PROCEEDINGS

Forty-Fourth Annual Meeting

of the

United States Live Stock Sanitary Association

HOTEL MORRISON, CHICAGO, ILL.
December 4, 5, 6, 1940
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Mark Welsh, College Park, Md.
HISTORICAL

Records of the early meetings of the Interstate Association of Live Stock 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 Live Stock Sanitary Association. All meetings since 1909 have been held in Chicago.

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*Information not available. †Deceased. ‡Dr. Musselman died October 27, 1930. Dr. W. F. Crewe, third vice-president, presided at the 1920 meeting. **Filled the unexpired term of L. Eno Day, who died April, 1989.

This information was supplied in the main by Dr. D. M. Campbell and D. F. Lucky.
ADDRESS OF THE PRESIDENT

By H. D. Port, Cheyenne, Wyoming, State Veterinarian

It is gratifying to me to have the opportunity of addressing you at this, the opening session of the 44th annual meeting of the United States Live Stock Sanitary Association.

Each year sanitary officials of the United States and foreign lands look forward with deep interest to the meeting held here for the purpose of considering and outlining sanitary measures, along with the dissemination of information relating thereto. Through the years that this organization has existed, it has effectively served as a clearing house for the numerous problems that have confronted the live stock interests of this and other countries.

As I look over this audience, I recognize members who have attended this meeting for many years, as well as members who have been a part of us but recently. There are also many visitors. In behalf of the officers of this Association, I extend to all of you a most hearty welcome. We trust this meeting will be both pleasant and profitable to you.

Our newly elected Secretary-Treasurer, Dr. Mark Welsh, and the various committees have prepared a very interesting and instructive program. No doubt, in glancing over the outline, you have noticed that the subject to
be presented vary widely. Each individual contributing to the program is recognized as possessing special qualifications in his chosen field. This assembly of special talent will bring to you newly acquired experiences, as well as the research findings of the present time.

The chairmen of the various committees will give their reports. These reports represent a vast amount of work by the committee members. The splendid choice of material to be offered should command the interest of everyone here, and I hope you will plan to attend every session.

It is my intention this morning to make my talk very short and to confine my remarks to subjects which I believe are of general interest.

**Purpose of This Association**

The purpose of this organization, as stated by the Constitution and By-Laws, "... shall be the study of live stock sanitary science, milk and meat hygiene, and the dissemination of information relating thereto, the unification so far as possible of the laws, regulations, policies and methods pertaining to milk and meat hygiene, and the prevention, control and eradication of transmissible live stock diseases; to maintain co-ordination among the various live stock regulatory organizations, and to serve as a live stock sanitary science clearing house between this Association and the following: the live stock owner, the live stock sanitarian, the milk and meat hygienist, the veterinary practitioner, the transportation and stock yard companies, the milk and meat producing and distributing companies, and various other interested agencies. The word "live stock" as herein used shall be understood to include poultry."

**Value of Association Recommendations**

Since the organization of this Association in 1897, sanitary measures and regulations have been formulated through the careful deliberations of its members. Many of these measures and regulations have been adopted by state, federal and municipal regulatory officers, and have proven effective in the successful eradication of various live stock diseases from this country. However, there are still many major problems confronting us. Through the continued study of live stock diseases, along with the practical application of information obtained from year to year, I am confident we can and will cope with these problems.

Agriculture is more or less dependent upon the successful raising of live stock. The security of investments in live stock depends very largely upon the protection afforded against disease. Likewise, in our present state of civilization our people are largely dependent upon live stock for food, clothing and other necessities. Hence live stock production and its affiliated industries hold a very important place among the nation's enterprises and are most vital to the common welfare of the country. This Association, being aware of the importance of these industries, has by unity of purpose devoted its efforts to the preservation of live stock.
World Affairs

World affairs the past year have naturally brought about a reaction in the Western Hemisphere, and irrespective of personal opinions regarding the conditions in Europe and Asia, we are affected by them. In the present program of preparedness in the United States, sanitary officials must be ready to assume increased responsibility in safeguarding public health and in protecting the food supply of this nation. To effectively accomplish this, live stock diseases must be held to a minimum.

I believe I express the opinion of every member of this organization when I say that in this time of preparedness, we stand ready and willing to make my personal sacrifice necessary to serve our country. At present we are well organized for the control of live stock diseases. Yet we know that under severe economic conditions, such as occur in time of war, animal diseases are a grave danger to any country and could easily determine its destiny. We should be mindful of this fact, and be prepared to face the situations that arise as the result of the ever-increasing economic problems.

Foot and Mouth Disease

"Modification of present laws to permit entry of Argentine beef into the United States as recommended in the Sanitary Convention findings, now awaiting Senate approval, constitutes no menace to the North American cattle industry." This statement was made by Dr. Mordecai Ezekiel, Department of Agriculture economic adviser, when addressing the Colorado State Farmers' Union Convention held in Denver; and was printed in the Rocky Mountain News of November 9, 1940.

The Sanitary Convention to which he referred proposed that entry of meat be allowed from those portions of South America which the United States Bureau of Animal Industry certified as being free from foot and mouth disease. Should the United States Bureau of Animal Industry be called upon to certify that certain areas in South America are free from this disease, it would, in my opinion, increase the responsibility of both federal and state sanitary officials of this country.

We have on several occasions in the past eradicated foot and mouth disease from the United States, but the expense of doing so was enormous.

While there may be areas in South America free from foot and mouth disease, yet knowing how rapidly this highly infectious and contagious disease can spread, the question arises, "How long will these areas remain free from the disease?"

The sanitary officials of this country are charged with the control and eradication of infectious and contagious diseases of live stock. For this reason, if the United States Senate contemplates changing the present law governing the importation of live stock or unsterilized meat from countries where foot and mouth disease is known to exist, members of the Senate could well afford to consider any recommendations of this organization.
Infectious Diseases

Sanitary officials of this country, through cooperative agencies, have made marked progress in the control of tick fever, tuberculosis, glanders, dourine and many other diseases affecting the live stock industry and public health. The control of these diseases has been brought about by the continual advancement of veterinary science and sanitation. When taking into consideration the comparatively short time which has been devoted to the control of these diseases, the veterinary profession can be justly proud of the progress that has been made.

Through the united efforts of federal and state research institutions, commercial establishments, and the veterinary practitioner, scientific knowledge is proving an effective means of dealing with diseases that have been a menace to the live stock industry as well as to public health.

Certain transmissible diseases are more prevalent in some localities than in others. As far as possible they are being controlled. Worthy of particular mention at this time are anaplasmosis, trichomoniasis and keratitis of cattle, as well as certain parasitic diseases of all animals. To effectively cope with these diseases, additional research will be necessary. Much of our present knowledge of various human and animal diseases can be attributed to the research workers. This Association has always enjoyed the full cooperation of those engaged in the control and study of diseases.

Bang's Disease

Generally speaking, the present program for the control of Bang's disease through the test and slaughter method has resulted in eliminating the infection from many herds. Yet there are some herds in which the eradication of this disease under the present program becomes a real problem.

Our increasing knowledge on controlling Bang's disease through a supervised program of calfhood vaccination may result in the solution for the eradication of this disease in the so-called problem herds, and in the range areas where the test and slaughter method is not practical.

Poultry

Statistics reveal a steady increase in the production of poultry, and today it is estimated as a billion dollar industry. In conjunction with the growth of this industry there has arisen the need for the control of poultry diseases.

During the past twenty years, through research, a great deal of knowledge has been acquired on avian diseases, and this has been of valuable assistance in their control. This group has given much attention to the subject of poultry diseases, particularly tuberculosis and bacillary white diarrhea, and through its recommendations renders a valuable service to the industry.

Transportation of Semen

Artificial insemination in certain species of live stock is becoming a common practice. With our present means of air transportation, shipments of semen are moving long distances. The possibility of spreading
disease, particularly trichomoniasis in cattle, through the process of artificial insemination should be given our study. These studies would assist in the promulgation of regulations that would prevent the movement of semen from infected herds.

**Recommendations to the Executive Committee**

I recommend to the Executive Committee that they give consideration to increasing our membership. Officers of breeders' associations, stock yards, and transportation officials, leading live stock breeders, meat packers, and others directly concerned with the live stock industry could be invited to become members. Such memberships are in accordance with the Constitution and By-Laws.

I also recommend a study of the feasibility of selling advertising space in the annual report. Revenue derived from this source could be used in defraying the cost of printing the annual proceedings, as well as for other expenses.

**Conclusion**

In conclusion, I take this opportunity to thank the members of the United States Live Stock Sanitary Association for the honor and privilege of being President of this organization. I also express my appreciation and thanks to the officers and committee members who have served so efficiently in carrying out the affairs of the Association during the past year. To all of you appearing on the program of this Convention, I am deeply grateful.

It is a pleasure to commend the efficient and excellent administration of our Secretary-Treasurer, Dr. Mark Welsh, who was elected to this important office one year ago. He has clearly demonstrated his ability to handle the affairs of the Association in a very able manner, and I hope we may have the benefit of his continued service.

I thank you.

**Remarks of Mr. Tom Linder**

PRESIDENT PORT: We have with us Mr. Tom Linder, Assistant Commissioner of Agriculture of Georgia. (Applause). Will you say a few words, Mr. Linder?

MR. TOM LINDER: Gentlemen, I am reminded of the two Negroes who were campaigning for election as a deacon. Finally one of them got up and made a speech. When he finished they called upon the second candidate. He said, "Well, brethren and sistren, I ain't got nothing to say. What Brother Jones say, I say too, only more so."

So I am satisfied with the discussion that you have heard so far this morning.

Down in Georgia twenty years ago we were a one-crop state. People down there planted every acre in cotton, and they shipped corn and hay from the West to feed the mules in Georgia. They got about 50 counties, down there, started with grass that they didn't want. Now they have found what they needed it for. We have
millions of acres, and all they need is just a further development of the cattle industry. During those twenty years we have developed wonderfully along the line of raising livestock. Today we sell some of the best beef cattle, and we have some of the best milk cattle to be found anywhere in the country.

I am very much interested in the control of animal diseases. I think probably we have one or two problems in Georgia which do not apply so much to the large ranches of the West. I noticed in the last federal census that a good many of our farm counties lost population during the last ten years, due largely to the migration of Negroes and sharecroppers from farms to the cities. I noticed, also, that a good many of the farm states of the West lost population.

We have a great many small farms in Georgia run by farmers who plow with one or two mules, keep half a dozen cattle and raise a few hogs. The control of these diseases is especially important. I have in mind especially Bang's disease. A half dozen small farmers living in one neighborhood breed their cattle cooperatively, and there is no way that one of these farmers can protect himself against infection of his cattle unless the neighbors with whom he is cooperating also have their cattle free of disease. I am very pleased to learn that this body is giving such serious consideration to the control of these diseases.

I want to say, as I intimated a few moments ago, that we have a wonderful opportunity down in Georgia for some of you experienced cattle men who live in the countries where cold weather is natural. We have a wonderful climate, and we have whole counties of grass that is ready for a good cattle man to turn his cattle into and start them grazing. I hope that some of you men from other states will take advantage of this opportunity, and come down and be with us.

Dr. Sutton, our State Veterinarian, is here with you. I imagine you all know him. He is in a much better position to give you any statistical information that you might want. I appreciate this opportunity to say a few words to you, and I appreciate what you are trying to do. I want to invite you to come down to Georgia on a visit, and then maybe you will decide to stay with us. Thank you. (Applause).

REPORT OF THE AUDITING COMMITTEE

Your committee appointed by President Port to audit the accounts, beg leave to report as follows:

We have examined the records of the Secretary-Treasurer which include assets carried over from the previous year and receipts and disbursements during the period, January 5 to November 30, 1940. As of December 6, 1940, we find the following assets:

- Cash in Prince George's Bank and Trust Company: $1,572.82
- Check received—not yet deposited in bank: 13.57
- United States Treasury Bonds: 5,200.00
- Furniture and Fixtures: 116.50

Total Assets: $6,902.89
We find the records to be properly kept and all monies accounted for. Your committee wish to commend the Secretary-Treasurer for the splendid and efficient manner in which the books are now set up and accounts kept.

We recommend that a surety bond in the amount of $10,000.00 be provided by the Secretary-Treasurer. We would further recommend that the United States Treasury Bonds at the present time held at the Drovers National Bank of Chicago be transferred to the Prince George's Bank and Trust Company, Hyattsville, Maryland, which is the present depository of the Association funds.

MEMORIAL SERVICE
UNITED STATES
LIVE STOCK SANITARY ASSOCIATION
CONDUCTED BY PRESIDENT H. D. PORT

The following list of persons passed away during the past year, who were either directly connected with or related to the Association:

John F. Devine, D. V. S.  Arthur G. Hall, D. V. M.
Chauncey E. Sawyer, D. V. M.  Barnard Al Gallagher, D. V. M.
Richard F. Eagle, D. V. S.  W. B. Massie, D. V. M.
F. E. Jones, D. V. M.  R. M. Chapin, Ph.D.
R. A. Craig, D. V. S.

As a last organized expression of respect, love and esteem, and in their memory, I do now respectfully ask all assembled to arise and remain standing for a short period, that whosoever will may offer a silent prayer for the repose of the soul of each.

Silent Prayer

It seems to me that in the case of these men—I would rather say of their spirits—where they were is of little consequence, that it is always what they were that really arrests our thoughts and takes hold of our imagination.

They, like the rest of us, were put through the discipline of the world, an indispensable discipline for every man who would know what he is about in the midst of the world's affairs; but their spirit got only schooling there. They did not derive their character or vision from the experiences which brought them to their full revelation; making it obvious, the test of every American must always be, "not where he is, but what he is."

If we look carefully we can see the very essence of democracy interwoven in the warp and woof of their lives, constituting a moral gravely expressive to all thinking men and women, wherein we will not look into the mystery of how and why they came, but rather ever keep the door open for them always, and give them a hearty welcome, and be gracious enough to tell them we do appreciate them, after we have recognized them.
Upon the death of these, and all who were near and dear, we are again and again confronted with the futile attempt to find solace in philosophy or science. All of these fail to assuage the sorrow or afford an understanding, leaving us confronted with but one related known fact, "Memory is the only friend that grief can call its own."

Therefore, today we revere their memory, and, if in doubt, seek consolation as did William Cullen Bryant when in his "To a Waterfowl" he said,

"He who, from zone to zone,
Guides through the boundless sky thy certain flight,
In the long way that I must tread alone,
Will lead my steps aright."

If comfort is to be sustained, if life's verities are lived to their fulfillment in the ever-changing panorama of human activities, such can only be found in an admission of the common experience of all:

"Through him the first fond prayers are said
Our lips of childhood frame,
The last low whispers of our dead
Are burdened with his name,
Let us then strive with purpose set
Tears, heartbreaks useless be,—
But faith has still its Olivet,
And love its Galilee."

J. L. Axby—Mr. President, I move that this service be made of permanent record, and a copy be sent the family of each deceased member.

ARE "HORSE AND BUGGY" REGULATIONS ADEQUATE IN THESE STREAMLINE DAYS?


The live stock industry in general and especially growers and feeders of live stock will benefit from decreased losses of live stock in transit when the present inadequate federal 28-hour law is amended to apply to all methods of transporting live stock. Such legislation should not apply to regular, farmer-owned market bound shipments.

As a group largely of state and federal regulatory officials, you are interested primarily in the prevention and eradication of losses due to communicable infectious diseases. You are interested in an amended "28-hour" law to the extent that this change will be an important factor in controlling and preventing live stock losses. You probably are not inter-
ested in the mode of transportation—whether by trailing, driving, or by bringing into your state by train, truck, wagon, aeroplane or wheelbarrow. However, you are vitally interested in knowing that inbound shipments to your states are so handled that they remain healthy so that they can make a profit for the grower.

