low values, however, predominating in producing females during the warm season. Since most of the present specimens were collected from summer layers, the differences found may be significant. In confirmation of previous findings, uric acid determined by the methods of Folin (9) and Newton (17), was again found to be high, particularly in advanced cases, and probably constitutes one of the most reliable chemico-diagnostic findings. The values for serum potassium, determined according to Harris (10), in severe cases of pullet disease appeared to be slightly below normal, while those of whole blood potassium (10) were high. Total chlorides determined according to Sendroy (23) were strikingly low in the small number of severe cases available. Extended chemical data on severe cases are difficult to obtain, on account of the rapidly fatal outcome. If the above chemico-pathologic picture can be verified on a larger series, it would suggest a marked physiologic disturbance of the nitrogen and water metabolism and the electrolyte balance in pullet disease.

ETIOLOGY

Except for the claim by Weisner (30) that pullet disease is caused by certain strains of *Escherichia coli*, no bacterial organism has been found to be constantly associated with pullet disease. Waller (26) (27) (28) has reported the recovery of a virus from acute cases of pullet disease. When passaged through embryonated chicken or turkey eggs, this agent was capable of producing a non-fatal disease in susceptible chickens characterized by leukocytosis and focal necrosis of the liver. This work will be reported in detail in another paper on this program. In 55 attempts by the authors, in cooperation with Dr. E. L. Minard, to recover a virus-like agent from known pullet disease cases after two to eight passages through developing chicken eggs, no conclusive results were obtained. Reinoculation of egg-passaged material into chickens, which had been reared in isolation, failed to produce symptoms or hematologic and histologic changes except in one case, which however could not be subpassaged. Although these negative results do not discount a possible virus-agent, they do suggest that its isolation is difficult, particularly for diagnostic purposes; and secondly, that the virus may not represent the entire causative mechanism. Furthermore, birds or droppings from birds known to be affected with pullet disease have been scattered intentionally among presumably susceptible chickens, without indication of spread of the disease. To explain the often explosive outbreaks of pullet disease one would have to assume that a latent virus is widely seeded in a susceptible poultry population, and that its pathogenic action is set into motion by some secondary nonspecific factor, similar to the situation in swine influenza, as elucidated by R. E. Shope. As already mentioned, Quigley (19) has suggested that the disease may be induced by certain lots of wheat, presumably due to the existence of an unidentified toxic principle. This aspect needs further investigation. That the kidney affection in pullet disease is
not due to vitamin A deficiency, was shown by Jungherr (13). Neutralization tests with pneumoencephalitis virus and sera from recovered cases of pullet disease failed to show any serologic relationship (16), a possibility suggested by Stover (25).

Field observations indicate that in some instances pullet disease may be progressive from one flock to another on the same premises. Such experiences have been used to support the infectious theory of pullet disease, but the possibility that similar non-infectious factors may be operative at the same time cannot be denied. Recent fowl pox vaccination, excessive heat, faulty housing, and insufficient water supply may apparently act as predisposing factors in pullet disease outbreaks. The true causative complex of the syndrome, is unknown.

**DIFFERENTIAL DIAGNOSIS**

Many of the pathologic criteria given for pullet disease may also occur in connection with known infectious diseases of poultry, so that they become valid only by exclusion of other conditions. Furthermore, pullet disease specimens sometimes reveal complicating diseases, such as coccidiosis, lymphomatosis, respiratory troubles, etc., which tend to obscure the underlying process. Study of the flock symptoms and of several specimens is helpful in reaching a decision. The most reliable diagnostic points, either alone or in combination, of pullet disease are cyanosis and diarrhea, high monocytes, high uric acid, hepatic necrosis and/or uric nephrosis. The clinical symptoms are not definite in themselves unless accompanied by widespread sudden morbidity. Monocytic leukocytosis and hepatic necrosis occur in a number of infectious diseases, particularly pullorum disease, fowl typhoid and fowl cholera, all of which must be ruled out by appropriate bacteriologic tests. Uric acid is sometimes increased in visceral lymphomatosis with renal involvement. In the writers' experience, uric nephrosis without associated infectious or neoplastic diseases, is highly indicative of recently past or present pullet disease. If, however, this concept is correct the question arises as to whether isolated cases of visceral gout etiologically belong to the same complex.

**NOMENCLATURE**

A list of terms for the disease under discussion has been collated (12). The original term "X disease" (1) and its more emphatic running mate, "XX" disease, stress primarily the unknown aspects of the condition. Names like "summer"- and "housing disease" refer to the most prevalent time of occurrence and thereby ignore the unseasonal outbreaks. The widely used term "pullet disease" is unsuitable, because the condition has been demonstrated beyond doubt in birds of both sexes, and outside the pullet age. The term "blue comb" has some clinically descriptive merits as a common name, but, due to having received a different interpretation from that of pullet disease, has largely lost its value. To establish separate entities for pullet disease and blue comb on the basis of the criteria set forth by Bullis (3) (4) is invalidated by the fact that the acute hepatic form (pullet disease) has been observed in males and in non-producing birds, and the subacute renal form (blue comb), together with the acute form, in the same outbreaks. Furthermore, histologic data obtained during the last two years on 385 birds showed no specific lesions in 14 per cent; there were liver lesions alone in 11, kidney lesions in 22, and liver and kidney lesions in 53 per cent, of the cases. This is not to say that a
single etiologic factor is necessarily involved, but the now available criteria are insufficient to establish different entities within the pullet disease syndrome.

Among the proposed scientific terms, "cholera-like disease" (20) is definitely confusing and points in the wrong direction; "contagious indigestion" (28) refers to a symptom which is not basic; "acute toxemia" and "colibacillosis" (30) have no factual foundation; "Bright's disease" (29) would be exclusive of the no-lesion cases and the acute forms; "hepato-nephrosis" (15) likewise does not cover the clinically positive no-lesion cases.

In view of the apparent shortcomings of the above terms, and since no specific scientific name has been suggested, it is proposed to term the syndrome "avian monocytosis," which is descriptive of a major manifestation of the disease and apparently associated with most of its pathologic expressions. A precedent has recently been established in the new entity, 'lymphocytosis' in man (24).

**PREVENTION AND TREATMENT**

To outline a definite plan of control for avian monocytosis is not possible in the present state of our knowledge. The vagaries of the disease with regard to both occurrence and intensity of the outbreaks do not suggest live virus vaccination as the practical solution of the problem. Attention should be paid to reducing the influence of apparently secondary precipitating factors by insisting on early fowl pox vaccination, long summer ranging, careful management at time of housing, and especially upon facilities for shading and an abundant, constantly available supply of water.

Treatment should be instituted as soon as the first symptoms are recognized, and should begin with reducing grain and mash intake. Various medicinal measures have been used on an empirical basis (12), among them 1:2000 copper sulfate or 1:4000 potassium dichromate in the drinking water, or about 40 per cent of black strap molasses in a wet mash composed half and half of bran and oats. Since controlled therapeutic tests on the field syndrome are difficult, Scott, Jungherr and Matterson (21) induced uric nephrosis in chicks by feeding sodium citrate according to Correll (6), and found the experimental kidney disease, in confirmation of Correll's observation, to be preventable by various potassium salts, including potassium chloride or fertilizer grades of muriate of potash. Forty per cent molasses had the same preventive effect, presumably on account of its high potassium content, but copper sulfate was ineffective. On the basis of these experiments, two lots of 15 clinically affected hens from a field outbreak were observed at the laboratory for 6 weeks. In the control lot 11 survivors showed average egg production of 2.18 eggs per bird, and renal changes, namely gross lesions in 7, and microscopic ones in all 11. In the lot receiving 2 per cent potassium chloride in the feed, 8 survivors produced 4.25 eggs per bird, and showed no gross kidney lesions, and only minor microscopic lesions in 2 birds. Of the 11 birds succumbing in the two lots during the first two weeks, all showed typical uric nephrosis and some of them hepatic necrosis. Subsequent field tests have shown that recommended amounts of potassium chloride are not harmful, and are apparently beneficial in alleviating the renal damage which is primarily responsible for fatal outcomes and delay in systemic and functional recovery.
AVIAN MONOCYTOSIS

The present recommendations are to use 0.5 per cent (about 1 tablespoonful per gallon) of muriate of potash (at least 60% K\textsubscript{2}O) in the drinking water for 4 to 5 days, followed by 1% per cent of the drug in the feed for 10 to 14 days. The ultimate evaluation of potassium as a curative measure, and perhaps as a preventive treatment during the critical season, must await reports on extended field trials.

SUMMARY

Pullet disease occurs mainly in the northeastern and northcentral states during the early laying period, but may affect birds of both sexes from about 2 to 18 months of age. It is characterized by anorexia, diarrhea, monocytosis, uricemia, hepatic necrosis and/or uric nephrosis. These diagnostic features may be present either alone or in combination, and presuppose exclusion of other infectious or neoplastic diseases. "Avian monocytosis" is suggested as a scientific term for this condition, which is not completely understood from the etiologic point of view. Its importance from the economic standpoint lies in the resulting loss of egg production and mortality, and from the livestock sanitary standpoint in its clinical and pathologic resemblance to known bacterial diseases. An accurate diagnosis is essential, because in the field avian monocytosis may be handled unnecessarily like a known infectious disease, or vice versa, definite infectious diseases may be taken lightly on the assumption of dealing with the pullet disease syndrome. Scientific control measures, save for sound management practices, are unknown; immediate treatment with potassium chloride or muriate of potash in the water and feed is promising for alleviating kidney damage resulting from the disease.

REFERENCES

REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY


In a letter dated May 15, 1944, Doctor Cliff D. Carpenter, a member of this Committee, suggested that a study be made of the reasons for the 3.2 per cent decline in "laying house mortality" from the year 1942 to 1943. The chairman of your committee felt that Mr. H. L. Shrader, Senior Extension Poultry Husbandman of the U. S. D. A., would be in the best position to render an opinion on this subject. He was, therefore, contacted by letter. During the summer he came to Michigan State College, where the matter of "laying house mortality" was discussed. It was Mr. Shrader's opinion that it would be very difficult to ascertain the exact reason or reasons for the reduction in mortality. The mortality figures are based on a survey made by the Crop Reporting Board, U. S. D. A. These data show a decline of 0.3 per cent in 1940, an increase of 1.3 per cent in 1941, and increase of 0.3 per cent in 1942, and a decrease of 3.2 per cent in 1943.

Mr. Shrader stated that the National Poultry Advisory Council had conducted an intensive campaign on reducing mortality during 1943 and full credit should be given to this organization for centering the attention of poultry raisers on this important phase of the subject. Mr. Shrader offered the following reasons for the reduction in mortality:

1. The wartime urge providing the necessary incentive for more careful attention to feeding, sanitation, culling and flock management.
2. Reduction in traffic of a certain type of remedies due to a curtailment of travel because of shortage in gasoline and tires. This reduction accounted for a decrease in mechanical spread of infection from flock to flock by travelling salesmen, also a smaller sale of that type of remedies. Statistics show an increase in manufacture but the lack of travel undoubtedly affected the distribution of these remedies.
3. Lower protein content of feeds due to protein shortage which made for slower growth and less crowding or forcing of birds into quick physical maturity.
4. Higher percentage of young birds on farm. Since 1937 poultry population has shown an increase of about 39 per cent. This has brought about more intensive culling of older birds with a larger supply of young birds on hand.

We wish to express our appreciation to Mr. Shrader for his contribution to this report.

While "laying house mortality," considered on a national basis, may have been lowered, such is unfortunately not the case in certain local areas. Respiratory diseases, some of undetermined etiology, have been very destructive for the past two or more years. Furthermore, many poultry processors complain about the low grade of products delivered to them and are much concerned about means of returning to grade buying as an incentive to improvement in quality.
A fairly representative picture of poultry disease conditions throughout the country may be had from the following summaries of the reports which have appeared during the year.

**BACTERIAL DISEASES**

*Erysipelothrix rhusiopathiae* infection in turkeys was reported in Connecticut by Jungherr and Gifford (1).

*Simple coryza*. The contribution of Gregory (2), and Cunningham and Stuart (3) to our knowledge of the growth requirements of *Hemophilus gallinarum* will be helpful to research workers and diagnosticians working with diseases of the upper respiratory tract of chickens.

*Pasteurella Infections*. *Pasteurella pseudotuberculosis* was found by Rosen- and Dickinson (4) to be the cause of several outbreaks of a disease of turkeys in Oregon marked by anorexia, diarrhea, droopiness, lameness and sudden death.

Delaplane (5) found a *Pasteurella* or Pasteurella-like organism to be the cause of sinusitis in turkeys in Texas. Sinusitis continues to be a serious disease of turkeys in several states.

After a lapse of seven years Darby (6) diagnosed fowl cholera bacteriologically in chickens in Michigan, and Hudson (7) reported having found this disease in ringed-necked pheasants in New Jersey.

According to a personal communication from Dr. Durant, fowl cholera is a very important disease in Missouri.

*Salmonella Infections*. *Salmonella newington* was isolated from turkeys in California by Hinshaw and McNeil (8). Hinshaw, McNeil and Taylor (9) described the epidemiology of a maltose-fermenting variant of *S. pullorum*.

Of special interest is the report of Felsenfeld and Young (10) concerning the occurrence of members of the genus *Salmonella* in inhabitants of state hospitals of the Greater Chicago area. These workers found *S. pullorum* to be the cause of a dysentery-like disease in human beings. In a personal communication they stated that they had also encountered *Salmonella gallinarum* in human beings. Thus more and more of the diseases of livestock are being proved to be communicable to man.

An interesting account of studies on *Salmonella* infections in turkeys was published by Pomeroy and Fenstermacher (11) according to which 24 types of salmonellae have been isolated from turkeys.

The reports of Hinshaw and McNeil (12) and McNeil and Hinshaw (13) on the transmission of salmonellae and paracolon bacilli by snakes, cats and flies are of much practical importance.

Higgins, Christiansen and Schroeder (14) found *Salmonella enteritidis* to be the cause of a leg deformity in turkeys.

An increase in the incidence of fowl typhoid has been noted in New Jersey (Beaudette). Baker and Hays (15) report a marked increase in the incidence of fowl typhoid in Delaware and offer evidence to show that this disease can be spread by people going from one poultry plant to another without taking the proper preventive measures.

In Utah, pullorum disease and paratyphoid infections cause considerable losses in baby poults. These diseases followed by trichomoniasis, enterohepatitis and
hexamitiasis caused an estimated loss of 25 to 30 per cent of the turkey crop (Hendricks).

Doctor Hinshaw has called attention to a misstatement in our report for 1943. This statement reads: "In Utah a law has been passed prohibiting the importation of hatching eggs, baby chicks or turkey poults unless they come from U. S. Pullorum Clean Breeding Stock." This law actually allows any stock (eggs, chicks, poults, etc.) to enter the state provided it comes from an "Officially" tested flock and is of a status equivalent to the U. S. Tested class or better.

According to the 1944 Annual Report on Participation in the National Poultry Improvement Plan, there is an increase of 12.9 per cent over last year in the number of participating hatcheries. The increase over last year in the number of flocks is 17.6 per cent and in the number of birds in the participating flocks, 23.0 per cent.

The requirement that flocks must qualify for a pullorum class of the plan as a prerequisite to qualifying for a breeding stage became effective September 1, 1943. Of the 20 million birds in hatchery supply flocks in 1943-44 the percentage in flocks of each pullorum class was as follows:

<table>
<thead>
<tr>
<th>Pullorum Class</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. S. Pullorum-Tested</td>
<td>42 per cent</td>
</tr>
<tr>
<td>U. S. Pullorum-Controlled</td>
<td>39 per cent</td>
</tr>
<tr>
<td>U. S. Pullorum-Passed</td>
<td>6 per cent</td>
</tr>
<tr>
<td>U. S. Pullorum-Clean</td>
<td>13 per cent</td>
</tr>
</tbody>
</table>

The number of birds qualifying for a pullorum class increased from about 16 million in 1942-43 to more than 20 million in 1943-44.

These figures seem, at first, very impressive, but we must not forget that only 19 per cent of the flocks are in the U. S. Pullorum Passed and U. S. Pullorum Clean groups and that 81 per cent of the flocks are still infected.

A regulation pertaining to pullorum disease, Order No. 415, became effective July 1, 1944, in the State of Washington. This regulation was the result of the recommendations of the Washington State Turkey and Poultry Disease Control Committee and reads as follows:

"Whereas, It has been determined that the poultry industry in the State of Washington suffers severe losses annually from a disease in poultry known as pullorum disease which is caused by a specific organism Salmonella pullorum, and that there is conclusive evidence that this disease is transmissible from the parent hen to the baby chick and/or poult;

"Now, Therefore, I, Arthur E. Cox, Director of Agriculture of the State of Washington, by virtue of the authority vested in me under section 3113 of Remington's Revised Statutes do make and issue the following regulation providing for the sale and distribution of baby chicks and/or poults in the State of Washington:

"Regulation 1. It shall be unlawful for any person, firm or corporation to sell, offer for sale or otherwise distribute baby chicks and/or poults in the State of Washington that are affected with pullorum disease.