The men who drafted the 28-Hour Law some 34 years ago are to be commended rather than censured in formulating the present legislation, even though in a third of a century it has reached a state where it now covers less than half of the present day live stock shipments. This situation is not unique in days of progress and change. There appears to be but one document of laws and regulations of ten short, concise statements which has come down to us through the ages and which apparently is still pretty well up to date. We probably cannot amend the “28-Hour” Law so that it will be up to date a century from now, but we can make a few apparently needed amendments that will aid today’s live stock growers and feeders in preventing avoidable shipping losses.

The present situation governing the movement and inspection of live stock is very forcefully and plainly stated in the 1939 Report of the Secretary of Agriculture, by the Chief of the Federal B. A. I.:

"Livestock Trucking in Relation to Disease"

"In connection with both the marketing of live stock and the veterinary inspection of such animals shipped interstate, new problems have arisen, caused principally by the great increase in live stock marketing by motor truck.

"Normally about 20,000,000 cattle, 24,000,000 sheep, and 22,000,000 swine pass through the principal markets, in the course of a year, in interstate commerce. These animals are inspected for disease by trained employees of the Bureau of Animal Industry. Affected animals and those exposed to disease are treated under supervision and disposed of in a manner which prevents contagion from spreading to animals in other states. The origin of the diseased animals is determined and reported to the authorities of the state concerned. This phase of the work is highly important; frequently the first information received by a live stock sanitary official of an outbreak of disease in his state is furnished through the report of a Department employee at one of the central markets.

"Certificates are issued covering the interstate shipment of animals free from disease and of those which have been properly treated. Cars, trucks, and other vehicles and premises which have contained diseased animals are subject to cleaning and disinfection, under supervision. These operations are conducted on a large scale.

"The type of supervision described has been greatly complicated, however, with the advent of the motor truck as a principal live stock carrier. At a representative market, during June, 1939, only about 16,000 cattle were received by rail as compared with 70,000 by truck. For sheep the corresponding figures, in round numbers, were 37,000 and 99,000; and for hogs,
2,000 and 25,000. Thus in all cases truck shipments were noticeably pre-
dominant. The mobility of the truck makes it possible to deliver diseased
animals to the stockyards and depart before the infection is discovered.
Moreover, the truck may be used again before it can be traced and disinfected,
whereas the railroad stock car which has contained diseased animals can be
easily traced and cleaned and disinfected, in nearly every instance, before
being reloaded.

"In the transportation of live stock, losses due to improper loading, feed-
ing, watering, and yarding are largely avoidable, and one of the functions
of the Department is to enforce the laws enacted to prevent such losses. The
28-hour law, when properly complied with, causes the animals to be un-
loaded for rest and proper feeding and watering at stated intervals. Handling
live stock in conformity with the provisions of this law prevents much suffer-
ing and shrinkage, and the animals are delivered at their destination in the
best condition possible. At the time this law was enacted motor trucks were
not a factor in live stock transportation and, therefore, no provision was
made for the proper handling of live stock shipped interstate by truck.
However, reports have been received of long-haul truck shipments of animals
which have been handled in an inhumane manner, and efforts are being
made to have the present law amended so that it will cover truck as well as
railroad shipments of live stock."

Since the country as a whole looks to our state and federal regulatory
officials for constructive leadership and guidance in the suggestion of
needed sanitary laws and regulations, it seems fitting that this body ear-
nestly consider the recommendations of our Chief of the B. A. I. Construc-
tive suggestions and recommendations passed by this group representing
the best thought of the nation's sanitarians will be a safe guide for needed
legislation.

Shipping Records

It is apparent that when all forms of transportation operate under an
amended 28-Hour Law, records must accompany each shipment and be
presented to state or federal regulatory officials on demand or at State
Port of Entry. These duplicate records should carry the necessary descrip-
tion of the shipment, such as:

1. License number and description of vehicle, including inside dimen-
sions of floor space;

2. Number, weight and description of live stock for breeding, feeding or
immediate slaughter;

3. Name and address of shipper and consignee;

4. Record or driver's log of route taken;

5. Final destination;

6. Feeding and rest record to include: place, pen number, unloading and
reloading record giving date, time and count; deads or cripples removed and
the amount, kind and price of feeds fed;
7. Record of transfer of shipment from different vehicles while en route;
8. Amount and kind of bedding used;
9. Health certificate to be attached. Present F. I. Forms 48 and 24 be amended to include a certification of apparent freedom from all communicable diseases.

These records will give regulatory officials definite information regarding the consignment and the manner and places in which it has been handled. Sanitary officials could then definitely determine whether or not each shipment moved into his state in compliance with current live stock regulations. In case of diseased shipments such records would designate pens and vehicles to be cleaned and disinfected before further use.

Few states employ enough regulatory officials to inspect each lot of live stock that enters its borders by rail and by truck. If all transportation agencies were required to file the above information on each shipment of live stock at some specified regulatory official's office in the state that receives the shipment, the method of inspecting inbound shipments in each state would be simplified and protection from infection increased accordingly.

Federal F. I. Forms now sent state veterinarians on outbound shipments from stock yards maintaining B. A. I. inspection would supplement information furnished by carriers' shipping records.

Very Little Regulation at Most Community Markets and Feed Yards

Soon after our first range counties in the southwest were accredited we contacted the state and federal regulatory officials in feeder buying states and had an understanding with them regarding the shipment of identified, accredited county feeders into their states without further testing. All such feeders leaving our market were inspected and classified as "CATTLE FROM MODIFIED, ACCREDITED AREAS" by the federal B. A. I. inspectors on our yards. Soon after shipping operations started under our arrangement I had a letter from Doctor "Daddy" Welch, then state veterinarian in Illinois. In his very characteristic and direct manner he told me what he thought of a person who had made an agreement to handle accredited county cattle in a certain way under federal supervision and who would send to a feeder buyer in his state a load of cattle that when shipped from a point in Texas were listed as steers, but which on arrival at the Illinois point were found to be heavy springer cows. Naturally, I told him that anyone who would disregard his promises was not trustworthy. I then asked him who the offender was. He then told me the load of cattle came from Kansas City. I asked if they came from the Kansas City Stock Yards or from one of the several other points in our immediate vicinity where cattle are handled and sold. Upon further study he found these cattle had not passed through the federally inspected stock yards, but from one of the nearby trading centers where evidently the springer cows had been substituted by the shipper for the load of steers. This illustrates the point that unless we have federal inspection or competent state inspection at markets and feed yards, shippers are likely to avoid compliance with regulations.
Recently, a man from New Mexico who visited us stated that he had a considerable number of sheep that he would like to bring to our market where he could sort out and sell the fattest lambs and ship the rest for feeding purposes. The first question he asked was: "Will I have to dip feeder sheep leaving this market for some specified states east of the Mississippi River?" When he learned that his sheep would have to be dipped under federal supervision in order to comply with state regulations, he stated that he would ship these sheep to another point where federal inspection was not maintained so that he could ship them without dipping and inspection. I am glad to say that the states in question very recently amended their regulations so that range carlot sheep passed by federal inspectors can be shipped to these states from public, federally supervised markets, using the F. I. Form 24 B in lieu of a permit and without the requirements of dipping. This is an illustration of the need of more uniform enforcement of existing state sanitary regulations.

**Destination Should Be Definite**

As conditions change it may be necessary to divert shipments of different kinds of materials from the original consignee to another purchaser who at that time has a more favorable outlet for the product in transit. But the too common practice should be discouraged of intentionally misrepresenting the actual destination of a shipment. For example—the owner of a shipment of sheep that is to be moved by a carrier other than rail can get a permit from a federally inspected market to move a load of sheep, say, into Kansas, where dipping for scabies from the federally inspected market is not required, while in reality he plans to take the sheep to his farm in the State of Missouri where dipping is required. It is practically impossible for the Federal Bureau of Animal Industry to check the delivery of every load of live stock leaving federally inspected stock yards.

**Better Enforcement Methods**

A few progressive states have passed legislation authorizing State Highway Patrols or State Police to stop vehicles transporting live stock and ask to see the health certificates or other documents which may be legally required to move the particular shipment intrastate or interstate. Naturally some form of shipping certificate as previously described would be very valuable to the highway patrol in determining whether or not the transporting agencies were meeting the requirements and regulations governing the movement of live stock in that particular state. Such movement combined with all transporting agencies operating within the 28-Hour Law will be most effective in regulating the proper movement of live stock shipments.

**Overfatigue, Overcrowding and Overfilling**

In Doctor Mohler's statement is mentioned the importance of proper loading, rest and feeding. Normally live stock will not become overfatigued when transported under the 28-Hour Law. But if vehicles are overcrowded, the animals struggling to maintain their footing become tired
much faster than animals comfortably loaded. Keeping animals off water and feed for too long periods and then allowing them to gorge on water and dry feed in order to gain excessive weights before going over the scales is a most inhumane and wasteful practice. These three "overs" appear to be very important factors in the prevalence of colds or so-called shipping fever in feeder cattle. Our records on outbound cattle over a period of five years show that in loads of cattle which were overcrowded and not stopped for rest, feed and water every 28 hours more "so-called" shipping fever occurred than in lots properly loaded and rested every 28 hours and traveling the same distance.

Rail shippers have published a safe shipping guide. The following table shows the average weight per head of uniform sized cattle or calves that can safely be loaded in 36 and 40-foot single deck cars:

<table>
<thead>
<tr>
<th>Average Weight Per Head</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>500</th>
<th>550</th>
<th>600</th>
<th>650</th>
<th>700</th>
<th>750</th>
</tr>
</thead>
<tbody>
<tr>
<td>36' Car.</td>
<td>60</td>
<td>55</td>
<td>50</td>
<td>46</td>
<td>42</td>
<td>39</td>
<td>36</td>
<td>34</td>
<td>33</td>
<td>31</td>
</tr>
<tr>
<td>40' Car.</td>
<td>67</td>
<td>61</td>
<td>56</td>
<td>51</td>
<td>46</td>
<td>43</td>
<td>40</td>
<td>38</td>
<td>37</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Weight Per Head</th>
<th>800</th>
<th>850</th>
<th>900</th>
<th>950</th>
<th>1000</th>
<th>1050</th>
<th>1100</th>
<th>1150</th>
<th>1200</th>
<th>1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>36' Car.</td>
<td>50</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>23</td>
<td>22</td>
<td>21</td>
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</tr>
<tr>
<td>40' Car.</td>
<td>33</td>
<td>31</td>
<td>30</td>
<td>29</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>

To show the necessity of avoiding overcrowding and overloading, a live stock insurance company attached this statement to its policy: "This company will classify as 'overloaded' or 'overcrowded' all carloads containing more cattle or calves, of uniform size, than 10% over the number recommended in the following standard shipping guide specifications for single deck loads. In no case will this company insure 36 ft. carloads containing more than 63 head of calves, or 40 ft. carloads containing more than 70 head of calves. Car lengths specified are inside measurements."

As overfatigue, overcrowding and overfilling are economic factors in profitable production of live stock, especially animals used for feeding purposes, it seems very desirable that state and federal regulatory officials study the practices followed in transportation and feeding to determine the desirability of curbing any wasteful, inhumane practices.

Conclusions

At present there seems to be a lack of uniformity in state laws and regulations and in federal laws, as the present 28-Hour Law applies only to rail carriers. In my opinion it is doubtful and probably not desirable that all states operating under entirely different conditions have the same laws and regulations to protect the health of their live stock. However, it does seem feasible and practical that all states have legislation authorizing the state highway patrols as well as the state regulatory officials to inspect and check the intrastate as well as the interstate shipments of live stock. Regulations and laws, unless enforced, are valueless and worse than no regulations. Today the best enforcement agency appears to be the state and federal regulatory officials cooperating with the state highway patrols.
May we again bring to your attention Doctor Mohler's statement of a year ago, that "efforts are being made to have the present law amended so that it will cover truck as well as railroad shipments of live stock." May we suggest that this organization study this proposition with the thought that it be endorsed by this convention. If you state live stock sanitary officials wish to secure from the Federal Bureau of Animal Industry maximum protection against the importation of uninspected, diseased live stock into your states, the first step necessary is giving your whole-hearted support to an amendment that the 28-Hour Law apply to truck as well as rail shipments.

REPORT OF COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS, UNITED STATES LIVE STOCK SANITARY ASSOCIATION, DECEMBER, 1940

W. H. HENDRICKS, Chairman, Salt Lake City, Utah
A. W. MILLER, W. H. LYTLE,
Washington, D. C. Salem, Oregon
T. B. JONES, Phoenix, Arizona

It is quite obvious that this organization should make an honest endeavor to bring about the adoption of uniform laws and regulations pertaining to the interstate movement of live stock. We are aware of the fact that uniformity in some cases will be difficult to obtain; especially will this be true where basic live stock and sanitary laws of the various states will have to be changed. We recognize the fact that a committee report on this subject has been submitted to this Association, and accepted at each meeting for several years past. Granting this, we know that very little has actually been accomplished with respect to uniformity of various state regulations.

We desire to call your attention to the committee report of the 43rd annual meeting of this Association. A summarization of state requirements governing entry of live stock is there presented. This summary takes into account various requirements for the interstate movement of swine, wherein all swine diseases are included, but with particular emphasis on hog cholera. Also, on the interstate movement of horses with respect to glanders and dourine; also on the interstate movement of cattle with respect to cattle scab; and sheep with respect to sheep scab. There is a summary given with respect to Bang and T. B. regulations on cattle entering the various states. This summary very clearly points out the many variations in the state requirements. Transportation companies, stock yard officials, and live stock men are very much confused as a result of the existing laws and regulations in this respect. It does, therefore, seem plausible that they should ask this organization to take the lead in an honest endeavor to correct the situation as far as possible.

The basis for the unification of state requirements should be the federal regulations. If these are inadequate or if some specific live stock diseases are not included in existing federal regulations, then this Association should request the United States Bureau of Animal Industry to
adopt suitable regulations that may be used as a basis for the states to adopt so that uniformity may be attained. Certainly the situation existing today, as disclosed by the summarization of laws and regulations governing the interstate movement of live stock, as submitted in the report of the 1939 committee, would be ample proof for the necessity of the states and federal government cooperating to establish uniformity. The fact that up until the present time nothing very definite has been accomplished with respect to unification of laws and regulations may be due in part to the fact that some live stock disease control programs have not been sufficiently completed to permit of unification of these regulations. On the other hand some disease control programs which have been completed, or nearly so, and some live stock diseases which have been brought under control, or practically eradicated, should be reason enough for the changing of laws and regulations to permit more freedom and unification in the interstate movement of live stock.

Your committee believes that a start can be made with respect to unification of some regulations and that others may be made more uniform in the future as disease control programs become more nearly completed. Since a majority, or as a matter of fact, practically all of the counties in the United States have become modified free accredited areas for bovine tuberculosis there has been a trend on the part of some states to modify their requirements slightly in this respect. The federal regulations are accepted by some as sufficient to govern the interstate movement of cattle as far as tuberculosis is concerned. Other states still maintain restrictive requirements. Your committee is of the opinion that the trend toward the adoption, by the states, of federal regulations in this respect should continue and that more states should endeavor to unify their requirements on a basis of the federal regulations. We believe also that the various state laws and regulations with respect to all other live stock diseases should follow the same trend as rapidly as possible. It may not be possible to get this unification of requirements with respect to all live stock diseases, but your committee feels that a start should be made on a few of them at least, and then an effort made to include more of them as rapidly as feasible.

We, therefore, recommend:

1. That this Association, through its secretary, request the various states to adopt, as soon as possible, the federal regulations regarding the interstate movement of cattle for bovine tuberculosis.

2. Inasmuch as glanders in horses is practically non-existent in the United States, we recommend that state requirements for the Mallein test for the interstate movement of horses, be eliminated and that horses be permitted to move interstate subject to more or less uniform regulations which would provide for clinical inspections and freedom from contagious or infectious diseases.

3. We believe that the federal regulations governing the interstate movement of sheep with respect to sheep scab are sufficient, and we therefore
recommend that the present federal regulations in this respect be adopted as a pattern for uniform regulations, and that in addition to sheep scab, other infectious and contagious diseases of sheep be included with the thought in view that sheep visibly affected with contagious or infectious diseases be excluded from interstate shipment, except in cases of immediate slaughter at destination or to stock yards or areas which can be maintained under quarantine.