"Penalty: Any person, firm or corporation violating this regulation shall be deemed guilty of a misdemeanor."

Tuberculosis. Tuberculosis is spreading in Missouri, having been encountered in the southern part of the State (Durant).
FUNGUS INFECTIONS

Mycotic encephalomalacia, characterized by such symptoms as incoordination, retraction of the head, retroplulsion, and other neurologic evidence of cerebral disturbance, was observed in two lots of poult's in Connecticut by Jungherr and Gifford (16).

PROTOZOOAN DISEASES

Sulfamethazine was found by Hawkins (17) to be of considerable value in the treatment of cecal coccidiosis in chicks.

Edgar and Herrick (18) made the very interesting observation that the resistance of chickens to cecal coccidiosis was greater when feed was kept before them at all times than when it was withheld until 7 A. M. Central Standard Time.

A protozoon of the genus Tetrahymena was encountered in some white Plymouth Rock cockerels by Knight and McDougle (19). These birds were brought to the Veterinary Department of the University of Missouri with the history that 50 per cent of a partially confined flock of 300 birds was out of condition. The possibility is suggested that this protozoon may under certain conditions assume the role of a parasite.

Hepatozoon infection in turkeys was encountered in Texas by Delaplane (20) December, 1943. The existence of this disease in Texas turkeys was confirmed by three other investigators. It has been found in three flocks in different parts of the State.

Hexamitiasis was encountered in Utah (Hendricks).

VIRUS DISEASES

The development of families of chickens free of lymphomatosis was reported by Waters and Prickett (21).

Syverton and McTaggart (22) found fowl pox virus to be the cause of a naturally occurring disease of sooty grouse in the Cowichan Valley of Southeastern Vancouver Island, British Columbia.

Hutt, Cole, Ball, Bruckner and Ball (23) came to the conclusion that mortality from lymphomatosis can be reduced by keeping young birds from coming in direct or indirect contact with older birds for the first two weeks of life.

An important development in the field of poultry pathology since our last meeting is a report by Beach (24) on the neutralization in vitro of avian pneumoencephalitis virus by Newcastle disease immune serum. This information submitted previous to publication to the U. S. D. A., Bureau of Animal Industry, prompted an announcement on June 3, 1944, by Doctor A. W. Miller in Circular Letter No. 2652, U. S. D. A. Agricultural Research Administration, B. A. I., to all State Regulatory Officials, informing them of this finding. This latter was for the purpose of warning state officials and others concerned with control of poultry diseases to be on the lookout for the disease. Whether this means that Newcastle disease and pneumoencephalitis are caused by the same virus or by two antigenically related viruses remains to be definitely proved.

The pathology of experimental avian pneumoencephalitis was described by
Jungherr and Minard (25). This description compares the pathology of pneumoencephalitis and that of avian encephalomyelitis and is a valuable contribution to our knowledge of these diseases.

Minard and Jungherr (26) have adapted the quantitative virus neutralization test for use in pneumoencephalitis. They report the finding of neutralizing antibodies in one flock in Connecticut. In a personal communication the authors stated that they were unable to show any serologic relationship of pneumoencephalitis to pullet disease by this neutralization test.

Lorenz and Newlon (27) found that pneumoencephalitis affects egg quality unfavorably for a period of at least 45 days.

Prompted by the B. A. I. announcement referred to above, Dr. R. A. Hendershott, New Jersey Department of Agriculture, has referred to the Committee a resolution presented at the 16th Annual Conference of Laboratory Workers in Pulmonary Disease Control, at Storrs, Connecticut, June 8 and 9, 1944. This resolution urges this Committee to "review critically the entire problem of transmission of poultry disease and make definite recommendations with respect to reporting, quarantine and disinfection of premises where any infectious communicable disease is diagnosed."

The time available did not permit such a study this year, but future committees may well take this resolution into consideration.

RECOMMENDATIONS

1. We recommend that the Committee on Transmissible Diseases give consideration to Dr. Hendershott's resolution, and that the chairman be granted permission to appoint a sub-committee to study the problems presented.

2. We recommend that serums for typing viruses be made available by the Biochemic Division of the B. A. I. for the use of diagnostic and research laboratories.

3. We recommend that all suspected cases of pneumoencephalitis, in areas previously free of it, be promptly reported to the Chief of the U. S. D. A. Bureau of Animal Industry, and that steps be taken immediately to obtain a correct diagnosis.

REFERENCES


16. See Reference No. 1.


"Post-War Wars" is the heading of an article which recently appeared in Science News Letter (1). The author gave as examples of such wars the illnesses that age and kill men and women before their time. He mentioned five particularly with some discussion, but failed to include tuberculosis which held first place forty years ago, and still occupies seventh place among causes of death in the human family. He probably had it listed among diseases which are less spectacular in their affects during the development of typical cases.

Members of this association are in position to appreciate how post-war wars must be conducted even more vigorously from year to year to bring under complete control and in some instances eradicate diseases affecting our domestic livestock.

In another magazine with national distribution recently appeared an article entitled "The Next Plague to Go" (2). It portrays a plan sponsored by Surgeon General Parran looking towards the future control and eradication of tuberculosis in the United States. The ground work of this plan is based upon X-ray diagnosis of the disease, and much preliminary work is already under way. This able presentation fails to mention the necessary prerequisite of bovine tuberculosis eradication as a basic requirement in any general program of tuberculosis control among humans.

The connection is quite generally recognized, however, although the extent to which human infection is dependent directly or indirectly upon exposure to the bovine type remains questionable, and will continue to offer bases for extended research projects. The connection between bovine type and diseases developing in infants and adolescents is better known. This knowledge in itself has been considered sufficiently important to justify the procedure on a grand national scale against bovine tuberculosis, which has resulted in its reduction from an epidemic scourge, down to a percentage considered proper for practical control; i.e., less than one-half of one per cent, which is the maximum allowed for Modified Accreditation. When that stage of eradication has been reached, even though it be on the basis of one test of a county or other designated area, the tendency to "rest on our oars" is more or less apparent in different sections of the country.

There are several among this membership whose activities include close supervision of cattle shipments. In that connection, and especially on the receiving end, we have splendid opportunities to check up on the actual conditions of animals constituting the several shipments received per week or month or year.

Possibly having expressed my thoughts too freely in the presence of the chairman of your committee on tuberculosis, I have been called on the carpet to explain somewhat in detail the reason for my fears and misgivings. The answer is presented in chart form, including data compiled during the last five years covering shipments from practically all counties of California, all western and Rocky Mountain states,
a few from the Midwest and some Canadian shipments. As we hear frequently in the halls of Congress and Legislature, one may well "view with alarm" the trends in reactions per hundred head, types of lesions, etc.

The chart includes:
1. Number of dairy and breeding cattle imported into Los Angeles County. Origin of such cattle, as of California and Out of State.
2. Number and per cent of reactors per year.
3. Type of lesions; i.e., external, internal, and non-visible lesions.
4. Condemnation per year on basis of postmortem examinations.

I may anticipate a question upon the number tested from California and other states. We are willing to accept properly identified shipments of cattle on the

Summary of Data on Tuberculosis Reactors, Los Angeles County Importations 1939-43

<table>
<thead>
<tr>
<th>TOTAL NO. IN YEAR</th>
<th>ORIGIN</th>
<th>REACTORS</th>
<th>NO VISIBLE LESIONS</th>
<th>SKIN LESIONS</th>
<th>VISCERA LESIONS</th>
<th>COND. CARCASS</th>
<th>PER CENT LESIONS (INCLUDING SKIN, LESIONS AND CONDEMNATION)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1939</td>
<td>Interstate 20,176</td>
<td>0.90</td>
<td>189</td>
<td>165</td>
<td>11</td>
<td>13</td>
<td>12.6%</td>
</tr>
<tr>
<td>34,935</td>
<td>IntraState 14,759</td>
<td>0.51</td>
<td>97</td>
<td>72</td>
<td>9</td>
<td>16</td>
<td>25.7%</td>
</tr>
<tr>
<td>1940</td>
<td>Interstate 21,894</td>
<td>0.96</td>
<td>216</td>
<td>163</td>
<td>26</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>36,495</td>
<td>IntraState 14,601</td>
<td>0.53</td>
<td>71</td>
<td>59</td>
<td>5</td>
<td>7</td>
<td>16.9%</td>
</tr>
<tr>
<td>1941</td>
<td>Interstate 20,061</td>
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<td>197</td>
<td>158</td>
<td>18</td>
<td>21</td>
<td>0</td>
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<tr>
<td>39,315</td>
<td>IntraState 19,254</td>
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<td>80</td>
<td>52</td>
<td>9</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>1942</td>
<td>Interstate 12,353</td>
<td>1.11</td>
<td>139</td>
<td>101</td>
<td>20</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>43,636</td>
<td>IntraState 31,283</td>
<td>1.14</td>
<td>62</td>
<td>44</td>
<td>11</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>1943</td>
<td>Interstate 14,680</td>
<td>0.74</td>
<td>121</td>
<td>71</td>
<td>14</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>48,651</td>
<td>IntraState 33,971</td>
<td>0.75</td>
<td>56</td>
<td>44</td>
<td>5</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

basis of tests administered within 60 days prior to date of shipment by accredited and official veterinarians.