4. We recommend further that the present federal regulations regarding the interstate movement of cattle with respect to cattle scab be adopted as far as possible by the various states, and that in addition to cattle scab, other infectious and contagious diseases of cattle be included with the thought in view that cattle visibly affected with contagious or infectious diseases be excluded from interstate shipment, except in cases of immediate slaughter at destination or to stock yards or areas which can be maintained under quarantine.

5. Your committee feels that uniform regulations at the present time with respect to Bang's disease may be difficult to attain. It would seem that the Bang control program has not yet been established on a definitely uniform basis. There are still differences of opinion as you will note by the summarization of the various state regulations contained in the 1939 report. The Federal Bureau of Animal Industry has not yet adopted regulations in this respect due to the fact that the Congress has not acted on the amendment which has been introduced which would give the Secretary of Agriculture authority to issue regulations on this subject. Control work in some states has progressed more rapidly than in others. The method of control is somewhat different, due to various factors which have a bearing on control programs. No definite stand has been taken on vaccination but it is our understanding that something concrete will probably be submitted at this meeting of the Association. In view of these facts your committee does not deem it advisable to propose anything definite at this time. However, in order to start a program for unification of the laws and regulations regarding the interstate movement of cattle with respect to Bang's disease, your committee feels that it would be very helpful if the regularly appointed committee of this Association on Bang's disease should study this problem and furnish our committee important and pertinent points which they feel should be included in a suitable interstate regulation which would be the basis for the unification of Bang regulations, this material to be available for our committee for use in the preparation of its report next year.

6. With respect to the interstate movement of swine the situation is still somewhat puzzling. Our committee feels that Federal regulations could be used for the unification of State regulations regarding hog cholera but due to the fact that there are various other swine diseases that are presenting problems to the various states, and since they should be considered in the adoption of interstate regulations on a uniform basis, we feel that here again it would be helpful if we could have the views of the regular committee on this subject, which is the one on transmissible diseases of swine. We, therefore, recommend that that committee furnish us with the important points which they feel should be considered in the adoption of uniform regulations
on the interstate movement of swine, this report to include all swine diseases and to be made available to us in time for study before the preparation of our committee's report for the coming year.

Due to the fact that various state regulations should be predicated upon federal regulations we would ask that the Federal Bureau of Animal Industry be requested to use this information as a basis for the adoption of federal regulations which then may be used by the various states. In case this report is adopted, your committee recommends that the secretary be instructed to inform the various state livestock sanitarians regarding the action taken, and also the United States Bureau of Animal Industry, and to request that the various states work for the adoption of uniform regulations predicated upon federal regulations at as early a date as possible.

President Port: Due to the lateness of the hour we will dispense with the meeting and will reconvene promptly at one-fifteen o'clock.

The meeting adjourned at 12:20 o'clock.

WEDNESDAY AFTERNOON SESSION,
DECEMBER 4, 1940

The Meeting convened at 1:30 o'clock, President H. D. Port presiding.

Field Tests of Crystal-Violet Vaccine for the Prevention of Hog Cholera

By C. G. Cole and C. N. McBryde, Field Station, Pathological Division, U. S. Bureau of Animal Industry, Ames, Iowa

INTRODUCTORY

The use of anti-hog-cholera serum in conjunction with hog-cholera virus, known as the serum-virus method of immunization, or in common parlance "vaccination," has been of inestimable value in the prevention of hog cholera and this method of immunization is now employed the world over, wherever swine are raised. However, there have always been certain drawbacks associated with this valuable and widely used prophylactic method.

The chief objection to the serum-virus method of immunization is the fact that a live and active virus is used in conjunction with the serum. In the case of perfectly normal and healthy swine, there is no danger from this procedure, but when secondary bacterial infections are present at the time of vaccination or are picked up shortly thereafter, the method may be fraught with danger, for the virus seems prone to activate such infections and serious trouble may ensue.
Another drawback to the widespread or general use of the serum-virus method has been the matter of cost. If the method is used when the pigs are small, this is not a serious objection, for improved methods of production have greatly lowered the cost of anti-hog-cholera serum within recent years. Nevertheless, many farmers are apt to defer immunization until hog cholera appears in their vicinity. As the disease is apt to have a rather distinct seasonal incidence, occurring in the late summer and fall, the spring pigs will have attained considerable size by the time the disease becomes widely prevalent and the cost of immunization, which is proportionate to the weight of the pigs, will therefore have increased considerably, so much so, that many farmers will decide to take the risk of getting by without vaccinating, rather than go to the expense of protecting their herds, and, as a consequence, heavy losses are sometimes incurred.

With a view to overcoming these objectionable features connected with the serum-virus method of immunization, officials and scientific workers in the Bureau of Animal Industry have had in mind for many years the development of a vaccine, which would afford a safer and cheaper method of immunization. Much time and a great amount of work has been devoted to the preparation and testing of experimental vaccines at the Bureau Experiment Station at Ames, Iowa, during the past fifteen or twenty years. In the course of this work, various chemical agents have been used in the preparation of vaccines. In some cases effective vaccines were obtained, but the results were not uniform and consistent when repeated lots of vaccine were prepared and tested.

It was not until 1934, when the late Dr. Dorset, then Chief of the Biochemic Division, thought of using crystal violet, an aniline dye, as an attenuating agent that consistent results were obtained. It was found that the addition of crystal violet to virus blood served to eliminate the disease-producing property of the virus but did not affect its immunizing or antigenic property. Experiments with the new vaccine had only gotten well under way and no farm tests had been made when Dr. Dorset died in July, 1935.

After the death of Dr. Dorset, further experimental work with the new vaccine was carried forward by his bureau co-workers at Washington and at Ames. Improvements in the earlier methods of preparing the vaccine were developed and extensive farm experiments were carried out.

A preliminary or progress report was made by McBryde and Cole on crystal-violet vaccine for the prevention of hog cholera in a paper which was presented at the seventy-third annual meeting of the American Veterinary Medical Association at Columbus, Ohio, in August, 1936. This paper described methods of preparing the vaccine and gave the results of pen experiments in which 271 pigs were treated with the vaccine and subsequently exposed to hog cholera by virus injection. One farm experiment, in which a herd of 40 shoats was successfully treated, as evidenced by the fact that half the number withstood subsequent exposure by virus injec-
tion, was also described in this preliminary report. The results obtained in these preliminary experiments were so encouraging, it was decided to subject the vaccine to practical field tests on farm herds in the vicinity of the Bureau Station at Ames.

The present paper embodies the results of farm experiments, which have been carried out from November 5, 1935, the date on which the first farm herd was treated, to October 1, 1940.

Methods of Preparing Crystal-Violet Vaccine

Earlier methods of preparing the vaccines were given in our Progress Report of August, 1936. It would seem advisable, however, to make brief reference to these methods before describing our present method of preparing the vaccine.

At first, vaccines were prepared with crystal violet alone, by the addition of five parts of a 1.0 per cent solution of the dye to 100 parts of defibrinated blood. Eight lots of vaccine were thus prepared and tested experimentally on susceptible pigs at the station with excellent results. None of these vaccines were tested in the field, however.

Later, with a view to increasing bactericidal action and thus enhancing the keeping qualities of the vaccine, 0.1 per cent of phenol was added. Forty-two lots of vaccine were prepared by this formula and tested on 251 experiment pigs with excellent results. Sixteen farm herds were also treated with phenolized vaccines during 1935 and 1936 with good results. It was found, however, that even small amounts of phenol have a marked gelatinizing effect on defibrinated blood and the phenol was accordingly omitted in the preparation of the vaccine.

As a result of experimentation in the laboratories of the Biochemic Division, carried out by the late R. M. Chapin, who succeeded Dr. Dorset as chief of that division at Washington, it was discovered that the germicidal action of crystal violet in defibrinated blood varies with the pH value of the blood. It was found that a slight increase in pH value was sufficient to enhance very markedly the germicidal action of crystal violet and that by rendering the blood slightly more alkaline through the addition of a small proportion of anhydrous dibasic sodium phosphate, the desired degree of germicidal action could be obtained.

Our present formula for preparing crystal-violet vaccine with anhydrous dibasic sodium phosphate was adopted in May, 1936, as our routine or standard method of preparing the vaccine. Early in 1937, this method of preparing the vaccine was given to all serum producers who desired to experiment with the new vaccine.

OUTLINE OF PRODUCTION OF CRYSTAL-VIOLET VACCINE

A—Materials: (a) Defibrinated virulent virus blood, freshly drawn with aseptic precautions from pigs sick with acute, uncomplicated hog cholera induced by the injection of virulent virus. This blood should be drawn from the pigs from the sixth to the eighth days, inclusive, after injection of the virus.
(b) Crystal violet of commercially high purity, equal to "du Pont Crystal Violet Extra Pure." A 0.5 per cent solution is prepared by thorough digestion with hot water, the substance being somewhat difficulty soluble. The solution should be stored at a temperature not below 20 degrees C. to avoid deposition of crystals. It may be filtered if desired.

(c) Anhydrous dibasic sodium phosphate, equal in quality to Exsiccated Sodium Phosphate U.S.P. It should be free from moisture, which it readily absorbs from the air, or freshly dried to constant weight at 110 degrees C. A 3.0 per cent aqueous solution is prepared, which should be sterilized by heat and protected against bacterial contamination.

B—The Vaccine Mixture: With aseptic precautions, to 800 cc. defibrinated virus blood is added, with stirring, 100cc. of the crystal-violet solution and 100 cc. of the anhydrous dibasic sodium phosphate solution. The mixture is preserved under aseptic conditions.

C—Attenuation: The vaccine mixture is held at a temperature of 37.5 degrees C. for 14 days, being agitated sufficiently to distribute sediment uniformly at least once each day. At the expiration of this period the containers are placed in cold storage, and the vaccine is then ready for use.

All pigs used in vaccine production are subjected to a careful post-mortem examination and the organs are cultured bacteriologically. If marked evidence of secondary infection is found in a virus pig, something which occurs quite rarely at the Ames Station, the blood is discarded.

The vaccine has been prepared at the Ames Station by the foregoing method in comparatively small amounts. Thus, 77 lots were prepared from the blood of one, two or three virus pigs, while 21 lots were prepared from the mixed blood of from four to nine virus pigs. Each lot was given a serial number and subjected to a potency test soon after its preparation.

From time to time, various lots of tested vaccine, prepared as just described, were pooled. These pooled lots of vaccine were always retested for potency before being used in the field. The demand for the vaccine from farmers became so great at times, that its use in the field had to be temporarily discontinued until additional lots could be prepared and tested.

During the last five years, crystal-violet vaccine prepared with anhydrous dibasic sodium phosphate has been produced at the Ames Station in increasing amounts, as follows:

1936—25 lots—13,925 cc.
1937—18 lots—26,350 cc.
1938—21 lots—34,800 cc.
1939—15 lots—41,481 cc.
1940—19 lots—75,247 cc. (in 9 months)

Totals 98 lots—191,803 cc.
Purity Tests of Vaccine

The vaccines were tested bacteriologically at the time they were removed from the incubator, that is, at the end of the usual 14-day attenuation period.

Agar plates were made from each lot of vaccine, using suitable dilutions in sterile salt solution to prevent the carrying over of crystal violet in sufficient amounts to inhibit bacterial growth.

The samples were found to be quite uniformly sterile and only now and then did the agar plates reveal an occasional colony due to air contamination.

Occasionally, when the vaccine was being rapidly produced and sufficient time was not allowed for the bacteriological examination of the organs of the virus pigs, the purity tests revealed contamination with *S. choleraesuis* and in these cases the vaccine was discarded. This occurred in only a very few instances, however, because of the care that was exercised in the selection of virus pigs used in vaccine production.

Potency Tests of Vaccine

Pigs weighing from 40 to 70 pounds of known susceptibility were used in these tests. A 4-pig test was made of each vaccine as soon as possible after its preparation.

At first, the vaccines were tested in 5 cc. and 10 cc. doses. Later, the test doses were reduced to 3 cc. and 5 cc. and still later were further reduced to 2 cc. and 4 cc. All potency tests are now being made in 3 cc. and 5 cc. doses.

In conducting these tests the vaccine is injected in the loose tissues of the ham, beneath the subcutaneous tissue and fascia, but not in the muscular tissue. Two of the test pigs receive the lower dose and two the higher dose of vaccine. The test pigs are placed in clean, disinfected outside pens and kept under careful observation and away from exposure for three weeks, previous tests having established the fact that an interval of from two to three weeks is required to establish immunity. No temperatures are taken during this time in order to avoid possibility of transferring infection. The pigs are then given an injection of 1 cc. each of virus of known virulence and carefully observed for another two weeks. Five weeks are thus required in carrying out the potency tests and during this time the test pigs must show no visible symptoms of sickness.

Up to the present time 98 lots of vaccine prepared with anhydrous dibasic sodium phosphate have been tested. More than 300 pigs have been used in these tests. Sickness developed in 5 pigs during the interval between vaccination and virus injection, but in no instance was the sickness due to hog cholera. A few of the vaccines have failed on the first test to afford adequate protection in all doses to the vaccinated pigs against subsequent virus injection, but only two have failed to give adequate protection when retested. The tests have demonstrated (1st) that our present method of preparing the vaccine had in all cases attenu-
ated the virus to a point where it no longer produced hog cholera, and that (2nd) the vaccine produced a high degree of immunity within three weeks after its administration.

**Keeping Qualities of Crystal-Violet Vaccine**

In our preliminary or progress report made in 1936, experiments were reported showing that the vaccine retained its potency remarkably well when held in cold storage.

With a view to obtaining more data on this point, four lots of old vaccine which had been in storage for periods of approximately one, two, three and four years were selected for retests of potency. A 4-pig test was made of each sample in the same doses that were used in the first potency tests, carried out at the time the vaccines were prepared. All of these old lots of vaccine, from one to four years old, afforded perfect protection to the test pigs. This would indicate that the potency of crystal-violet vaccine is exceptionally well retained under cold-storage conditions.

Experiments have also been carried out to determine the effect of relatively high and prolonged temperatures on the potency of the vaccine. Different lots of vaccine were held for periods of two, four, six and eight weeks at incubator temperature, which would be equivalent to a high summer temperature in most parts of the United States, and were then tested for potency. In these experiments prolonged exposure of the vaccine to a temperature equal to a high summer temperature had no deleterious effect on the potency of the vaccine. In another experiment a sample of vaccine was held for two weeks at 50° C. (122° F.) without impairment of potency.

It would thus appear from the experiments just cited that the vaccine retains its potency exceptionally well under cold storage conditions and that it also withstands remarkably well temperatures equivalent to and in excess of a high summer temperature. It might therefore be assumed that the vaccine is capable of withstanding considerable abuse in regard to temperature, but it is nevertheless considered highly advisable that the vaccine, like other biological products, be held under cold storage conditions.

**Farm Tests of Crystal-Violet Vaccine**

**General Plan of Farm Experiments**

In carrying out these experiments, the nature of the new vaccine was carefully explained to each cooperating farmer. It was pointed out and emphasized that the treatment was still in an experimental stage and its limitations as well as advantages were fully explained. The farmers were assured that the method was a safe one and that no ill effects would follow the vaccination of their herds. They were also told that because of the slow development of immunity the vaccine should not be used in a neighborhood or community where hog cholera was known to be prevalent. Herds were therefore selected for treatment in communities where no cholera prevailed. If there was any suspicion that such might be the case, inquiries were made and treatment was refused if cholera was found to
FIELD TESTS OF CRYSTAL-VIOLET

prevail on neighboring farms. In the treatment of farm herds, every precaution was taken to prevent the introduction of disease. Equipment and clothing were used which had not come in contact with hog-cholera virus.

The herds were not kept under observation following vaccination, as this was not considered necessary in view of the absence of any symptoms of sickness in experimental and test pigs at the Bureau Station. The farmers were instructed, however, to report immediately any unusual symptoms in their herds. They were informed that the vaccine appeared to protect the treated animals through the usual fattening period up to market age, but no guarantee was given as to the duration of the immunity. Retreatment with vaccine or serum-virus treatment at the end of 8 months was advised for animals to be kept for breeding stock.