Since no indemnity is available upon reactors detected under our test, the dealers generally prefer to make their purchases in California subject to tuberculin tests administered at points of origin, thus occasionally avoiding severe losses of from one to several head in a carload. The out of state stuff, however, is usually bought outright in their efforts to save time and expense. Such shipments are made under declaration of having originated in a Modified Accredited area or county. Under such conditions, we frequently receive cattle which may not have been tested for two, three, or more years,—if at all!

Even though no compensation is allowed owners of shipments for their losses and therefore no records or special forms are required of us in that connection, post-
mortem reports on all stock which we brand as reactors are collected. We are fortunate in that all slaughtering of meat animals is conducted under Federal and California State Meat Inspection services, and their reports are acceptable as authentic. The usual criticism applies in that such inspections seldom extend far beyond routine postmortem examinations to secure the maximum utilization of meats and meat products, and may, therefore, skip many lesions which would increase the per cent of visible lesion cases. These percentages are comparable, however, to those quoted by Federal and State Meat Inspection agencies in connection with the inspection of carcasses of animals branded as reactors and tagged for identification under cooperative indemnification agreements.

In conclusion, I may say this is no conclusion. The charts tell a story which should be seriously considered by all who are in any way responsible for the condition of animals, herds, and areas so far as bovine tuberculosis is concerned. We, of all people, are most directly concerned, and can fully appreciate why the term "Post-War Wars" applies to and should include the tubercle bacillus in its various forms as a most dangerous, insidious and persistent enemy.

REFERENCES


(2) Times Weekly Magazine, September 15, 1944, by J. D. Ratcliff, Editor Science Yearbook of 1944.
BOVINE TUBERCULOSIS ERADICATION IN CANADA

BY M. BARKER, B.V.S.

Veterinary Director General Department of Agriculture, Dominion of Canada, Ottawa, Ontario

A paper on bovine tuberculosis eradication before this Association may be considered by many as very much like "threshing old straw." This paper, however, refers to what is being done in Canada. Here in the United States you have reduced the infection to what is termed practical limits over the entire country, while we in Canada are only at the half way mark. We are, however, on common ground when it comes to the problem of cleaning up small centers of infection in tested areas which have escaped detection and only revealed at some routine test or on slaughter at an abattoir where official inspection is maintained.

Bovine tuberculosis control in Canada goes back almost to the time when tuberculin was first discovered. As early as 1896 a free tuberculin testing service was available to the herd owner. Later in 1902 the assistance was limited to furnishing the tuberculin free of charge to the veterinarian employed by the stock owner to conduct the test provided a report on the results of the test was made to the Department.

The permanent ear-marking of reactors with the letter "T" in the right ear was adopted about this time (1903) and their exportation from Canada prohibited.

In 1905 the Department adopted what is known as the supervised herd plan. Under this policy the herds are tested free of charge. The owner must, however, agree to dispose of all reactors for which he receives no compensation. This policy, which is available to owners of pure bred or grade herds without restrictions, is still in effect. Today some 33,700 herds containing approximately 404,400 head of cattle are being dealt with under this plan and there is a waiting list of nearly 3,000 herds. These herds are all outside the tuberculosis-free areas.

The next control policy to come into force was known as the Municipal Tuberculosis Order and was possibly more of a public health measure than an eradication plan. This was the first policy in Canada in which provision was made for the payment of compensation to the owner for reactors ordered slaughtered.

This policy provided for the testing of dairy herds supplying milk to any city or town making application for assistance under the Order.

This policy remained in operation from 1914 to 1933 when the work was discontinued. A total of some 30 cities and towns received assistance during the time the Order was in effect.

The next policy of assistance to herd owners was the accredited herd plan adopted in 1919 which provided for the testing of pure bred breeding herds, compensation to be paid for reactors ordered slaughtered. During the twenty-five years that this form of assistance has been available there has been a constant and steady demand from the breeders of pure bred livestock for this service.

At the present time there are 8,303 fully accredited herds, 295 in process of
accreditation and 30 waiting initial test, a total of 8,628 containing approximately 259,000 head of cattle.

We now come to the last control and eradication policy adopted, the restricted area plan, which came into operation in 1922. It is under this plan that real progress in eradicating bovine tuberculosis is being made.

The first area to be established consisted of three rural municipalities in the province of Manitoba with a total of some 16,500 cattle, the first test being completed early in 1923. From this small beginning the work has progressed until today it is estimated that one-half the cattle in the Dominion have now been brought under supervision.

The percentages by provinces are as follows:

<table>
<thead>
<tr>
<th>Province</th>
<th>Tested Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prince Edward Island</td>
<td>100%</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>93%</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>100%</td>
</tr>
<tr>
<td>Quebec</td>
<td>78%</td>
</tr>
<tr>
<td>Ontario</td>
<td>56%</td>
</tr>
<tr>
<td>Manitoba</td>
<td>41%</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>29%</td>
</tr>
<tr>
<td>Alberta</td>
<td>9%</td>
</tr>
<tr>
<td>British Columbia</td>
<td>28%</td>
</tr>
</tbody>
</table>

While approximately one-half the cattle in the Dominion have been tested much more than half of the infected animals have been removed. This is due to the fact that more testing has been done in the older settled districts particularly in Quebec and Ontario, where the infection was heaviest.

The percentage of reactors found under area testing at initial tests has averaged 5.2, the heaviest being 47 per cent in a small rural municipality in Manitoba to 0 per cent in several of the rural municipalities in Western Canada. It is estimated that not over two per cent of the cattle remaining to be tested are infected.

In 1924 the percentage of infected cattle found on post-mortem in abattoirs under Federal inspection was 6.42 per cent. In 1944 the percentage to date is 2.47 per cent. These figures include all reactors shipped in for slaughter. Exclude these reactors and taking the normal run of cattle slaughtered the percentage of infection found during the past year is 1.72 per cent. These figures cover cattle from both tested and non-tested areas. This is a very brief summary of what has been accomplished. If the war had not intervened a great deal more testing especially in new areas would have been done. There is no lack of funds and the stock owner is anxious to have his cattle tested. The difficulty is an acute shortage of veterinarians to do the testing. The ranks of the full time veterinary inspector are seriously depleted and while the services of a considerable number of practitioners are made use of as part-time inspectors many of them are too busy with the regular practice to give much time to Departmental work. While some new areas have been brought under test during the past four years most of the work has been the testing of established areas in order to renew their accreditation. Interest in the work of eradicating bovine tuberculosis is not lagging and the work will be carried to completion as rapidly as conditions will permit.
PRESENT STATUS OF BOVINE TUBERCULOSIS ERADICATION PROGRAM

BY A. E. WIGHT, M.D.V.

Chief, Tuberculosis Eradication Division, United States Department of Agriculture, Washington, D. C.

At the request of Dr. William H. Feldman, Chairman of the Committee on Tuberculosis, I have prepared the following report on the progress of the cooperative tuberculosis eradication work during the past year.

TUBERCULOSIS IN CATTLE

It has been further demonstrated during that period that follow-up work in the bovine tuberculosis eradication program is a very important feature. Since 1941, due to the shortage of veterinarians, there has been a falling off in the numbers of cattle tuberculin tested, and it has been impossible to make all of the herd tests that should have been made. However, every effort is being made to locate infected centers, eliminate the reactors, clean and disinfect the premises, and thereby come nearer to the end of this disease in cattle.

Valuable aid for the program is rendered by the meat inspection service, both Federal and State. We are fortunate in having a system whereby the veterinarians at the various packing centers can furnish information regarding tuberculous cattle and hogs found in their regular work of post-mortem inspection. It is through these reports that we are often able to locate centers of infection which might not be reached at all if we depended on tuberculin testing alone. Shortly before Dr. George E. Totten took leave prior to his retirement as Chief of the Meat Inspection Division, War Food Administration, he requested all veterinarians in charge of federally inspected plants to assist in every way possible in determining the origin of tuberculous cattle found in the regular kill. No doubt this will have the effect of producing more of these reports, as there are quite a large number of new establishments and consequently new men in charge.