The herds selected for treatment averaged about 50 pigs, which were from six weeks to six months of age at time of treatment. The weights ranged from 20 to 125 pounds. At first, only weaned pigs weighing from 40 to 100 pounds were treated. Subsequently, a considerable number of unweaned pigs were treated, as it was deemed desirable to compare the immunity following vaccine treatment in both weaned and unweaned pigs.

The farm herds were treated free of charge with the one proviso that when the pigs reached market age or weight, a certain number of animals from each herd, usually four, would be delivered at the Bureau Station for an immunity test. It was not considered expedient or desirable to conduct such tests on the farms for fear that virus might thereby be disseminated. The farmers were not asked to give their animals for these tests, but were paid for their animals at the prevailing market price or else received in exchange hogs of equivalent value which had been tested and found to be immune. The farmers were eager to have their pigs treated under these conditions and displayed little, if any, doubt as to the efficacy of the treatment.

News of the new treatment spread rapidly throughout the surrounding country and farmers began to apply for the treatment in increasing numbers, with the result that during the past two summers it has been necessary to maintain waiting lists of the applicants and treat the herds in the order in which the applications were received. The safety of the method and the absence of expense were, of course, the chief points of appeal. The rapid increase in the number of herds and number of pigs treated in the calendar years during which the farm experiments have been in progress is shown in the following table:

<table>
<thead>
<tr>
<th>Calendar years</th>
<th>No. Herds Treated</th>
<th>No. Pigs Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935</td>
<td>1</td>
<td>47</td>
</tr>
<tr>
<td>1936</td>
<td>16</td>
<td>617</td>
</tr>
<tr>
<td>1937</td>
<td>26</td>
<td>1,248</td>
</tr>
<tr>
<td>1938</td>
<td>53</td>
<td>2,273</td>
</tr>
<tr>
<td>1939</td>
<td>84</td>
<td>4,879</td>
</tr>
<tr>
<td>1940 (9 months)</td>
<td>56</td>
<td>3,508</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>236</strong></td>
<td><strong>12,572</strong></td>
</tr>
</tbody>
</table>
Notes were made on the sanitary conditions obtaining on each farm at the time of treatment and also on the feed ration. The weights of the pigs were estimated as accurately as possible at the time of treatment. When farrowing dates could be obtained, the ages of pigs were recorded; at other times the ages were approximated as closely as possible.

**Method of Administering Vaccine and Dosage**

The vaccine was administered by subcutaneous injection in the loose tissue on the inner side of the thigh. Pigs weighing under 75 pounds received a 5 cc. dose, while those above this weight were given a 10 cc. dose. In a limited number of herds, a portion of the herd was given two treatments, two weeks apart, with a view to determining whether the immunity might be thereby enhanced, the pigs being appropriately earmarked to indicate dosage.

In the first sixteen herds, treated in 1935 and 1936, vaccine prepared with 0.1* per cent phenol was used. Subsequently, vaccine prepared by our present formula with anhydrous dibasic sodium phosphate and no phenol was used in the treatment of all herds.

**Safety of Crystal-Violet Vaccine**

As already stated, the herds were not kept under personal observation, but the owners were instructed to report any unusual or untoward symptoms following vaccination.

In only two of the 236 farm herds which are included in this report was any trouble reported by the owners. In one instance, the trouble developed two weeks after vaccination and in the other instance an interval of more than two months had elapsed. Both herds were promptly investigated and a pig was posted at each farm. While suspicious lesions were noted, the clinical symptoms were not typical of hog cholera. However, both herds were given anti-hog-cholera serum to allay anxiety on the part of the herd owners. Two pigs were left in each herd without serum treatment and in no case did these pigs sicken. The trouble cleared up in both herds with the loss of only one or two pigs in addition to those which were killed for postmortem examination and it would thus appear that the treatment of these herds with anti-hog-cholera serum had been unnecessary.

The fact that 236 herds consisting of 12,572 pigs were treated with crystal-violet vaccine with sickness developing in only two of these herds would seem to furnish indisputable evidence that the product is a safe one. Furthermore, one hundred and fifty-one untreated control pigs were left in 79 of these herds in contact with the vaccine-treated pigs and no sickness developed in these pigs.

**Immunity Tests of Farm Herds:**

In order to evaluate the efficacy of crystal-violet vaccine in the immunization of farm herds against hog cholera, a certain number of animals, usually four, were obtained from as many treated herds as possible for immunity tests.

* In a few instances phenol up to 0.5% was used.
As previously stated, the only obligation imposed upon the farmers whose herds were treated, was the promise to deliver a certain number of hogs at the Bureau Station after the animals had reached market age in order that an immunity test might be made of each herd. In a few cases, farmers failed to keep this promise, but market hogs were obtained from most of the treated herds.

The farm hogs were brought to the Bureau Station and injected with virus of tested virulence. In a few cases the hogs were subjected to contact exposure, but the great majority were exposed by virus injection.

As a rule, the farm hogs were held for a week after reaching the station in order that they might become accustomed to changes in feed and surroundings, but at times, owing to the number of hogs coming in and the lack of accommodation, this precaution could not always be observed and some of these hogs received injections of virulent virus shortly after their arrival at the station.

A total of six hundred and forty-seven hogs of market age were obtained for immunity tests from 166 farm herds which had been treated with crystal-violet vaccine, prepared by our present formula with anhydrous dibasic sodium phosphate. The results of these immunity tests were briefly as follows: Five hundred and thirty-five of the test hogs, or about 83 per cent, remained normal or showed only a slight reaction; about 11 per cent showed severe reactions and about 6 per cent died or were killed in worthless condition.

Included in the foregoing tests, were market hogs which had received vaccine treatment at various ages, both before and after weaning. However, in the course of our experimental work, it was found, as will be pointed out later, that the results were not so good when pigs were treated prior to weaning and especially was this true in the case of pigs farrowed by immune mothers. As a result of this observation, which was based on both experimental and field data, the treatment of unweaned pigs in the field was discontinued and treatment was administered when the pigs were 10 weeks of age or over. When this plan was adopted, there was a noticeable decrease or diminution in the death loss following subsequent exposure in our immunity tests. It was also found, as will be shown later, that crystal-violet vaccine cannot be depended upon to protect swine against hog cholera beyond the usual market age, which is about eight months in Iowa.

It would seem, therefore, that a more accurate evaluation of our field tests of crystal-violet vaccine would be obtained by basing our conclusions on those farm hogs which were treated when 10 weeks of age or over and exposed by virus injection not later than 8 months after vaccine treatment. Confining our summary within these limitations, 214 market hogs from 55 herds were exposed to hog cholera in our immunity tests and of this number 89 per cent remained normal or showed only a slight reaction and could be regarded as adequately protected against hog cholera; 10 per cent showed severe reactions and only 1 per cent died. It is believed
that this summary affords a more accurate indication of the real value of crystal-violet vaccine as a prophylactic agent against hog cholera.

It should be noted that the development of severe reactions and the death of vaccinated market hogs following virus injection, regardless of whether such hogs showed clinical symptoms and lesions of hog cholera, is attributed in these tests to the failure of the vaccine to protect against cholera. Further, since most of the vaccinated hogs reached market age in December or January, it was necessary in most instances to carry out the immunity tests during midwinter—the most unfavorable time of the year to subject hogs to a virus injection on top of a change in feed and environment—and, as a matter of fact, a number of the hogs which succumbed in these tests died from pneumonia.

While somewhat better results were obtained with two doses of vaccine, spaced two weeks apart, the difference was not sufficient to warrant adoption of the double treatment. It was felt that the administration of two treatments would greatly lessen the value of the vaccine in the treatment of farm herds, for there would be serious objection on the part of farmers to handling their herds twice and even greater objection to the increased cost of two treatments. Furthermore, it was found that a single treatment with crystal-violet vaccine in the doses mentioned was sufficient to protect farm pigs up to market age.

**Duration of Immunity Following Vaccine Treatment**

It was necessary, of course, to accept vaccine-treated farm hogs for immunity tests whenever their owners decided to market them. This necessitated the testing of market hogs at various intervals after vaccination and sometimes these intervals were shorter than we would have desired, but the majority of the farm herds were tested for immunity at five to eight months after treatment.

While the duration of the immunity following treatment with crystal-violet vaccine has not, as yet, been definitely established, the vaccine seems to protect swine against hog cholera quite well through the fattening period or up to the usual market age, which is around eight months in Iowa. A number of farm herds were tested between the 9th and 10th months following vaccination and were found to be immune. Only a few herds have been tested after the 10th month and of those only about 60 per cent were found to be adequately protected. However, the number of hogs tested after the 10th month is not sufficient to warrant a final decision as to the duration of immunity.

It has been our custom to tell the owners of farm herds selected for treatment with crystal-violet vaccine that the vaccine may be expected to protect their herds quite well up to the usual market age, around eight months, but they are advised that when gilts are to be kept over for breeding stock they should receive a second treatment with crystal-violet vaccine at the end of eight months, or else be given serum-virus treatment at that time.
Vaccine Treatment of Pigs Nursing Non-immune and Immune Sows

The observation was made in the course of earlier experiments with crystal-violet vaccine and described in our preliminary report that there was a distinct interference in the antigenic action of the vaccine when anti-hog-cholera serum is given at the same time as, or shortly after, the vaccine. The passive immunity from the serum evidently interfered with the usual antigenic action of the vaccine.

With a view to determining whether a similar interference might occur when the vaccine was given to pigs nursing immune sows an experiment was carried out at the Bureau Station in which one group of little pigs nursing non-immune sows and another group nursing immune sows were treated with crystal-violet vaccine and later exposed by virus injection with a very striking difference in results. The protection afforded the first group was 100 per cent and in the second group but 61.5 per cent. This would indicate that the natal immunity in pigs nursing immune sows interferes with the antigenic action of the vaccine in a similar manner to that noted in the experiment where anti-hog-cholera serum was given in conjunction with the vaccine or shortly thereafter. Pigs farrowed by immune sows should not, therefore, receive crystal-violet vaccine until after they are weaned and we prefer to wait until two weeks after weaning in the treatment of all young pigs. As the average weaning time in Iowa is around eight weeks, the administration of the vaccine was therefore restricted to pigs ten weeks of age or over.

Tests of Crystal-Violet Vaccine in Cooperation With Practicing Veterinarians

By June of the present year, over ten thousand pigs had been treated with crystal-violet vaccine on farms around Ames with satisfactory results and it was then decided to adopt a different policy with a view to obtaining a more extensive and widespread test of the vaccine.

The treatment of farm herds around Ames was discontinued except those where treatment had been promised and arrangements were made for the distribution of the vaccine through government channels to veterinarians in various parts of the country in order that the new product could be tried out in the hands of veterinary practitioners and the results compared with those obtained in our farm tests around Ames.

The production of the vaccine was accordingly stepped up and the vaccine has been distributed in considerable amounts to veterinarians in Iowa, Illinois and several Eastern states. Sufficient time has not yet elapsed for a report on this cooperative project.

Summary

Two hundred and thirty-six swine herds, comprising twelve thousand, five hundred and seventy-two pigs, were treated with crystal-violet vaccine in the course of field tests carried out in the vicinity of the Bureau Experiment Station at Ames, Iowa. In this territory, widespread immunization of swine herds by the serum-virus method has been practiced for many years.
At first, crystal-violet vaccine was administered to pigs both before as well as after weaning, but it was found that in the case of pigs treated prior to weaning the results were not so good. This was especially true in the case of pigs farrowed by immune sows and the poor results were attributed to a pre-existing natal immunity which interfered with the antigenic action of the vaccine. When the practice of administering the vaccine to unweaned pigs was discontinued and its use restricted to pigs ten weeks of age or over, approximately 89 per cent of these pigs were proven to be immune to hog cholera by subsequent inoculation tests carried out within eight months after vaccine treatment.

In the preparation of the vaccine, which is essentially a modified virus, the disease-producing property of the virus is completely eliminated, which would seem to indicate that the virus is either killed or very markedly attenuated by contact with crystal violet. Pigs treated with the vaccine show no visible reaction and there is no danger of introducing hog cholera on non-infected premises by its use.

Because it produces no systemic reaction the use of this vaccine should greatly lessen the possibility or probability of post-vaccination troubles, for a very attenuated or killed virus does not tend to lower resistance or activate other infections as in the case of serum-virus immunization, where a live virus is used.

The absence of any reaction period following the administration of crystal-violet vaccine, with no apparent loss of appetite and no necessity for change or curtailment of ration, will have the advantage of insuring an uninterrupted gain in weight and this in turn should effect somewhat earlier marketing than in the case of pigs receiving serum-virus treatment. Simultaneous or serum-virus treatment is often followed by a more or less definite reaction period, characterized by anorexia, and it is usually considered good practice to restrict the feed for some time after such treatment.

The period or interval required for the establishment of immunity will undoubtedly constitute the most serious limitation in the use of crystal-violet vaccine, for it would not, of course, be safe to use the vaccine when cholera is prevailing in a community. Nor would it be safe to use the vaccine on herds fed upon raw garbage for the same reason. The vaccine cannot, therefore, be expected to replace entirely the serum-virus method of immunization.

While the duration of the immunity following the use of crystal-violet vaccine has not, as yet, been definitely established, the vaccine seems to protect swine quite well up to the average Iowa market age, which is 8 months. If gilts are to be kept over for breeding stock, they should receive a second treatment with the vaccine at the end of eight months or else be given serum-virus treatment at that time.

Remarks of Mr. J. L. Brock

PRESIDENT PORT: We have with us an array of state representatives of various live stock interests. I see in the audience Mr. J. L. Brock, president of the National Live Stock Association, whom I am going to ask to say a few words. (Applause).
DR. BROCK: President Port, members and guests: It is indeed a privilege and pleasure for me to be introduced to this aggregation of scientists and regulatory officials.

Speaking for the industry which I represent, I want to say that we realize we are perhaps more secure in the protection from contagious and infectious diseases than any like industry in any country in the world.

I have appeared before this organization on different occasions, unfortunately sometimes on controversial issues. I have today just come from a luncheon with members of the Bureau of Animal Industry, at which stockmen were urging further research on certain diseases.

The fact that we sometimes differ on the practical application of some of the curative remedies on our stock in strictly range countries does not mean in any way that we do not realize the importance of your profession and what it means to our industry. I think you people working with us will learn, and we also will learn, that what will apply in our country is not practical in other sections, and you likewise will perhaps find that remedies which are applicable in your section are not applicable in ours. I think a closer cooperation between these groups, the producers and the profession, will do much for this livestock industry.

I can't say more than again to reiterate that while sometimes we differ on methods of application, we do realize and appreciate the importance of your profession and what it has done for our industry.

REPORT OF COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES

ADOLPH EICHHORN, Chairman, Beltsville, Maryland
A. E. CAMERON, Ottawa, Canada
L. M. HURT, Los Angeles, California
A. C. TOPMILLER, Nashville, Tennessee
HADLEIGH MARSH, Bozeman, Montana
D. E. WESTMORLAND, Frankfort, Kentucky

Many of the important infectious diseases of livestock are being dealt with in the reports of special committees and the Report of the Committee on Miscellaneous Transmissible Diseases confines its report to diseases not included in the reports of these respective committees.

The importance of virus diseases is now recognized as being of the greatest significance and unquestionably, at the present time, they constitute one of the biggest problems to livestock owners. The primary difficulty in developing methods of control lies in the difficulty of cultivation of the various viruses. More recently, however, many of these viruses have been successfully propagated upon living tissue or in chick embryos. With further development of a prolific propagation, the possibility of developing effective immunizing agents is apparent, as, for instance, the successful achievement in the case of equine encephalomyelitis. Furthermore, with the aid of the ultra-centrifuge, the fractionization of the virus-containing material will enable us to acquire more data pertaining to their molecular size and composition through obtaining them in purer form.
The nature of the viruses is still being disputed, whether they represent definite living bodies or inanimate protein molecules. A discussion of this conception, while of the greatest importance, cannot be undertaken at this time.

The possibility of adaptation of viruses to various species of animals must also be given cognizance as evidence in that direction is ample, especially exemplified by the virus of pox. It is a well-known fact that the pathological manifestations of all pox infections in the various species of animals are identical, yet the pathogenicity of the virus is typical for different species. Thus the adaptation of a single virus for the various species of animals from an original type is probable.

The same applies to the virus of foot-and-mouth disease. Not only have we at least three strains of this virus which antigenically are not correlated yet the virulence as well as the lesions produced are identical. In this regard we might also consider vesicular stomatitis and vesicular exanthema both appearing in multiple types and which in their pathological manifestations simulate foot-and-mouth disease, yet the pathogenicity of the viruses for various species of animals is distinct. A striking peculiarity in this regard is apparent in the equine encephalomyelitis virus. There is a sharp geographical distribution of the eastern and western types of the disease but the clinical manifestations are very difficult or impossible to differentiate, although immunologically these viruses appear to have no relation.

Other similar examples could be furnished with regard to certain viruses affecting animals and man and it is evident that while research has not as yet developed any proof of adaptations, the indications strongly suggest such possibilities.

The behavior of some viruses in inducing in the animal a resistance against another virus has also been brought out in some instances. Thus, Horsfall and Lennette of the Rockefeller Institute, in the Journal of Experimental Medicine, September 1, 1940, found that ferrets injected with the human influenza virus showed marked resistance against the virus of canine distemper. The possible relationship of these viruses have also been pointed out by Eichhorn and Pyle, but in actual immunization work Horsfall and his associates have definitely shown the possibility of immunization with these two combined viruses whereas the individual virus failed in its action.

Equine encephalomyelitis was regarded as being strictly limited to the equine species until 1938 when several cases were definitely recognized and diagnosed in human beings which suggested the possibility of this disease becoming a public health problem. In 1939, and especially in 1940, the number of cases in horses has receded while human cases have occurred in greater numbers, especially during the present year. Dr. Karl F. Meyer, in a verbal report, stated that in 1940 over 120 cases of this disease occurred in California alone and possibly even a larger number in which the diagnosis of poliomyelitis might have erroneously been made by the attending physician. Are we confronted in this instance with the adapta-
tion of this virus for the human and may we not expect a continuous in-
crease in the pathogenicity of the virus for man? The committee desires
especially to bring these facts to your attention as it behooves us to be
watchful in all developments pertaining to the different viruses. We must
not deny the fact that progress is being made in our knowledge pertaining
to these mystifying infections and it is hoped that the extensive research
will develop more rational control procedures for these infections.

**Equine Infectious Anemia**

Among the diseases of particular interest to members of the profession
is equine infectious anemia. This disease still prevails in all parts of the
United States and remains a problem of serious concern to owners of
horses and mules.

Infectious anemia has a world-wide distribution. The disease has existed
in the United States for more than 50 years, and due to the difficulty of
diagnosis is probably more widespread than reports indicate. Since 1900
its existence has been reported in isolated areas from 28 different states.

Although this disease has been the subject of extensive and continuous
study in different parts of the world for the past two decades, no specific
treatment or preventive vaccination has as yet been discovered nor has a
reliable laboratory diagnostic test been perfected.

Experimental evidence obtained by the bureau and other investigators
working with this disease indicates:

1. That the virus is filterable.
2. That the virulence is variable.
3. That the virus is constantly present in the blood and body tissues of
   infected animals.
4. That body secretions and excretions may contain the virus.
5. That the virus may persist in the host for years.
6. That under natural conditions the virus appears to be specific for
   equidae.
7. That infected mares may transmit the disease to their offspring.
8. That this disease can be readily reproduced in normal animals by the
   subcutaneous injection of very small amounts of virulent horse blood.
9. That the disease may be transmitted by ecto or endo parasites.
10. That the disease may spread slowly by long, continuous intimate
    contact.
11. That the virus is very resistant to heat, cold, drying, and ordinary
    chemical disinfectants.
12. That the chronic type of the disease, which frequently co-exists with
    strongyloides and is often mistaken for the latter condition, predominates
    especially in those sections where the disease has become established, as in
    the Mississippi Delta.
With the knowledge that the disease may exist in the inactive form and that such animals carry the contagion in the blood stream at all times, the greatest care should always be used to prevent transmission of the disease from animal to animal by unsterilized instruments, bleeding needles, or even hypodermic needles. Until such time as a practical means of diagnosis becomes available and until definite information is obtained on the mechanism of infection in the natural state, sanitary measures constitute the best known means of controlling infectious anemia. In those areas where there is reason to believe that many animals are affected with the disease in either a chronic or an inapparent form, the maintenance of good sanitary conditions, systematic control of parasites, attention to the feed, care, and handling of animals will help to hold the ill effects of the disease to a minimum.

**Equine Encephalomyelitis**

With regard to the present status of infectious equine encephalomyelitis, from the reports of the Bureau of Animal Industry, the indications are that less than 6,000 cases of the disease occurred in 24 states in 1940. This is comparable with the final figure, 9,008 cases for 1939 despite the estimate that only about 1,000,000 horses and mules were vaccinated in 1940 as contrasted with the estimated number, 3,000,000 for 1939.

As in previous years, most of the cases occurred in the midwest. There, over half of the number reported occurred in late September and early October, which is later than heretofore experienced.

Western type virus was identified in cases from Alabama and Minnesota, and eastern-type virus was identified in a Georgia case. Several states remain in which the disease has been repeatedly diagnosed clinically, without either recovery of the virus or its classification as to type. It has been recommended, and may be reiterated, that detailed study of each local outbreak should be made to determine first whether the disease encountered is actually virus-induced encephalomyelitis, and next, if virus is demonstrated, to classify it as to type.

In view of the uncertainty as to the reservoir of the virus, particularly during the interval between epizootic seasons, continued search for and investigation of host species is desirable. During the past year, the assassin bug (Triatoma sanguisuga), collected in nature, was reported to harbor virus in Kansas. Two additional species of mosquitoes, Aedes atropalpus and Aedes triseriatus, were added to the list of these insects capable of transmitting the disease experimentally, and confirmatory evidence against Aedes vexans was obtained. The list of mosquitoes now totals ten species, all of the genus Aedes. In all, over a score of bird species, including pheasants and pigeons, identified in natural outbreaks, have now been found susceptible to the equine virus.

**Anaplasmosis**

Anaplasmosis was diagnosed in states where the disease has not been known to exist, and must be considered a serious problem to the livestock industry. This disease produces serious anemia by destruction of
red corpuscles. It may be transmitted from sick animals to cattle and sheep by blood-sucking insects. Apparently healthy cattle which have recovered from the disease and which continue to harbor the blood parasite may be responsible for spreading the infection. Two varieties of the disease have been described due to the Anaplasma marginale and A. centrale. It may also be transmitted mechanically as in dehorning, bleeding, or operating upon one animal after another without properly disinfecting the instruments and equipment. The most prominent symptoms include fluctuating temperatures which may become reduced to subnormal, weakness, rapid loss of flesh and icteric staining of the mucous membranes. Death loss is usually low but sufficient to worry cattlemen. Many cattle are effectively treated with sodium cacodylate; others given complete rest with easily accessible feed and water. This latter procedure is most important. In Los Angeles County one outbreak occurred in a feed yard among a lot of 500 cattle brought in from an infected area in an adjoining county. Among them about twenty cases developed, of which three died. Another sizable outbreak of this disease was diagnosed among beef cattle on pasture in the western portion of the county. About twenty-five head of young stock were lost in this case. Beef cattle that recover from the disease usually take on flesh very slowly and are quite disappointing to the owners.

**Tularemia**

While in the early studies of this infection it was thought to be limited to certain areas of the United States, it now has been found that it occurs in all parts. The infection carried by various species of animals would suggest the possibility of its becoming a constantly growing menace to human health, and in this connection a rather widespread epidemic in beaver in Montana during the past year should be noted. The diagnosis of tularemia in beaver was made in the laboratory of the Montana Live Stock Sanitary Board, and a detailed investigation was made by Jellison and Kohls of the Rocky Mountain Laboratory of the U. S. Public Health Service.

Dead beaver were reported from the Little Big Horn River and its tributaries in southeastern Montana; Dry Wolf Creek, Smith River, and the Musselshell River and its tributaries in central Montana; Beaverhead River, Wise River, and a tributary of the Madison River in southwestern Montana. Pasteurella tularensis was recovered from the beaver from all areas except the Wise River. By guinea pig inoculations, the presence of P. tularensis was demonstrated in four of the streams where beaver died, the bacteria being found in the water in one case as long as 30 days after any beavers were known to be present in the pond tested.

The findings indicate that water may be a medium of transmission of tularemia and might be a possible source of human infection. Water-caused epidemics of tularemia in man have been reported in Russia and Turkey.

The present conflict in Europe and other hemispheres and consequently the relaxing of sanitary police measures throughout the war areas are unquestionably inducive for the propagation of various infectious dis-
DISCUSSION

DR. ADRIAN J. DURANT (Columbia, Missouri): In 1939 we had an outbreak of anaplasmosis in a herd of cattle, which I thought might be worth while to mention, because of the peculiar circumstances under which it happened.

In this herd, which was purchased, 18 or 19 of the animals were de-horned, and it was only in the de-horned animals of that herd that anaplasmosis showed up. Apparently the process of de-horning transmitted the disease from one animal to another.

SOME FACTORS INFLUENCING SWINE ERYSIPELAS PROPHYLAXIS

By L. Van Es, J. F. Olney and I. C. Blore, University of Nebraska

Since some years ago swine erysipelas in its more damaging forms appeared in those regions in which the production of pork is a major part of agricultural pursuits, it has become increasingly apparent that the disease constitutes a hazard of more than ordinary importance. As such, swine erysipelas ranks with such maladies as hog cholera, pig typhus, and tuberculosis.

In the course of these years swine erysipelas spread over many areas. Definite erysipelas districts developed and even now we hear of farms on which hog raising is no longer profitable because of the disorder. The seriousness of such a situation is warrant for the consideration of such means of prophylaxis as may find practical application.

It is not to be expected that the practice of hygiene and sanitation, useful as it may be in general, can exercise a favorable influence on swine erysipelas morbidity. The ubiquity of the primary etiologic factor, its resistance to external influences and its capacity to maintain and to propagate itself in the soil as a saprophyte seem sufficient to defeat sanitary measures of prevention.

Even quarantine and the exercise of sanitary police measures may fail to contribute to the prevention of swine erysipelas, owing to the fact that a conspicuous number of apparently healthy swine may prove to be infection carriers when bacteriologically challenged. Yet it seems wise to do what is possible to prevent infective contacts and to exclude healthy swine from hog lots and pastures which were occupied by animals affected with the disease.

Of more practical importance is the prevention of the disease by immunological methods. By these, either a passive or an active immunity may be established. Like in several other diseases a passive immunity may
be secured by the use of anti-swine erysipelas serum, which when subcutaneously injected in adequate amounts will afford protection for a period of from two to three weeks. The use of anti-serum is particularly indicated in swine herds already involved in erysipelas. By the administration of a fully potent serum, it is possible to prevent further progress of the disease but it cannot be depended on for a more lasting immunity.

A more enduring immunity can be secured by injection of appropriate amounts of a broth culture of the swine erysipelas bacillus and the simultaneous injection of anti-serum in amounts sufficient to protect the animal concerned against the pathogenic action of the culture. This method of immunization was developed by Lorenz of Germany and Leclainche of France in the early nineties of the preceding century. Since that time the method has been constantly applied in most countries in which the disease must be perennially combated.

The culture used in simultaneous vaccination is a 48-hours-old broth culture which must be fully virulent in order to be effective and must have a good capacity for growth. The anti-serum injected with the culture must be of adequate potency in order to avoid vaccination erysipelas.

In a fact-finding project pertaining to the application of the Lorenz method of swine erysipelas prophylaxis on Nebraska farms, with the cooperation of the National and State Bureaus of Animal Industry, the University of Nebraska undertook potency tests of a considerable number of samples of anti-swine erysipelas serum such as was used in the field by cooperating veterinarians.

For reasons which will become apparent later in this discussion it seems proper to devote some attention to the technique of potency testing and to mention some of the results. This method of serum testing was originally designed by Leclainche. Pigeons are used as test animals and a test is completed in 21 days. Five groups of four pigeons each are used in each test. The birds of the first group receive 0.50 cc. of serum, the ones of the second group 0.25 cc. each, those of the third group 0.10 cc. each and the ones of the fourth group 0.05 cc. each. Simultaneously each pigeon receives 0.50 cc. of a 48 hours broth culture of the swine erysipelas bacillus. Culture in a similar quantity and manner is also injected into each of the four pigeons constituting the fifth group which serve as culture controls.

The latter should die within a period of from two to six days and the blood of all pigeons dying while a test is in progress is subjected to a microscopic examination for the presence of the specific etiologic factor. If bacilli are then not found the blood is further challenged by culture methods.

At the conclusion of the test period the serum potency can be roughly evaluated in about the following manner:

Serum is to be considered as of normal potency (N) when all pigeons of the 0.50 cc. dose group are healthy on the 21st test day. If in addition the birds in the 0.25 cc. dose group also survive, the serum is graded as of double potency (N \(\times\) 2); the test pigeons of the 0.10 cc. dose group
also surviving the serum potency is expressed as being five times normal potency \((N \times 5)\) and when those of the 0.05 cc. dose group also live the serum potency is estimated to be of ten times the normal potency \((N \times 10)\).

However, the pigeons of a given test series do not always behave in such an orderly manner. They are apt to die or to survive out of place, as it were, and thus cause difficulty in the interpretation of the test results. The causes of such unorthodox behavior are not precisely known. They are probably associated with variations of normal susceptibility or resistance and it is not impossible that a faulty or unbalanced complementation in the immunity chain also plays a part. These phenomena often necessitate a more or less arbitrary determination of serum values which does not tend to make for scientific accuracy. Hence an attempt was made to devise a method by which serum potency could be numerically expressed.

This effort was particularly prompted by the exigencies of an, as yet, incomplete study of anti-swine erysipelas serum potency requiring the determination of potency averages of a considerable number of serum specimens. After several trials, tests and the application of a bit of logic the following method of serum potency grading was devised and given practical application.

In order to determine the numerical potency \((N \times P)\) of a given specimen of anti-swine erysipelas serum, each of the surviving pigeons in a test are accredited with a number of points as follows:

<table>
<thead>
<tr>
<th>Serum dose Groups</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50 cc.</td>
<td>10</td>
</tr>
<tr>
<td>0.25 cc.</td>
<td>5</td>
</tr>
<tr>
<td>0.10 cc.</td>
<td>2</td>
</tr>
<tr>
<td>0.05 cc.</td>
<td>1</td>
</tr>
</tbody>
</table>

The numerical potency value of the serum tested is expressed by the sum of all credits obtained in a given test series.

Although the influence of pigeon irregularity is not set aside by this method it has the advantage of eliminating arbitrary considerations and to properly accredit each surviving pigeon regardless of what its position in a test series may happen to be. The method was designed for a special purpose pertaining to an investigational project and without reference to regulatory requirements. It may, however, be also of value to serum producers aiming at the production of serum of a more or less stable or uniform potency grade.

Serum specimens tested in the course of the period 1937-1940 by the Department of Animal Pathology and Hygiene of the University of Nebraska were at first graded more or less arbitrarily as described above. The potencies revealed by these tests, not only varied to a great extent but
many samples were found to be devoid of any protective power. This situation persisted during 1938 and part of 1939. After this period better sera became available through the combined efforts of the Virus-Serum Control Division of the B. A. I. and of the serum producers themselves.

After the numerical potency grades of all serum specimens tested were calculated, it became possible to form a more or less accurate and comparable estimate not only of potency trends in general but also of the degree of variance shown by our domestic products. The data supplied by the test protocols revealed that serum samples tested during the first half of 1939 69.5% had a numerical potency ranging between 0 and 39 and that 30.5% ranged in potency between 40 and 59.