During the fiscal year ended June 30, 1944, 8,894,466 cattle, located in 524,927 herds, were tuberculin tested in the official work. The percentage of reactors found was 0.21, a slight increase over the 0.18 per cent recorded during the previous year, which was the lowest ever reported since the beginning of the work.

During the last fiscal year, the Federal funds expended amounted to about $1,350,000 for both operating expenses and indemnity. The combined State, territory, and county expenditure was about $2,745,000, of which about $2,275,000 was for operating expenses and the remainder for indemnity. The average appraisal of reactors was $154.53, and the average salvage, $59.93. The owner also received an average of $21.72 from the Federal Government and $36.07 from the State, for each bovine condemned. Seven per cent of the reactors were registered purebred cattle.
During the month of October, 649,736 cattle were tested in the various States and Puerto Rico, and the total number of reactors was only 1,167, or 0.18 per cent. There were no reactors found in 13 States, where 1,075 herds, containing 20,781 cattle were tested. This was a very good showing for the month, and it is hoped reports as satisfactory as this may be received in the future.

A large percentage of the tuberculin testing during the year was under what is known as the area plan. It was possible to remodify practically all the counties due for such action, but considerable difficulty was encountered in this connection due to lack of manpower and other conditions existing because of the war. At the meeting of this Association last year, a change was made in the uniform methods and rules of establishing modified accredited areas, providing that areas where the incidence of infection on the last complete test of all the cattle in the county did not exceed 0.2 of 1 per cent might remain in the accredited status for a further period of 3 years, provided all infected herds had been quarantined and tested in accordance with the regulations. This provision was applied in some cases and a considerable amount of testing was eliminated.

In some of the states there is considerable interest in accrediting herds of cattle as tuberculosis-free. According to our records, on October 30, approximately 243,000 herds, containing about 3,819,000 cattle, were in this classification, in 45 States.

The State livestock sanitary requirements call for the tuberculin testing of cattle moved interstate in many cases, and last year, approved and accredited veterinarians tested for interstate shipment 147,346 dairy and breeding cattle, of which only 10 were reported as reactors.

The reports from packinghouses operating under Federal inspection show a continued reduction in the incidence of tuberculosis, both in cattle and in swine. During the last fiscal year, about 12,900,000 cattle were slaughtered at these establishments, not including those that had previously given a positive reaction to the tuberculin test; and only 5,778, or 0.044 per cent, showed any evidence of tuberculosis; 1,628, or 0.012 per cent, being considered either unfit for food or fit to be used for food after the affected parts were removed and the meat thoroughly cooked.

Reports of post-mortem examination of cattle slaughtered in connection with the official brucellosis work, have been helpful in some cases in locating centers of tuberculosis infection. However, it is gratifying to report that the percentage of such cattle that show evidence of tuberculosis is about 0.066. In one large Eastern state where there had been a considerable amount of bovine tuberculosis, 15,198 reactors to the test for brucellosis were slaughtered during the 12-month period ending October 1944; only 16, or 0.105 per cent, showed lesions of tuberculosis on post-mortem examination; and only 5, or 0.032 per cent, proved to be generalized cases.

**TUBERCULOSIS IN SWINE**

During the last fiscal year, about 74,946,000 hogs were slaughtered at federally inspected establishments; and about 5,185,000, or 6.91 per cent, showed evidence of tuberculosis; 31,654, or .042 per cent, being either condemned or allowed to be used for food after being sterilized. Probably most of these cases were due to the avian type of tuberculosis.
AVIAN TUBERCULOSIS

Our friend, Professor H. R. Smith, is on this program this afternoon and will give a complete report on this subject, including some features developed during the year, which will be of much interest to you.

About 15 veterinarians of the Federal Bureau of Animal Industry have been devoting their entire time to this branch of the work in 9 states. They visited over 11,000 farms during the last fiscal year and observed about 2,065,000 fowls. Tuberculosis infection was found on 1,341 farms. The tuberculin test was applied to about 295,300 fowls and about 8,000 reactors were disclosed, or 2.7 per cent.

JOHNE'S DISEASE

Of 2,578 cattle tested for Johne’s disease in 11 states, 3.2 per cent were found to be reactors to either johnin or avian tuberculin. These reactors were condemned, and the owners received State and Federal indemnity in addition to the salvage.

Studies of this disease are being continued at the Federal and State Regional Animal Disease Research Laboratory at Auburn, Alabama; and much valuable information is being obtained and made available for distribution. There are two very interesting articles relating to Johne’s disease in the April 1944 number of the American Journal of Veterinary Research.

CATTLE INFECTED FROM HUMANS HAVING THE BOVINE TYPE OF TUBERCULOSIS

It is an established fact that humans may become infected with tuberculosis of the bovine type. It is also true that cattle may be infected from a human source. A few very interesting cases have appeared in connection with the cooperative tuberculosis eradication work among cattle. Attention is invited to this matter as it may help to explain the reason for outbreaks of tuberculosis in some herds of cattle where it is difficult to locate the source of infection. A very interesting report on such a case will be found in the October number of The Cornell Veterinarian, entitled “Man a Source of Bovine Tuberculosis in Cattle,” by Dr. F. J. Tice of Norwich, N. Y.

We were fortunate in having Dr. Herman E. Hilleboe, Chief, Tuberculosis Control Division, United States Public Health Service, on our program today. I am sure the information he has furnished will be of much value to the cooperative tuberculosis eradication work in livestock.

Combination intradermic and subcutaneous tuberculin tests are sometimes necessary in herds where it seems very difficult to eradicate the disease. Many times during the past year the spreader has been located by the subcutaneous test. It is hoped that research will develop a tuberculin that will be of much value in detecting spreaders of this disease. Just recently a special tuberculin for ophthalmic use has been prepared in the laboratory of the Pathological Division of the Bureau, and we have hopes that it will be of considerable value in locating the infected cattle in problem herds. If any of the State and Federal officials in charge of this work desire some of this material for use in such herds, it can be obtained upon request.
The study of the problem of no-visible-lesions of tuberculosis among reactors to the tuberculin test, is one that should be continued. All of us connected with the work know there are many angles to be considered in this problem.

In 1940 this Association adopted a very important measure in connection with the handling of herds of cattle infected with tuberculosis; namely, in requiring that herds in which infection occurs shall be required to pass 3 consecutive negative tests not less than 60 days apart before the quarantine shall be removed; and further, that such herds shall not be fully accredited until they have passed a test without reactors not less than 12 nor more than 14 months following the last test which disclosed infection. The results obtained by following this plan have proved its value.

There is ample evidence that the tuberculosis eradication work among livestock must be continued. So far the funds required to continue the official work have been made available by the Federal government, the states, territories, and counties. To some it may appear that the program is being dragged on indefinitely without accomplishing as much as desired, but, taking into consideration the conditions that have existed in the field in the last four years, it is believed we have held our ground pretty well and that all lost ground will be picked up rapidly when veterinarians become available for assignment to this work, both those in the official capacity and the practicing veterinarians who have always taken an important part in this program.

A pamphlet which contains statistical information on the progress of the tuberculosis work among livestock, as well as the cooperative bovine brucellosis work, has been prepared for distribution at this meeting, and copies will be furnished upon request.
AN ANALYSIS OF FACTORS CONTRIBUTING TO THE DIFFICULTIES OF ERADICATING TUBERCULOSIS OF POULTRY AND SWINE

BY H. R. SMITH

General Manager, National Live Stock Loss Prevention Board, Chicago, Illinois

When Dr. Feldman, Chairman of the Tuberculosis Committee, asked me to appear on this program, the subject he suggested seemed an excellent one, for progress in the eradication of tuberculosis in poultry and swine cannot be made without full recognition of the difficulties encountered with efforts made to overcome them. There are four principal difficulties—(1) lack of physical symptoms in tuberculous poultry, (2) lack of postmortem inspection, (3) lack of veterinarians, and (4) lack of labor, of which the last two may be temporary.

LACK OF PHYSICAL SYMPTOMS

We all know how impossible it is to detect tuberculosis in cattle by physical symptoms except in those that have reached a very advanced stage of the disease, which is also true in humans and equally true in swine and poultry. In one state where considerable poultry testing has been done, only one flock showed physical symptoms such as emaciation, pale combs, etc., out of six that disclosed reacting birds when tuberculin tested. It is conservative to say that five-sixths of the flocks infected do not show external evidence of the disease. The owner, therefore, does not usually know his flock is infected, and even though some may die, he is not unduly alarmed because he has become accustomed to it. This inability to detect tuberculosis in live poultry without the application of the tuberculin test is unquestionably the chief cause of relatively slow progress in its eradication from both poultry and swine.