A marked improvement was shown by serum samples tested during the second half of 1939 and 1940 to date, when 20% showed potencies ranging between 25 and 39 whereas 80% ranged between 40 and 67. Apparently entirely worthless samples were no longer encountered and the better sera attained a higher numerical potency.

The seemingly rather slow improvement in serum quality must at least in part, be attributed to older serum stocks already in the hands of ultimate users at a time when better grades of serum were being produced.

It will be observed that with the better qualities of serum now available, the variance of potency is still conspicuous. In view of the impending increased application of simultaneous serum-culture vaccination this variance is not without importance.

There are indications, largely based on empirical observations, that the dosage of anti-serum used in simultaneous vaccination, as well as its potency, exercises an influence on the solidity of the immunity which may be conferred by this procedure. In some manner, too large a dosage of a potent serum may be apt to interfere with the establishment of a lasting immunity and there is agreement among European veterinarians that the injection of just enough serum to make vaccination safe is apt to enhance the development of a maximum degree of protection. Therefore, there is warrant for the suspicion that failure of individual swine to become adequately protected may be due to excessive amounts of anti-serum administered simultaneously with a given dose of culture. For this reason the determination of serum dosage should be based not only on the body weight of pigs to be immunized, but also on the potency value of the serum.

After the vaccination by the simultaneous injection of culture and anti-serum the immunity thus engendered has an average duration of approximately six months. This signifies that individual animals may remain immune for a shorter or for a longer period. Some animals may even fail to acquire immunity, others may fall short of the average duration of protection and others will resist infection for much longer periods. These phenomena can be attributed either to excessive doses of potent anti-serum, to individual inherent qualities of the animals concerned, or to a combination of these factors.
That excessive doses of potent serum may reduce the chances of adequate protection find collateral support in a series of observations pertaining to pigeons which survived in the serum potency tests.

For the purpose of verification of a statement alleging that pigeons surviving in potency tests of anti-swine erysipelas serum fail to acquire immunity, such birds were given a subsequent injection of culture. It was found that the statement referred to was true for a considerable number of the pigeons receiving a second injection of culture, but by no means for all birds so treated.

After a considerable number of such trials had been made it began to appear that the pigeons injected with the smaller doses of the sera tested proved to be more resistant to the second injection of culture than the ones which had received the greater doses in the original serum tests.

This apparent phenomenon suggested further inquiry. Therefore, when records of 2,309 test pigeons had accumulated the data were subjected to an analysis.

The results of this analysis are illustrated by the accompanying graphs and numerical data. Briefly summarizing these results it was revealed that: 1. The acquisition of immunity declined from the lower serum potency groups to those of a higher numerical potency (Graph 1). 2. The number of pigeons surviving the immunity tests declines in accordance with the doses of serum given in the potency tests, the lower dose groups showing a higher degree of immunity than the ones receiving the larger doses in the tests (Graph 2). 3. When in the calculations the potency groups are divided into groups 1-40 and 41-72 and their influence is combined with that of serum dosage, the decline in the acquisition of immunity by test pigeons from higher serum doses and the more potent sera becomes conspicuously manifest (Graph 3).

The division of the potency groups as above indicated was made near the line of demarkation between acceptable and non-acceptable serum samples.

The term "break" is frequently applied when one or more vaccinated animals sicken with swine erysipelas within a period shorter than the six months accepted as the average duration of immunity without consideration to the varying capacity of individuals to acquire or to maintain a status of immunity. It would seem to be more appropriate to reserve the term "break" exclusively to cases in which a conspicuous number of treated animals developed the disease in spite of vaccination.

Such disappointing results are by no means common, but they must be reckoned with. Data made available through the courtesy of Dr. C. C. Grey of the Pathologic Division of the B. À. I., indicate that thus far in 25 vaccinated herds some swine failed to acquire an immunity of six months' duration. Of these 40% pertained to herds apparently free from swine erysipelas and 60% to herds in which the disease was manifest at the time of vaccination.
The data pertaining to seven of the 25 herds did not admit definite analysis, but of the remaining 18 herds some estimate could be formed of the losses sustained. It was found that in seven herds, healthy at the time of vaccination, 582 swine were treated of which 58 or 9.96% developed erysipelas within six months after vaccination. The number of cases recorded in individual herds ranged between 2 and 25% of the swine vaccinated.

The 11 herds in which the disease could be recognized at the time of vaccination comprised 1,411 swine of which 161 or 11.33% sickened within six months after vaccination, the number of cases of erysipelas, in individual herds ranging between 1.88 and 100%.

Leaving out of consideration the 11 herds in which the disease was already present at the time of vaccination and which probably should have been treated otherwise than by serum-culture vaccination, it appears that disappointing results were rather rare in view of the thousands of swine which were subjected to vaccination. However, even so, they constitute a disadvantage to be overcome.

In this the proper adjustment of serum doses to the amount of culture used may serve a useful purpose. To accomplish the latter effectively, uniformity of serum potency within circumscribed limits for all anti-swine erysipelas sera obtainable seems imperative. Then, and then only would it be possible to work out what would constitute desirable and proper dosage.

A more or less standardized degree of potency does not require the manufacture of serum of highest potency. Sera of a numerical potency fluctuating between 40 and 50 would be adequate. Such a degree of potency may even be preferable because its production would probably reduce the hazards to which serum producing horses are exposed when forced to yield serum of much higher potency values.

Wherever the control of swine erysipelas must depend on the general application of the Lorenz method of immunization, it should be kept in mind that it is solely designed as a means of prophylaxis and that it should be practiced in accordance with prevailing methods of swine production.

In definite swine erysipelas territory or on farms on which the infection has gained a foothold, it appears to be necessary to vaccinate pigs very early in life. Under such conditions swine erysipelas may destroy pigs less than one week of age and therefore there should be no delay in securing their protection. On farms on which swine erysipelas has established itself each litter of pigs should be vaccinated as soon as possible after their being farrowed and there should be no waiting until all brood sows have given birth to their pigs, if a maximum of desirable results are to be obtained.

Whenever it is desirable to establish an immunity longer than the average of six months, recourse may be had to a second vaccination. In such cases it should be applied from 12 to 14 days after the initial injec-
tion of serum and culture with this difference that in the second vaccina-
tion the serum dose is omitted and that an amount of culture double
that used in the first treatment be injected.

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**Figure 1: The Influence of Anti-Swine Erysipelas Serum Potency on the Acquisition of Immunity by Pigeons Surviving Potency Tests.**

<table>
<thead>
<tr>
<th>PERCENT</th>
<th>NUMERICAL POTENCY GROUPS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-10</td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2: The Influence of Anti-Swine Erysipelas Serum Dosage in Initial Potency Tests on the Acquisition of Immunity by Pigeons Surviving Tests.**

<table>
<thead>
<tr>
<th>PERCENT</th>
<th>SERUM DOSE GROUPS-CC.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>80</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>
THE COMBINED INFLUENCE OF ANTI-SWINE Erysipelas Serum Potency and Serum Dosage in Initial Potency Tests on the Acquisition of Immunity by Pigeons Surviving Tests.

The Average Percentage of Potency Groups 0-40 and 41-72 Respectively.

<table>
<thead>
<tr>
<th>Potency Groups 0-40</th>
<th>Initial Serum Doses - cc.</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05</td>
<td>0.10</td>
</tr>
<tr>
<td>0-40</td>
<td>90</td>
<td>80</td>
</tr>
</tbody>
</table>

The Distribution of 2309 "Test" Pigeons of which the Immunity was Challenged by Second Injections of 0.5 cc. of a 48 Hours Broth Culture Nos. 87184-87198.

<table>
<thead>
<tr>
<th>Numerical Potency Groups</th>
<th>Serum Doses in Original Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 cc.</td>
</tr>
<tr>
<td>0-10</td>
<td>3</td>
</tr>
<tr>
<td>11-20</td>
<td>26</td>
</tr>
<tr>
<td>21-30</td>
<td>56</td>
</tr>
<tr>
<td>31-40</td>
<td>105</td>
</tr>
<tr>
<td>41-50</td>
<td>168</td>
</tr>
<tr>
<td>51-60</td>
<td>237</td>
</tr>
<tr>
<td>61-72</td>
<td>188</td>
</tr>
<tr>
<td>Totals</td>
<td>783</td>
</tr>
</tbody>
</table>

GRAPH No. 1 DATA
PIGEONS SURVIVING IMMUNITY TESTS
Average of all Potency Groups

<table>
<thead>
<tr>
<th>Potency Groups</th>
<th>Percent Surviving</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>100.00</td>
</tr>
<tr>
<td>11-20</td>
<td>93.90</td>
</tr>
<tr>
<td>21-30</td>
<td>86.22</td>
</tr>
<tr>
<td>31-40</td>
<td>74.27</td>
</tr>
<tr>
<td>41-50</td>
<td>78.74</td>
</tr>
<tr>
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GRAPH No. 2 DATA
PIGEONS SURVIVING IMMUNITY TESTS
Average of serum-dose groups and potency groups 0–40 and 41–72

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<tr>
<th>Serum Dose Groups</th>
<th>Percent Surviving</th>
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<td>90.29</td>
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GRAPH No. 3 DATA
PIGEONS SURVIVING IMMUNITY TESTS
Average of Serum Dose Groups
All series

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<tr>
<th>Serum Dose Groups</th>
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<td>0.50 cc.</td>
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</table>

LISTERELLOSIS IN SWINE AND CRITERIA FOR DIAGNOSIS

By H. E. Biester and L. H. Schwarte, Veterinary Research Institute, Iowa State College, Ames, Iowa

The history of Listerellosis begins with the year 1926, at which time three English workers, Murray, Webb, and Swan, isolated and described a gram-positive rod from rabbits and guinea pigs. These animals showed generalized infections associated with gross changes of the liver and an exudate in the serous cavities. These workers named the organism Bac- terium monocytogenes on the basis of a marked increase in mononuclear cells of the blood of infected animals. Changes in the central nervous system were not mentioned by these investigators.

Following this first report others have found organisms of this type in rodents, sheep, cattle, humans, chickens, foxes, and swine. In 1934 Bergey created the genus Listerella. The organism described by Murray, Webb, and Swan in England is the type species of the genus Listerella and is designated "Listerella monocytogenes."

It might be of interest to note that in 1927, Pirie reported the isolation of Listerella organisms from the gerbille, a South African rodent. In 1940, Pirie (1) published a short note in which he states that the genus
designation "Listerella" is a homonym, i.e., the name had been given by Jahn in 1906 to a Mycetozoa and also to one of the Foraminifera by Cushman in 1939. Pirie proposes the designation Listeria monocytogenes for the type species. However, until systematic bacteriologists adopt the designation Listeria for the genus, we shall continue to use the term "Listerella."

Different species of hosts react somewhat differently to Listerella infections. In sheep, cattle, and swine the disease is manifested chiefly as an infection of the central nervous system, and, with a few exceptions, the organisms have been recovered only from the central nervous system. Graham, Hester and Levine (2) found Listerella in an aborted bovine fetus. Paterson (3) records the isolation of Listerella from four aborted ovine fetuses obtained during an epidemic of abortions in an English flock. However, in the cases of children, chickens and rodents, generalized gross changes are observed. Hematologic examination reveals an increase of monocytes in all species. A report on sheep Listerellosis by Jungherr (4) in 1937 contains an adequate review of the literature to that date.

**Bacteriology**

The causal organism is a non-motile gram-positive rod about 1.8 x .3 microns in size. The various characteristics of the organism isolated from swine are similar to the strains recovered from sheep and cattle.

The small number of outbreaks among swine that were studied by us (5) occurred in two adjoining counties in central Iowa. In one instance, suckling pigs were involved. When the pigs were brought to the laboratory, they were in the latter stage of the disease. The affected pigs showed incoordination, inability to stand alone, trembling, increased respirations and movements of the jaws and neck as if attempting to grasp something. The general clinical picture presented by these pigs could be associated with other pathological conditions. The sows showed no symptoms of any disturbance. They were not vaccinated. Hog cholera was ruled out by the injection of blood and saline suspensions of spleen, liver, kidneys and lymph nodes into cholera-susceptible pigs with negative results.

In a few other herds, pigs weighing from 40 to 150 pounds were affected. Some individuals showed incoordination or dragged the hind legs. The movements of the forelegs were characterized by an accentuated stilted gait. The animals appeared nervous and were readily excited. The clinical manifestations in the larger pigs might be confused with those of several other conditions generally attributed to faulty nutrition. A diagnosis of Listerellosis could not be made on clinical evidence alone in the several cases observed by us. The clinical manifestations, however, suggested to us the advisability of examining the central nervous system for the origin of the disturbance.
Pathology

Postmortem examination of the organs of the abdominal and thoracic cavities revealed no gross changes that were suggestive of the nature of the disease. In some instances a slight congestion was observed when the brain was sectioned. However, the brains of pigs affected with Listerellosis examined by us showed less gross alteration than those of Listerella infected sheep. Microscopic examination of the central nervous system of Listerella infected swine revealed meningitis with monocytic infiltration. Many blood vessels, especially those in the region of the pons, ventricles and the spinal canal showed pronounced perivascular cuffing. Numerous foci of monocytic infiltration were also noted. In some fields numerous polymorphonuclear cells were present. The monocytes of the blood were also increased.

Experimental Infection of Swine

Intracerebral inoculation of pure cultures of Listerella of swine origin into pigs produced death in about twenty-four hours. The organism was recovered only from the brains of these experimental pigs. The same microscopic changes noted in the field cases were present in the brains of the experimental pigs inoculated by the intracerebral method. The lining cells of the ventricles and neural canal were destroyed in many places, and foci of monocytes were present in the subependymal regions.

Repeated intramuscular, subcutaneous, or oral introductions of Listerella cultures of swine origin into healthy swine failed to produce clinical manifestations. However, it should be noted that swine used for experimental infections in this series weighed from 120 to 160 pounds. The mechanism of natural Listerella infections in swine is not understood. In several instances when we used smaller pigs (weighing about 55 pounds at the close of the experiment) and gave repeated intramuscular inoculations of ovine Listerella cultures over a period of about one month, no symptoms were noted during that time (6). However, about one month after the inoculations were discontinued the pigs developed central nervous disturbances. Both pigs showed advanced perivascular and meningeal infiltrations and the organisms were demonstrated in the foci of infiltration. A similar experience was had when a sheep was given repeated subcutaneous and intramuscular inoculations of Listerella cultures over a period of about one month without manifesting visible clinical symptoms. Four days after the inoculations were discontinued the sheep developed nervous symptoms, elevated temperature, and incoordination which were followed by death six days later. The histopathology of the brain was typical of the changes found in field cases. The organism was recovered in pure culture from the brain. The sera of the sheep possessed high agglutination titres when the injections were discontinued. These experiences are cited to point out the difficulties encountered in attempting to set up criteria for testing the efficacy of Listerella biologics.

Diagnosis of Listerellosis

Whereas Listerella infection in swine has been established, it should be pointed out that the number of field cases studied and recorded is small
and no broad conclusions should be drawn. In the limited number of Listerella infections in swine studied by us, the disease was manifested as an infection of the central nervous system similar to the forms reported in sheep and cattle.

The Listerella organisms were recovered directly from swine brains and grown on bacteriologic media. The organisms were not recovered from other organs. Brain from infected swine was ground in a sterile mortar and suspended in saline or 50% glycerine and inoculated intracerebrally into rabbits. The rabbits inoculated with this material died about 24 hours later. From the rabbit brains numerous colonies of Listerella were grown on liver infusion agar. The diagnostic procedures adopted by us in establishing a diagnosis of Listerellosis in swine, sheep and cattle are as follows:

1. Agar and broth media are inoculated with brain, spleen, liver, and kidney from the suspected animal by means of a platinum loop.

2. Frozen sections or rapid paraffin preparations are made from the brain of the field case.

3. At the time of autopsy, brain tissue from suitable areas is collected and stored in 50% sterile glycerine at refrigerator temperature and held pending the outcome of the pathological and bacteriological examinations.