The Poultry Departments in many of the Agricultural Colleges in the north-central states where approximately 50 per cent of the flocks tuberculin tested have disclosed reactors, have not been active in urging its eradication, no doubt because they hear from so few flock owners concerning it. Many livestock sanitary officials, even in states where this is a real problem, have not been active in its eradication, probably for the same reason. It is admitted that this is not the greatest cause of mortality in poultry, but in many states it does the most damage because it is transmitted to swine.

TUBERCULOSIS IN SWINE

During the fiscal year ended June 30, 1944, out of 74,946,117 hogs slaughtered under Federal inspection in the United States, 5,185,294 or 6.9 per cent were retained for tuberculosis, by which is meant lesions of the disease were found on postmortem, and in many of these, parts were condemned as unfit for food. Of the number retained, 15,910 entire carcasses were condemned, all of which caused a waste of approximately 18,000,000 lbs. of pork and pork products for the year. There were 15,744 hog carcasses sterilized and sold at about half-price. The
DIFFICULTIES OF ERADICATING TUBERCULOSIS

monetary loss on hogs would exceed $3,500,000 for the year, nearly all of it resulting from the disease in poultry. Why do we say nearly all? Because tuberculosis in cattle has been almost completely eradicated and there is no longer any appreciable exposure from cattle. The U. S. Division of Meat Inspection records show that only .04 per cent of all cattle slaughtered last year were retained for tuberculosis and only .01 per cent sterilized and condemned. Of the retained, but not condemned, practically none were spreaders, and of the generalized cases—sterilized or condemned—not all gave off the germs in milk or droppings to infect hogs. On the contrary, hogs are much exposed to the avian type as found in poultry. In fact, the percentage of hogs retained for tuberculosis in various sections is not only an excellent indicator of the prevalence of the disease in swine, but also in poultry in those areas. Table 1 is of interest.

LITTLE TUBERCULOSIS IN EAST AND SOUTH

We do not present data for the eastern states, nor for California, because a large proportion of the hogs slaughtered in those states are produced elsewhere. However, there is very little tuberculosis in either poultry or swine on farms in the eastern and southern states, and relatively little in California.

### Table 1. Percentage of Total Slaughter of Hogs Retained for Tuberculosis (Lesions Mostly Localized) under Federal Inspection by Markets and States for the Fiscal Years ended June 30, 1941 to 1944, Inclusive, in the Order of Percentage Retained for the Year 1944. Data Furnished by U. S. Division of Meat Inspection

<table>
<thead>
<tr>
<th>State</th>
<th>1941</th>
<th>1942</th>
<th>1943</th>
<th>1944</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Dakota</td>
<td>9.95</td>
<td>10.30</td>
<td>9.82</td>
<td>12.27</td>
</tr>
<tr>
<td>Wisconsin (All Plants)</td>
<td>13.44</td>
<td>12.64</td>
<td>11.81</td>
<td>10.98</td>
</tr>
<tr>
<td>South St. Paul</td>
<td>12.97</td>
<td>13.08</td>
<td>11.09</td>
<td>10.84</td>
</tr>
<tr>
<td>South Dakota (All Plants)</td>
<td>10.86</td>
<td>10.63</td>
<td>10.28</td>
<td>10.44</td>
</tr>
<tr>
<td>Cleveland</td>
<td>9.96</td>
<td>10.04</td>
<td>10.49</td>
<td>10.28</td>
</tr>
<tr>
<td>Michigan (All Plants)</td>
<td>18.77</td>
<td>13.2</td>
<td>12.38</td>
<td>9.99</td>
</tr>
<tr>
<td>Iowa (Exclusive of Sioux City)</td>
<td>11.77</td>
<td>10.82</td>
<td>10.18</td>
<td>9.60</td>
</tr>
<tr>
<td>Minnesota (Exclusive of St. Paul)</td>
<td>12.07</td>
<td>11.67</td>
<td>9.66</td>
<td>9.36</td>
</tr>
<tr>
<td>Washington (All Plants)</td>
<td></td>
<td></td>
<td></td>
<td>9.06</td>
</tr>
<tr>
<td>Sioux City</td>
<td>9.52</td>
<td>9.78</td>
<td>8.57</td>
<td>8.12</td>
</tr>
<tr>
<td>Oregon (All Plants)</td>
<td></td>
<td></td>
<td></td>
<td>6.46</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>5.93</td>
<td>5.16</td>
<td>5.35</td>
<td>6.01</td>
</tr>
<tr>
<td>Omaha</td>
<td>6.90</td>
<td>6.18</td>
<td>5.00</td>
<td>5.57</td>
</tr>
<tr>
<td>Denver</td>
<td>5.76</td>
<td>5.89</td>
<td>5.47</td>
<td>5.53</td>
</tr>
<tr>
<td>Chicago</td>
<td>7.94</td>
<td>7.06</td>
<td>6.34</td>
<td>5.32</td>
</tr>
<tr>
<td>St. Louis</td>
<td>4.97</td>
<td>4.98</td>
<td>4.51</td>
<td>4.48</td>
</tr>
<tr>
<td>Indiana (All Plants)</td>
<td>4.91</td>
<td>4.31</td>
<td>4.38</td>
<td>4.30</td>
</tr>
<tr>
<td>Kansas City</td>
<td>3.81</td>
<td>3.88</td>
<td>3.36</td>
<td>2.90</td>
</tr>
<tr>
<td>Georgia (All Plants)</td>
<td></td>
<td></td>
<td>.80</td>
<td>.73</td>
</tr>
<tr>
<td>United States</td>
<td>8.24</td>
<td>7.96</td>
<td>7.08</td>
<td>6.91</td>
</tr>
</tbody>
</table>
The table shows the highest incidence of the disease in swine in the most northern states and tuberculin tests of poultry show the highest percentage of reactors in those areas. No doubt longer periods of confinement in northern latitudes is a factor, but why is there so little in Maine, New Hampshire, Vermont, Connecticut and Rhode Island, in the same latitude? We know the reason. The farms are smaller there and poultry is an important source of revenue. Those eastern farmers know that they get many more eggs from feed consumed the first year of production. According to estimates of the College Poultrymen in those states, from 90 to 95 per cent of the commercial flocks are sold at the end of the first laying year. Incidentally, this practice has practically eliminated tuberculosis in eastern poultry.

Surveys in some of the middle west states indicate that "all-pullet flocks" do not constitute more than 25 per cent of the total. Here, cattle and hog raising are foremost, and the economies in poultry raising are given less consideration.

**INTEREST AROUSED BY TESTING**

If practically all flocks in one township, or even a half-township, in each of many counties in the middle west could be tuberculin tested for a sample to show how prevalent the disease is, and that the percentage of reactors is much lower in pullets than in older birds, then if proper local publicity could be given to this survey, more flock owners would adopt the practice of disposing of all birds except valuable breeding flocks at the end of the first year of egg production.

The annual testing of breeding and hatchery flocks in some states has not only eliminated the disease from those flocks, but has also created interest among owners of nearby commercial flocks.

**LACK OF POSTMORTEM INSPECTION OF POULTRY**

An important factor in the pronounced success of the national campaign to eradicate tuberculosis in cattle is our system of federal and state postmortem inspection which records give us a true picture of disease conditions in all parts of the country. It was the increasing losses each year from condemnations for tuberculosis in cattle and hogs that really gave impetus to the organization of the campaign.

Notwithstanding that disease and mortality is higher in poultry than in other livestock, no appropriations have been made by congress for postmortem inspection of poultry. We do have some eviscerated and inspected poultry, perhaps 7 per cent of total output, but the cost of inspection is paid by the processors. If we had general postmortem inspection, the condemnations for tuberculosis in the states where it is prevalent would react to the detriment of producers and create the incentive to get rid of it. What little postmortem inspection we have had since 1929 has been brought about by regulations passed by the New York City Health Department about that time prohibiting the sale of eviscerated or canned poultry in that city unless it had been previously inspected and identified by an authorized agency acceptable to the Department. Chicago and some other cities have similar regulations. This service is now conducted by the Dairy and Poultry branch of the Food Distribution Agency.
DIFFICULTIES OF ERADICATING TUBERCULOSIS

It is of interest to know that there has been a gradual increase in poultry eviscerated under this inspection, as indicated by the following:

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1934</td>
<td>17,000,000 lbs.</td>
</tr>
<tr>
<td>1935</td>
<td>21,000,000 lbs.</td>
</tr>
<tr>
<td>1936</td>
<td>26,000,000 lbs.</td>
</tr>
<tr>
<td>1937</td>
<td>39,000,000 lbs.</td>
</tr>
<tr>
<td>1938</td>
<td>43,600,000 lbs.</td>
</tr>
<tr>
<td>1939</td>
<td>47,100,000 lbs.</td>
</tr>
<tr>
<td>1940</td>
<td>72,400,000 lbs.</td>
</tr>
<tr>
<td>1941</td>
<td>78,000,000 lbs.</td>
</tr>
<tr>
<td>1942</td>
<td>115,000,000 lbs.</td>
</tr>
<tr>
<td>1943</td>
<td>168,800,000 lbs.</td>
</tr>
<tr>
<td>1944</td>
<td>187,000,000 lbs.</td>
</tr>
</tbody>
</table>

The increase would have been much greater since the war were it not for O. P. A. price ceilings.