4. If the cultures taken in step one remain negative but a positive or suggestive pathology is found in the field tissues, some of the brain tissue stored in 50% glycerine is inoculated intracerebrally into rabbits or guinea pigs.

In the case of swine we have recovered the organism directly on bacteriologic media following the inoculation of brain tissue from the field material. However, in our first studies on sheep involving western feeder lambs, we only rarely isolated the organisms from field cases by the direct inoculation of a loopful of brain tissue on media. When brain tissue was ground in a sterile mortar and then inoculated on media, the number of isolations of the Listerella organism increased to about 60%. We attributed this to the breaking up of the lesions in which the organisms were situated resulting in a more even distribution of the causal factor in the brain suspension. However, in every field case showing a positive histology, the organism was established in intracerebrally inoculated rabbits and from these it was readily grown on media.* When we subsequently studied the disease in field outbreaks among native sheep, our experience was similar to that of Jungherr; i.e., the organism was readily isolated by the inoculation of brain tissue on media. It is because of these experiences that we resort to histologic examination and animal inoculation when the direct culture inoculations are negative. When Listerella organisms are

* Since the above was written, we studied a bovine brain from a suspected case of Listerellosis. The histopathology was similar to this type of infection. but two series of rabbits and guinea pigs inoculated intracerebrally and intraperitoneally survived without showing symptoms. Bacteriologic examination revealed heavy bacterial contamination of the bovine brain submitted in 50% glycerine. Negri bodies could not be demonstrated.
grown on media inoculated with field material, these cultures are examined and if found pure are in turn inoculated intracerebrally into rabbits or guinea pigs. The brains of the succumbed laboratory animals are examined histologically for the presence of the cellular responses associated with Listerellosis.

We have been told that Listerellosis in swine is increasing. This should be questioned unless the diagnoses are supported by laboratory confirmations. The disease is one that cannot be definitely diagnosed clinically. Until additional cases in swine are adequately described and acceptable laboratory evidence submitted, we should consider this a relatively rare disease among swine. It is quite possible that when practitioners and laboratory workers become conscious of the presence of Listerellosis and look for its appearance, as was the case in human Brucelliasis, the number of cases recorded might increase. However, until that occurs we should not permit an unwarranted exploitation of this condition. Laboratory workers should record cases of swine Listerellosis that are established. Since our report on the few cases among swine, we have examined a large number of pigs, submitted to us as Listerella suspects, all of which proved negative after critical examination. The same is true of sheep—only a very small percentage of the Listerella suspects submitted proved positive.

The question has been asked whether or not guinea pigs are suitable for inoculation tests for Listerellosis. During our early investigations on Listerellosis, we used only rabbits for inoculation purposes. Subsequently, brain tissue from naturally infected sheep was injected intracerebrally into both rabbits and guinea pigs. In the limited number of cases in which this was done, both species were found suitable. Studies in this connection are being continued.

Porter and Hale (7) studied the effect of sulfanilamide and sulfapyridine on the course of experimental Listerella infection in mice. These drugs were suspended in glucose saline and injected intraperitoneally. Treatments were started three to four hours after the introduction of cultures and given approximately every four hours thereafter for five days. The results were good, but the repeated injections would be economically prohibitive in veterinary medicine. However, a single large dose might influence the course of field infections in animals.

DISCUSSION

DR. H. F. WILKINS (Helena, Montana): I would like to ask Dr. Biester, in his culture between the kidney and the brain, just what he did when he failed to find the listerella organism in these organs, excepting the brain.

DR. BIESTER: The reason we make it in the organisms is that so far the infection has been shown to be chiefly one of the nervous system, with an organism in the brain. We failed to find anything in the other organs. We are reasonably sure that post mortem changes and also secondary infections have not come in, so when we find these other organs sterile we have further proof that our material is very suitable for such examination. In other words, the negative findings are significant.

REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

H. C. KERNKAMP, Chairman, St. Paul, Minnesota
C. N. McBRYDE, Ames, Iowa
FRANK BREED, Lincoln, Nebraska
L. VAN ES, Lincoln, Nebraska
F. L. CARR, Columbus, Ohio

Of the transmissible diseases of swine, hog cholera is still the most important. While the incidence of this disease is quite high the mortality from it has not been particularly large. This favorable situation is due, we believe, to the use of protective therapeutic procedures. This phase of the problem is more fully discussed elsewhere on the program.

Second to hog cholera in morbidity and mortality are the diseases of the gastro-intestinal tract. During the past few years an acute hemorrhagic type of intestinal disease has been a serious drawback to swine production on many farms. Enteric disturbances characterized by catarrhal and later diphtheritic inflammatory changes in the alimentary tract continue to be a complex problem. The importance of intensive investigations and research on the disturbances and disorders which would come in this category is recognized. Due to the fact that apparently more than one etiological agent is capable of causing pathological changes in the intestinal tract of swine, especially the caecum and colon characterized by necrosis of the mucosa and at times the submucosa, therefore the committee recommends that the term necrotic enteritis be discontinued and since considerable evidence is available to show that an infectious enteritis of young growing swine is caused by Salmonella cholera suis (B. sui pestifer), the term swine typhus is more appropriate and should be substituted.

From recent experimental work it appears that substances other than infectious agents are capable of producing lesions in the alimentary tract so that the need for a more specific terminology becomes apparent.

Swine erysipelas appears to be on the increase and becoming more widespread. A more detailed discussion of swine erysipelas is considered on another part of this program.
Brucellosis in swine is, according to reports, becoming a real problem in some droves. Research and investigation on this disease must be done, especially with regard to carriers and sanitary control measures.

More and more our attention is being called to the matter of Listerella infections in swine, and it is important that we have knowledge of its characteristics so that it can be accurately recognized. An adequate appraisal of the disease from the standpoint of its distribution cannot be done until more precise information of clinical and gross pathological manifestations are available. A discussion of this phase of the disease forms a part of this program.

REPORT OF COMMITTEE TO STUDY REQUIREMENTS OF IDEAL STATE LIVE STOCK SANITARY SERVICE ORGANIZATION

W. J. BUTLER, Chairman, Helena, Montana
WARD GILTNER, C. D. STUBBS,
East Lansing, Michigan Little Rock, Arkansas
WALTER WISNICKY, H. A. SEIDEL,
Madison, Wisconsin Des Moines, Iowa
R. A. HENDERSHOTT, C. E. COTTON,
Trenton, New Jersey St. Paul, Minn.
W. H. HENDRICKS, Salt Lake City, Utah

Your special committee to study requirements of a live stock sanitary service organization beg leave to report as follows:

(1) Your committee is of the opinion that for the best interests of the live stock industry and the veterinary profession the state veterinary service should be a separate department actively cooperating with the state department of agriculture and the state department of health.

(2) It should be composed of six members, two of whom would be practicing veterinarians licensed under state law to practice veterinary medicine and engaged in the practice of veterinary medicine for a period of at least five years in the state, preceding the date of appointment; two live stock men actually engaged in the production of live stock; one member to be selected from the state agricultural college or the state university actually engaged in scientific work directly relating to animal disease problems or actively engaged in, and in close contact with the animal husbandry of the state; and one licensed physician who has been actively associated with public health work for two years next preceding date of appointment.

(3) Members of the live stock sanitary board should be appointed by the governor of the state for a term of six years, so rotated that the term of two members would expire each two years. The board should be empowered to adopt and enforce by-laws for the administration of their office. They should select their president and vice-president and should provide that the president would not vote excepting in the case of a tie vote. The by-laws should provide that the board should reorganize every two years after the appointment or re-appointment of two members. The by-laws should provide that meetings of the board may be called by the president or the executive officer or at the written request of any three members of the board made to the executive officer.
The live stock sanitary board should have authority to appoint their executive officer (from the civil service list where civil service exists) who would also act as the state veterinarian. The act creating the board should provide that the executive officer should also act as secretary of the board and subject to the rules and regulations of the board should have power to act for and perform the duties imposed by law upon the board when the board was not in session. However, any rule or regulation promulgated by him should be subject to review, modification, or annulment by the board at its next or any subsequent meeting.

The executive officer by and with the consent of the live stock sanitary board should have authority to appoint inspectors, deputy state veterinarians and other agents and assistants (from the civil service list where civil service exists) whose duties it would be to act under his direction. He should also have authority by and with the consent of the live stock sanitary board, together with the approval of either the United States Bureau of Animal Industry veterinary inspector in charge, or the Chief of the United States Bureau of Animal Industry to appoint federal veterinary inspectors stationed in his state as special deputy state veterinarians to have the powers and duties of deputy state veterinarians or agents to act without compensation and to hold office at the discretion of the board.

All deputy state veterinarians with the exception of United States Bureau of Animal Industry veterinarians should be qualified to practice veterinary medicine in the state and all deputy state veterinarians and other agents of the board should be required to take an oath of office and give bond to be paid for by the live stock sanitary board for the faithful performance of their duties.

All salaried employees of the board should be placed on a civil service basis.

The live stock sanitary board should have the power to promulgate and enforce such reasonable rules and regulations as they deem necessary for the carrying out of their duties. The law creating the board should delegate the following duties to the board:

(a) To supervise and control the action of their executive officer (state veterinarian), all deputies, inspectors, and other employees and to prescribe their duties and compensation.

(b) To prescribe their tenure of office until such time as state civil service becomes effective.

(c) To remove any one or more of its appointees, subordinates, or employees for cause after written charges of malfeasance of office had been filed with the board and a fair and impartial hearing sustained the charge.

(d) To supervise the sanitary conditions of live stock in their state and perform any duty which in their judgment was reasonable, under the provisions of the constitution and statutes of the state, and to quarantine any building, premise, enclosure, or other place or section or area in the state which is or may be occupied by live stock and which in the judgment of the state veterinarian or his authorized agent is affected or contaminated with a dangerous communicable disease of live stock or disease-carrying medium by which such disease may be communicated to live stock,
and have power to quarantine any live stock in the state when in the judgment of the state veterinarian or his authorized agent such live stock is affected with or has been exposed to such disease or disease-carrying medium, and have power to prescribe treatment and enforce sanitary regulations which in the judgment of the state veterinarian or his authorized agent are reasonably necessary and proper to circumvise, extirpate, control or prevent such disease.

(e) To foster, promote and protect the live stock industry in their state by the investigation of disease and other subjects related to ways and means of prevention, extirpation and control of disease or to the care of live stock and its products; and to this end to establish and maintain a laboratory and to make or cause to be made biologic products, curatives, and preventive agents when such biologies or preventive agents are not otherwise reasonably obtainable, to guarantee the potency and safety of such products and their use, sale, and distribution and to do or perform such other acts or things as in their judgment may be necessary or proper in the fostering, promotion, or protection of the live stock industry in their state.

(f) To promulgate and enforce such reasonable rules, regulations, and orders as they may deem necessary or proper to prevent the introduction or spread of dangerous communicable diseases affecting live stock into their state and to provide regulations governing inspections and tests of all live stock intended for importation into their state before such live stock may be imported into their state, and regulations which they may deem necessary or proper for the inspection, testing, and quarantining of all live stock imported into their state.

(g) To establish a system of meat inspection and meat grading in any city, town, county, or district when considered necessary for the public health or welfare on a fee basis if necessary and to promulgate and enforce such reasonable rules, regulations, and orders as they may deem necessary to govern meat inspection and meat grading and sanitary requirements of slaughterhouses and abattoirs; such rules and regulations also to include definitions and regulations governing the production, handling and distribution of meat and meat products.

(h) To have supervision over the production and distribution of fluid milk and cream and have power to issue rules and regulations defining milk and cream and providing for its proper production and distribution including inspection and tests of dairy herds and inspection of dairies and milk plants.

(i) To promulgate and enforce such reasonable rules, regulations, and orders as they may deem necessary or proper for the supervision or control of manufactured or refined foods for live stock and the manufacture, importation, sale, and method of handling any biologic remedy or curative or diagnostic agent for the treatment or diagnosis of disease of live stock.

(j) To slaughter or cause to be slaughtered any or all live stock in their state known to be affected with or which have been exposed to a dangerous communicable disease when in the opinion of the state veterinarian or a deputy state veterinarian, such slaughter is necessary for the protection of other live stock and to destroy or cause to be destroyed barns, stables, sheds, buildings, fixtures, furniture and personal property contaminated with any such infectious-contagious or communicable disease, when, in the judgment of the state veterinarian, or deputy state veterinarian, the same cannot be thoroughly cleaned and disinfected, and when in the opinion of that officer such destruction is necessary to prevent the spread of such disease.
(k) To indemnify the owners of any property destroyed by order of the board or its authorized representative under the provisions of the act creating the live stock sanitary board, or any rules, regulations or order promulgated by the board in pursuance of the act creating the board.

(1) Specific authority should be provided in the act creating the board, giving the board authority to accept and adopt on behalf of the state, rules and regulations adopted by the United States Bureau of Animal Industry or other federal agency for the appraisal, and destruction of animals affected with, or which have been exposed to a dangerous communicable disease and to destroy property in order to remove the infection and complete the cleaning and disinfection of the premises or to do any act or incur any expense reasonably necessary in suppressing such disease and be empowered to enforce such rules and regulations when the adoption and enforcement of such rules and regulations are necessary to secure United States Bureau of Animal Industry or other federal agency cooperation, indemnity, or financial aid.

(m) The law creating a live stock sanitary board should define live stock as any equine animal, bovine animal, sheep, goat, pig, dog, cat, poultry, and any wild or semi-wild animal under domestication or in custody of any person and be taken to include the singular and the plural.

(n) In addition to the regular funds appropriated by the legislative assembly from the general fund of the state for the adequate and proper discharge of the duties imposed upon the live stock sanitary board, an emergency fund should also be provided by the legislative assembly. The law should provide that no monies from the emergency fund could be spent excepting in an emergency and when that emergency was declared to exist by the live stock sanitary board and when the expenditure of money from the emergency fund was approved and authorized by the governor and the board controlling the expenditures of state monies.

(9) Nothing in the act creating the board should prevent the governing authority of any municipal corporation from enacting or enforcing ordinances providing for meat inspection or meat grading, or the inspection or grading of dairies or dairy products or the handling or sale of live stock within the limits of such municipal corporation, but provisions should be made that no such ordinance shall be enforced in conflict with the powers delegated to the live stock sanitary board, its officers or agents.

Your committee realizes that any plan for a veterinary service of a state may not be equally applicable in all states. In the creating of any board or department the basic industries of a state should be taken into consideration.

We realize that we have not made mention of compensation for members of the board. The committee, however, desires to suggest that fees paid to members should not be excessive. In fact, the committee suggests very modest fees. The incentive to become a member of the live stock sanitary board should arise from a sincere and honest desire to protect the live stock industry and public health rather than from a desire to earn a generous fee.
Your committee realizes that in states where the dairy industry is one of the principal industries of the state, that it is quite possible that the dairy industry would desire a separate department to regulate its affairs. However, your committee is of the opinion that the veterinary profession is well qualified to supervise the production and distribution of milk and cream.

**REPORT OF THE COMMITTEE ON RABIES**

**U. S. LIVE STOCK SANITARY ASSOCIATION**

**CHICAGO, 1940**

H. W. SCHOENING, *Chairman*, Washington, D. C.

H. C. RINEHART, J. C. FLYNN,
Springfield, Illinois  Kansas City, Missouri

M. F. BARNES, C. F. SCHLOTTHAUER,
Harrisburg, Pennsylvania  Rochester, Minnesota

L. E. STARR, Auburn, Alabama

The Committee on Rabies of this Association last year made a report on a survey of the available methods of controlling rabies in the various states, with a discussion on the standard methods and the requirements that needed to be met for an adequate control program of the disease in this country.

Your committee has been furnished material on the incidence of rabies in the various states in 1939 through the courtesy of Dr. John R. Mohler, chief of the Bureau of Animal Industry, U. S. Department of Agriculture. According to the reports received for the calendar year 1939, there were reported 7,386 cases of rabies in dogs, 358 in cattle, 36 in horses, 17 in sheep, 38 in swine, 269 in cats, 10 in goats, 172 miscellaneous, 30 in man, and a grand total of 8,314 cases.