Much of the eviscerated poultry is now going overseas, but after the war, eviscerated and inspected poultry, quick-frozen and under refrigeration in attractive packages, will make a strong appeal and will greatly increase in volume. How different this from the customer waiting in line for the butcher to open up the bird, watching him pull out with his hands the digestive organs, often on a bloody block.

C. L. Simmons of the Produce Department of Wilson & Company, writes:

"There is definitely a sizable consumer demand for poultry prepared in this manner and after the war, or should we say when price restrictions are removed or made more favorable, we are firmly of the opinion that there will be a very substantial increase in the sale of fully-drawn or ready-to-cook poultry."

A. F. Perrin of the Produce Department of Cudahy Packing Company, writes:

"I should think after the war ended, when the regulations as to price, etc., are relaxed and the restrictions on equipment for eviscerating plants and freezers are eased, that there would be a steady increase in the percentage of poultry to be eviscerated."

This seems to be the view of a large number of poultry processors and the industry as a whole. In fact, there is a general feeling that after the war there will be a great increase in quick-freezing and the displaying of packaged cuts of all meat in refrigerators where the customers can quickly make their own selection. When full-drawn and inspected poultry does materialize on a large scale, there will be many condemned—an indirect loss to producers.

One year ago on the program of this Association, Dr. H. A. Weckler of Chicago, Regional Supervisor of Poultry Inspection, reported that in 1943, 1.1 per cent of all poultry inspected was condemned as inedible, and 60 per cent of these were condemned for tuberculosis. He tells me that there was little change in 1944.

The fact that tuberculin tests in various areas show that on the average about 1 per cent of the birds under 18 months of age react as compared with an average of 10 per cent in birds over that age, leads one to believe that if separate records were kept on condemnations, it is quite probable that only 0.2 per cent of the poultry under 18 months of age, which greatly predominate, would be condemned as compared with 2 per cent in the older birds.

To lessen the jolt that will eventually come with general postmortem inspection,
we should all do what we can to reduce the incidence of this disease in poultry and swine.

We have distributed much literature urging more flock owners to dispose of all birds at the end of the first laying year except valuable breeding flocks which should be tuberculin tested annually.

Copies of sound films on avian tuberculosis, prepared by the U. S. Bureau of Animal Industry have been loaned extensively to vocational teachers and county agents. We have had numerous articles in agricultural journals on this subject. We ordered 5,000 reprints of an excellent article in the Farmers Guide on PULLETS AND PROFITS, in which J. W. Sicer, Extension Poultryman, Purdue University, says in part: "Sell old hens and keep pullets in laying flock to increase egg production and decrease disease." We have awarded many Certificates of Cooperation to those who keep "all-pullet poultry flocks."

LACK OF VETERINARIANS

The tuberculin testing of hatchery flocks, which has been of great value particularly in Michigan, Indiana, Ohio, Nebraska and South Dakota, has been slowed down by the lack of veterinarians, many of whom are in the service. We hope this is only temporary. We will all miss very much the activities of Dr. J. P. Simons, recently retired as supervisor of the tuberculin testing of poultry for the U. S. Bureau of Animal Industry.

LACK OF LABOR

The shortage of labor on farms has been a serious difficulty. This is well stated in a letter from Dr. J. R. Snyder, Chief, Nebraska Bureau of Animal Industry, as follows:

"A shortage of farm labor has created a problem in Nebraska, which, I believe, indirectly is responsible, as farm operators have been so busy with their farm work that they have had little time left to give attention to their poultry flocks. Even farm wives have had their time taken up in the assistance to the planting and harvesting of farm crops, therefore, have had very little time to even go into the matter of disease control of their poultry flocks. It is my belief that this condition will correct itself as soon as we get back to normal living and have time, veterinarians and man power to carry out a well-organized Poultry Disease Control Program."

CATTLE RARELY CONTRACT TUBERCULOSIS FROM POULTRY

Unlike hogs, cattle even though exposed to the disease in poultry by droppings in feed boxes, almost never contract the avian type. The fact that the percentage of cattle retained for tuberculosis has declined parallel with the decline in condemnations is proof that any infection from poultry does not produce lesions visible under the usual methods of inspection. For example, retentions for tuberculosis in cattle in the United States have been reduced 98 per cent, and condemnations 98 per cent in all cattle slaughtered since 1917. Each has been reduced 99 per cent at the Chicago market. Not so with hogs. The percentage of hogs retained in the United States increased from 9.9 per cent in 1917 to 13.5 per cent in 1927, the exposure from the increase in poultry tuberculosis being greater than the decrease
in exposure from cattle during that period. Since then there has been a decrease to 6.9 per cent in 1944 as a result of the elimination of the disease in poultry as well as cattle. In 1921, 20 per cent of the hogs slaughtered in Chicago were retained for tuberculosis as compared with 5.3 per cent in 1944.

**NO-LESION REACTING CATTLE**

While avian infection in cattle does not produce visible lesions, it does sensitize cattle causing some to react temporarily. Through recent correspondence we find that out of a total of 518 reacting cattle slaughtered since January 1, 1944 in ten southern states only 175 or 33 per cent were no-lesion cases. In a similar number of northern states, out of 2,992 reactors there were 1,466 no-lesion cases, or 49 per cent. There were, therefore, 50 per cent more no-lesion reactors in the north where tuberculosis is prevalent in poultry than in the south where there is very little.

The eradication of tuberculosis in poultry is important in this respect for undoubtedly some reactors are slaughtered unnecessarily, but it can hardly be avoided because the test does not reveal the type of infection.

**PROGRESS SLOW BUT SURE**

During the past 18 years retentions in hogs in the United States have decreased from 13.54 per cent to 6.91 per cent—an average decrease of 0.37 per cent per year. Much of this decrease in the last few years has been the result of the trend toward all-pullet flocks and to the application of the tuberculin test to breeding flocks.

With more veterinarians available for testing valuable breeding flocks, much more postmortem inspection of poultry, and more farm labor available after the war, we may reasonably expect more rapid progress. If there can be developed the same incentives and general interest in this project that prevailed in the cattle campaign, tuberculosis in all livestock will soon be virtually a thing of the past.
REPORT OF COMMITTEE ON TUBERCULOSIS


The Committee has surveyed the tuberculosis problem as it affects food-producing animals in the United States, and offers for the consideration of the Association the following observations:

1. The Committee is gratified to note that Federal Regulations are being contemplated to correct certain weaknesses in the existing regulations whereby the importation of cattle is permitted on the basis of a single tuberculin test, without reference to the history of the herd.

2. The policy governing the retesting of herds in certain areas of the United States may well be viewed with skepticism. We refer to the policy which provides for the retesting annually of only a small percentage of the herds. This practice has resulted in many herds escaping retest for as long as 10 to 12 years. Numerous instances have occurred in which tuberculosis has been demonstrated in such herds, often as a consequence of animals going to slaughter for reasons other than sensitivity to tuberculin. Undoubtedly, the practice of retesting mentioned previously has resulted in some areas in an increase in the disease. The Committee recognizes that under the exigencies of the present, the correction of this objectionable retesting practice would be difficult. However, the Association should be mindful of the potential hazards of this retesting procedure and remedial measures should be instituted as soon as possible. The Committee finds no serious objection to the plan in operation in some states, whereby one third of the cattle are retested every year, so that all are retested every three years. The approval expressed is applicable especially to dairy cattle, and does not apply to animals maintained under range or semi-range conditions.

3. The Committee is cognizant of the continuing importance of the so-called ‘Non-visible lesion” problem, the solution of which would contribute greatly to a more complete understanding of the specificity of tuberculin. While a generally acceptable explanation of the so-called “Non-visible lesion” tuberculin reaction is not at present available, research on the problem is proceeding in a few institutions.

4. Although the infectiousness of the bovine tubercle bacillus for human beings has been definitely established for nearly 50 years, it has been the accepted concept that the bovine form of the bacillus produces in man extra-pulmonary tuberculosis. During the past few years evidence has been accumulating that indicates quite definitely that the bovine tubercle bacillus is capable of causing pulmonary tuberculosis in human beings. Reports from England and Scotland and from the low countries of Europe, provide unequivocal proof of this statement. Although only a few instances of pulmonary tuberculosis in man due to the bacillus of bovine tuberculosis have been reported from the United States, the exact situation is not known, due to the fact that ordinarily the type of bacilli present in the sputum of patients with pulmonary tuberculosis is not determined. In view of the findings of certain
European investigators, an investigation of this problem in the United States might yield important information. Since human beings can become infected with bovine tubercle bacilli, and develop either pulmonary or extra-pulmonary tuberculosis, it is of the utmost importance that no laxity be permitted which will weaken practices or policies designed to control and eradicate the disease in cattle.

5. Tuberculous infections of livestock due to the bacillus of avian tuberculosis continues to constitute a problem of much concern. The avian tubercle bacillus affects not only its natural host, the domestic chicken, but in addition, possesses a rather high degree of infectiousness for other barnyard fowl and swine. To a lesser degree, this organism also affects sheep and cattle, and may be capable, in some instances, of sensitizing cattle to tuberculin. While the seriousness of infections due to the avian tubercle bacillus has been generally recognized for the past several years, the measures designed to reduce or satisfactorily control the disease in those sections of the United States where it is rampant, have not, in our opinion, been effective. Therefore, it is suggested that the efficacy of the procedure now advocated most widely, namely—the elimination of adult chickens after the first laying season—be reexamined, especially as this practice applies in the States with the highest incidence of infection. It is not our intention to disapprove of the practice of “giving the old hen a ride,” since it probably offers a satisfactory approach to the control—but not the elimination—of avian tuberculosis in certain areas where the percentage of infection is not high, and where good poultry husbandry is practiced. However, we are skeptical of its application successfully if the incidence of the disease is high, and where the poultry flock is permitted the freedom of the farm premises. Since in many states avian tuberculosis remains, as it has for many years, one of the major maladies of poultry, and is capable of dissemination to other species of livestock, it should be clearly evident that it is time to formulate plans—militant if necessary—to bring the situation under control. We recommend, therefore, that measures of control be reexamined to the end that an effective attack be directed against the disease in those states where its incidence is highest.

ADDRESS

Dr. Frank Liu

Chief, Bureau of Animal Industry and Ministry of Agriculture, Chungking, China

President—Chairman, Dr. Sutton, Members of the United States Livestock Sanitation Association and Friends:

It is indeed a rare privilege and a great honor for me and my colleagues to be invited to sit in with this celebrated group of learned and practical men at their annual national convention.

I am proud to say that we in China, as in all civilized nations of the world, pay high respect to men of learning and experience. Therefore, I consider myself prompted to bring to you gentlemen the sincere regards and greetings of my fellow country men, especially and particularly our men in the same professional lines as you.

When we consider the Chinese people as a race of farmers, comprising about 80 per cent of the total population, we are apt to lose sight of the fact that animal
husbandry is being extensively pursued by these people both as a major sideline and as an independent means of livelihood. On account of the fact, also, that misinformation having led us to think that the Chinese are a grain and vegetable eating people, has at the same time failed to bring to light the fact that we are among the largest meat and poultry producing countries in the world.

Because of the large population of about 450 million people, and the wide expanse of the country, China has been able to maintain a tremendous animal population. And with the large animal population such as she has had for centuries, coupled with the lack of scientific knowledge in veterinary medicine, China has always been faced with a most serious problem of livestock improvement and the urgency of disease prevention and control.

Being a country which has a high regard for literature, philosophy, and the arts, China has lagged far behind in the practical sciences. While engineering and the other applied sciences have gone further ahead in her awakening of such needs during recent decades, the modern sciences of agriculture, especially the science of animal husbandry and veterinary medicine, have not won the attention of her leaders until very recent years.

I am extremely glad in this connection to inform this body that we have seen great activity in these professions lately; and feel more so because of the fact that there lies ahead an unlimited future for men in these fields in China in the years of her rehabilitation and economic reconstruction.

I am also glad to note that we have had some of your top men in the profession who have participated during late years in helping China with her livestock problems, both in production and sanitation, as part of the war effort. These men not only brought to China the best in learning, training, and the qualifications of this profession, but also the spirit of good will and co-operation.

China is today in the darkest hours of her modern history. War-torn, war-weary, and depleted of most of her other resources. She is nevertheless the same spirited up-start among peace loving nations as she was eight years ago when she engaged the aggressor enemy in a fight to the finish. I can assure you that she would not, and never will, give up the fight, no matter what travailing condition she may be subjected to, and so long as she can expect the genuine friendship and co-operation of this great sister republic, until the last victory is our—yours and mine.

We need your help, not only now but after the war also. We especially need men from your profession in both our war effort and our post war rehabilitation program. But above all, we need your moral support as well. We need the continued, clear, understanding of your people to the life and needs of China—an understanding which has accounted for the maintaining of the traditional friendship since the "Clipper days."

I regret to say that my colleagues have been scheduled to visit some other places of professional interest this morning which has made it impossible to present them to you in person. However, I can assure you that they feel as much privileged and honored as myself in being enabled to attend this convention and to learn from your distinguished speakers about recent advances in livestock sanitation.

We all wish you a continued success during the fiscal year to come of your great Association, and to each and everyone of you we bid you the best of health and happiness!
REPORT OF COMMITTEE ON RESOLUTIONS


WHEREAS: This Association declared itself as favoring Federal legislation in behalf of the re-classification of employees of the Bureau of Animal Industry, and whereas said proposed legislation, when before Congress, was in urgent need of advocates of its just desserts and recommendations for enactment into law, and whereas Will J. Miller, of Topeka, Kansas, voluntarily occupied a leading role in advocating the passage of said legislation:

Be It Resolved: The United States Livestock Sanitary Association imparts its thanks and grateful appreciation to said Will J. Miller and all others who contributed their help and assistance in the passage of a just and indicated law.

WHEREAS: The formation of a program for United States Livestock Sanitary Association required the services of men known to be qualified in their respective fields of endeavor, wherein they receive no compensation, but make their contributions that livestock and poultry may be healthier and the people happier.

Be It Resolved: The United States Livestock Sanitary Association hereby conveys its thanks to each of those on the program for their service.

Be It Resolved: The Association hereby thanks the management of the La Salle Hotel for its courtesy, accommodation and many acts of thoughtfulness in making it possible for the Association to hold a successful meeting during this war emergency.

WHEREAS: On two occasions, 1924 and 1929 the United States had outbreaks of foot-and-mouth disease through the medium of ships' garbage, and

WHEREAS: Greatly increased movement of ships and the secrecy of such movement because of war activities greatly increase the possibility of additional outbreaks, and as there is no uniform law to control ships' garbage and through such control protect our agricultural economy from animal and plant pests now, therefore, be it

Resolved: The U. S. L. S. A. in regular session assembled on this 8th date of December 1944 does hereby urge that the Congress of the United States enact law ... controlling ships garbage in such manner as to eliminate or at least greatly minimize the danger of importation of animal or plant diseases through such garbage.

WHEREAS: Scientific advancement in disease prevention and control is based on and advanced by competent research and investigation.

Be It Resolved: The Association approves and recommends intensive research in animal disease causation, prevention and control.

Resolved: That Livestock in the name of this association be spelled as one word in accordance with the spelling in all standard dictionaries and with general usage.

Resolved: That in our Annual Reports and other publications of this association, the use of the term "Bang's disease" be discontinued and that "Brucellosis" or "bovine brucellosis" as may be appropriate, be used instead, in accordance with the usage in veterinary literature in this and other countries.
REPORT OF THE AUDITING COMMITTEE

Mark Welsh, C. P. Bishop, and William Moore

Your Committee has carefully examined the books and records of the Secretary-Treasurer, and finds them to be correct. We believe the Secretary-Treasurer should be commended for the excellent manner in which the finances of the Association have been handled. It appears, however, after some study of these records, that there was insufficient revenues received by the Association to carry on the proper functioning of the Association. A small net gain was made this year as a result of the sale of Circular No. 1, without which a deficit would have been incurred. We recommend that the Executive Committee consider additional sources of revenue.
Mr. President: Your Nominating Committee begs leave to report as follows:
For President: C. U. Duckworth, Sacramento, California
For 1st Vice-President: William Moore, Raleigh, North Carolina
For 2nd Vice-President: Will J. Miller, Topeka, Kansas
For 3rd Vice-President: J. V. Knapp, Tallahassee, Florida
FORTY-NINTH
ANNUAL MEETING
TO BE HELD
HOTEL LA SALLE
Chicago, Illinois
Dec. 5, 6, 7, 1945