Your committee last year also pointed out the desirability of a federal-state cooperative project in controlling rabies on a national basis. The success of the cooperative projects between the state live stock sanitary authorities of the various states and the Bureau of Animal Industry of the U. S. Department of Agriculture in controlling and eradicating such diseases as tuberculosis and Bang's disease has pointed the way for a method of approach to the control of rabies.

The Special Committee on Rabies of the American Veterinary Medical Association in its report at the annual meeting in Washington, D. C., August, 1940, also stressed this cooperative federal-state project, and that Association approved the recommendation of the executive board that some agency, preferably the Bureau of Animal Industry of the U. S. Department of Agriculture, correlate such a program.

It is the desire of your committee to again endorse a federal-state project, and since rabies is primarily a disease of animals it should be handled by the veterinary profession, which, through training, equipment, and experience, is properly prepared to cope with animal disease and epizootics.
An organized project developed in general along the lines of those used in the federal-state tuberculosis and Bang's disease programs should, with the modifications needed, be applicable to the control of rabies. In such a program, as it might develop, the practicing veterinarian, as is the case with tuberculosis and Bang's disease eradication, would play an important role.

In order, however, for a federal-state program for the control of rabies to become established, it would be necessary that certain legislation, both federal and state, concerning funds and authority be enacted. Laws would be necessary to give the dog a status equal to that of other livestock, since, for example, under the acts and regulations governing the U. S. Department of Agriculture, dogs are not considered in the class with other livestock, and funds, even if available, cannot be applied to the control of rabies in dogs.

In the elimination of rabies in wild species the Division of Predator and Rodent Control of the Fish and Wildlife Service, U. S. Department of the Interior, has been active in giving assistance. Their program embraces cooperation with various state agencies, county officials, farm and livestock associations, as well as with responsible individuals.

Pending the enactment of such laws as would look to the control of rabies on a national basis, much could be accomplished in the various states if proper machinery were available for the control of the disease. One of the principal obstacles at the present time is the lack of sufficient funds. In a rabies control program, whether or not the disease is present in a community, one of the essential safeguards is the removal of stray dogs from the streets. This should be the function of the authority concerned in the control of rabies when the disease appears in a community. By an effective means of removing stray dogs from the streets, a potential source of outbreaks of rabies may be eliminated. Adequate funds should always be available for the proper collection and disposition of stray dogs. In the event that an outbreak of rabies occurs, sufficient funds should be immediately available to the constituted authority for such use as needed to effectively control the outbreak. In order to have funds available at all times for immediate use, it would be necessary that they either be appropriated at the beginning of the fiscal year or that they be obtained from such other source as might be available, for example, the fee from dog taxes.

In the meantime, pending any action looking to the control of rabies on a national basis, it is very important that satisfactory measures for the control of rabies be adopted by the various states.

It is realized that it is not possible at this time and in the present stage of rabies control in the various states to prescribe hard and fast regulations since local conditions, with particular reference to the presence or absence of rabies, may make it advisable to modify certain of the regulations. The following proposed regulations, therefore, should be considered in this light:
(1) All dogs shall be licensed annually. The fee shall be at least $1 for a male, $1 for a spayed female, and $2 for an unspayed female.

(2) The license tag issued when the dog is licensed must be affixed to the collar of the dog and worn at all times when the animal is on public property.

(3) All unlicensed dogs or dogs not wearing license tags shall be either humanely destroyed or impounded and disposed of as follows: Animals shall be kept 48 hours (or 72 or 96 hours) and if not claimed within that time shall be humanely destroyed. If animals are claimed by their owner and have not been licensed, such dog may be returned to the owner upon the payment of a license fee and a collection and maintenance charge of $2. Licensed dogs claimed shall be returned to their owner upon payment of $1 collection charge. (In this connection it may be advisable to assess a penalty against the owner of the dog for violation of the dog regulations. It is also well to consider the possibility of rabies being spread through the return of impounded dogs to their owners and through the practice of selling dogs from the pound. Serious consideration should be given to these points, but they probably can best be handled as local conditions warrant.)

(4) A sufficient full-time personnel shall be available to properly control stray dogs and unlicensed dogs as provided above.

(5) In the event that rabies is reported or suspected in a dog, it shall be the duty of the official in charge to have determined definitely whether or not the animal is rabid. In the event that rabies is established, a thorough inquiry should be made immediately insofar as possible into the movements of the rabid dog so that all dogs known to have been bitten by or exposed to the rabid dog may be destroyed or kept in quarantine or otherwise treated as hereinafter provided. A quarantine of at least 60 days shall be placed over an area covering the possible movements of the said rabid dog. This quarantine shall provide that all dogs be kept on the premises of the owner, or, when upon public property, shall be held on a leash not over 6 feet long in the hands of a competent person.

Dogs not definitely known to have been bitten but which have had contact with a rabid dog may be kept in strict quarantine on the premises of the owner for a period of not less than 6 months. Such an animal in addition may be given a series of vaccination treatments by a qualified veterinarian. In this event the quarantine period may be reduced to 2 months. Dogs may not be removed from the quarantined area without specific permission from the constituted authority.

(6) Funds: There shall be ample funds available for immediate use at all times for the proper carrying out of these regulations. These funds shall be consistent with the size of the community. In addition to this, there shall be set aside a sum of money for the specific purpose of controlling outbreaks of rabies as they might occur. This money shall be available at all times and shall not be used for any other purpose than controlling such outbreaks. This money might come from regularly appropriated state funds labeled for this
specific purpose or from dog tax revenues or from any source as seems consistent with the procedures in the state. In any event, it shall be available at all times in sufficient amounts to meet any expected need.

(7) Personnel: Since rabies is an animal disease, the veterinary profession shall be represented in the personnel concerned with the control of the disease. The control of rabies in a state shall be fixed in an authority with power to work in any section of the state and to call for such local cooperation as may be feasible or desirable. In outbreaks in communities, due notice of such outbreak and quarantines that might be imposed shall be given publicity and in the several ways brought to the attention of the public at large and the dog owner in particular.

(8) Vaccination: When thought advisable or desirable, prophylactic vaccination of dogs may be encouraged or advocated on a voluntary basis. Vaccinated dogs, however, shall not enjoy any special privileges because of such vaccination, since vaccination is considered to be only an adjunct in any program for the control or rabies.

(9) The authority in the state charged with the control of rabies shall notify the authorities in the several states of outbreaks of rabies and their location as they occur, together with the date or dates the quarantine is lifted. All transportation companies in a state shall be notified of outbreaks of rabies and the quarantine regulations imposed governing such outbreaks.

RECOMMENDATION.

It is recommended that the Rabies Committee be continued and that it be empowered to confer and cooperate with the Special Committee on Rabies of the American Veterinary Medical Association, looking to the development of plans leading to the control of rabies on a national basis in line with the recommendations of this Committee, those of the Special Committee on Rabies of the American Veterinary Medical Association, and the recommendations of the Executive Board of that Association approved at the 77th annual meeting in Washington, D. C., August, 1940.

The following table gives a report on the incidence of rabies by states for the calendar year 1939. This table was compiled from a questionnaire sent by the Bureau of Animal Industry, U. S. Department of Agriculture, to the livestock sanitary official and the health officer of each state. In the report from some states, the statistical data from both sources were used.
### Rabies in the United States by States During the Year 1939

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<th>Dogs</th>
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<th>Sheep</th>
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President Port: The Meeting is adjourned until tomorrow morning. The meeting adjourned at 4:30 o’clock.

THURSDAY MORNING SESSION
DECEMBER 5, 1940

The Meeting convened at 9:00 o’clock, President H. D. Port presiding.

President Port: Gentlemen, it is necessary that we begin our sessions on time. We have a very full program this morning.

In order to cover all of the papers that will be presented this morning, the discussion on Bang’s disease will be withheld until after all the papers have been presented.

PROGRESS OF BANG’S DISEASE WORK IN THE SOUTHEASTERN STATES

By Dr. J. V. Knapp, State Veterinarian, Tallahassee, Florida

Following some persuasion by a member of the Program Committee, I agreed to discuss at this meeting the question of the progress of Bang’s disease control in Florida.

At a recent meeting, the committee concluded that a discussion of Bang’s disease control in Florida was not sufficient in scope to typify the work accomplished in the Southeast.

I am informed, naturally, regarding the work in Florida, but personally not too well informed about the work in the other southeastern states, and of necessity the data and conclusions I present comprise information furnished by the U. S. Bureau of Animal Industry and the livestock sanitary officials of the states of Maryland, Virginia, West Virginia, North Carolina, South Carolina, Kentucky, Tennessee, Georgia, Alabama, Louisiana, Mississippi and Florida—the 12 southeastern states covered by this paper. The other 36 states will be referred to in this discussion as the Group of 36.

Bang’s disease control work was inaugurated in the southeast in the summer of 1934 in much the same manner and conducted along the same lines employed throughout the nation. Following a period of voluntary testing, removal and slaughter of Bang’s reactors, and also, frequently, the removal of cows infected with mastitis, the several southeastern states continued the blood agglutination test for Bang’s disease, and in accordance with their respective state laws developed Bang’s disease eradication programs. After more than 5 years of continuous work, 8 of these states still confine their activities to the test and slaughter method. The other 4 regularly test all herds under supervision, and, in addition, are vaccinating some calves.

A tabulation of the records of the Bureau of Animal Industry, showing the estimated percentage of Bang’s infection in dairy and breeding cattle in 1934, and a report of the Bang’s work conducted by the 48 states up to 1940, produces some very interesting data:
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These figures are not presented as entirely accurate, but collected as they were by the bureau from the live stock sanitary officials of each state, the possibility of error cannot be great, and if inaccuracies do occur they apply to all states alike. These figures constitute the only existing basis for comparison known to me.

It will be noted from the foregoing tabulation that the national average of Bang's infection in 1934 was 9.83%. By 1940 this had been reduced to 6.68%.

The average infection for the group of 36 states was 10.8% in 1934, reduced to 7.86% by 1940. In 1934 the average of Bang's infection in the southeastern states was 6.916%, reduced to 3.166% by 1940.

The reduction in percentage points in Bang's infection in these areas was: Southeastern states, 3.75; for the nation, 3.15; and for the Group of 36 states, 2.94.

We note the average initial infection was 2.914% lower in the 12 southeastern states than the national average, and 3.884% lower in the southeastern states than the average for the Group of 36 states.

It is too early in the history of Bang's disease control to form conclusions, but from these records definite trends are obvious.

States having a high infection in 1934 still have it in 1940. Where reductions have been made, generally they are found in states having low initial infection. However, there are some exceptions to this rule, notably Washington and Oregon of the Group of 36 states, and Maryland and Florida in the group of 12 southeastern states.

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<th>% Infection 1940</th>
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The initial infection in Washington and Oregon was near the level of the national average. This has been reduced 6 and 8 percentage points respectively.

Maryland and Florida showed an initial infection of 5 percentage points higher than the national average but they have reduced their infection 8 and 10 percentage points respectively.

Considering the progress of Bang's disease control in the southeastern states from another angle, you will recall that the United States Live Stock Sanitary Association adopted regulations providing for modified accredited Bang's disease free areas during the annual meeting December, 1939.

These regulations were approved by the U. S. Bureau of Animal Industry the same year and, in accordance with them, 346 counties in the
United States have been placed on the list of modified accredited Bang's disease free areas. 205, or 59.2% of these counties, are located in the 12 southeastern states.

Another evidence of progress in the southeastern states is that approximately 38% of the cattle of the area are participating in the Bang's disease control programs, whereas approximately only 24% are under supervision in the Group of 36 states, and approximately only 28% in the nation.

From these comparisons may we conclude that there is a greater interest in the elimination of Bang's disease, and therefore more highly developed programs in the southeastern states than in states where the initial infection was high? Is it because it is comparatively easy to eliminate Bang's disease from areas where the initial infection is low?

The states of Washington, Oregon, Maryland and Florida support the contention that it is possible to conduct a successful Bang's program using the test and slaughter method in states having an initial infection as high and higher than the national average.

If Bang's disease is of sufficient economic importance to the live stock industry of the United States and deemed worthy of expending federal and state appropriations to control and eliminate, it is obvious that where the highest per cent of infection exists the necessity for such program is greater than in areas of low infection. If there was or is a recognition of the need for a Bang's disease program in the United States, assuredly this need is greater in the areas of high incidence.

In any live stock sanitary project the first essential is the recognition of the need for the project by the live stock sanitary official in charge and the live stock industry, and the second is the acceptance of the responsibility for the conduct of the program to a successful conclusion. It would follow that the official recognizing the need for the work and the responsibility his position entails, should develop a program that is applicable to conditions existing in his state.

It has been my experience in live stock sanitary activity that the citizenry, although cognizant of the necessity for the elimination of a disease, does not of itself effect the necessary laws and regulations and develop the program. Such service and the initiation of it is not only the function but the duty of the live stock sanitary official in charge, who should determine from all information available what program is best suited to conditions existing in his state, then believing so firmly and wholeheartedly in his program that he can, without equivocation, sell it and put it into effectual operation.

It is not presumed that the course of any program will meet the approval of all live stock owners but the success of a Bang's program, or any other disease eradication program, depends not so much upon the methods as upon the ability of the live stock sanitary official in charge to induce the live stock owners to conform to the program rather than to modify the program to conform to extenuating circumstances affecting individuals.
With your permission I will discuss briefly the Bang's disease control program in Florida.

Generally speaking, we have two classes of cattle. First, the native piney woods open range cattle. The second class consists of dairy herds, farm and family milch cows, purebred and grade beef cattle.

We established early in 1934 that the percentage of infection in the native piney woods cattle was extremely low, for we have yet to find a reactor in this class of cattle, and therefore, dismissed further consideration of these cattle until area work is undertaken.

Starting in 1934 on a 60-to-90-day interval basis, we tested 922 herds, comprising 38,109 cattle, disclosing 8,732 reactors, or a 23% infection.

The next year we tested 143,915 cattle in 5,377 herds, revealing 11,268 reactors, or 7.8% infection.

July, 1936, regulatory Bang's testing was inaugurated in Florida under state law and the owner or custodian required upon receipt of official notice, to present his cattle for test as directed.

During the first year of the compulsory program, 1936-37, the percentage of infection was reduced to 5.36%; during the next year, 1937-38, further reduced to 2.6%, and during 1938-39, to the present low of less than nine-tenths of 1% where it seems to remain.

Participating in our program we have 18,741 herds containing 142,049 cattle, of which 6,088 herds, or approximately 32.5%, containing 44,999 cattle have had three or more negative tests.

In the conduct of the compulsory program, all herds not having at least three or more negative tests are required to be tested at 30-day intervals. The immediate branding and disposition of reactors and isolation of suspects is required. In herds where infection is high or continues above the normal expectation, the 15-day test is applied.

Unfortunately, Florida does not produce all of her dairy herd replacements, but annually imports in the neighborhood of 10,000 dairy cattle.

After the first year of our compulsory program, that is, in 1938, we observed that certain herds readily became negative, while others, despite all efforts and supervised cleaning and disinfection of premises, continued to show a high level of infection. A comparative analysis of herd histories was made, and it was found that the herds in which infection persisted were the herds to which large additions of cattle from other states were made, while the herds which readily became negative were those producing their own replacements or purchasing native cows.

This turned our attention immediately to the Bang's status of interstate herd additions, and we adopted the policy of requiring an immediate retest of these cattle. Our record of retests in 1938 showed that approximately 10% of the cattle shipped to Florida covered by health certificate and negative Bang's test chart were positive on immediate retest.
The fact that we were introducing a greater percentage of Bang’s infected cattle than existed in the herds to which they were added was alarming, and seeking to discover why this condition existed, we submitted a portion of the serum from each re-tested cow to the laboratory of the state from which the cattle were shipped, and also to the federal laboratory at Beltsville, Maryland. This check-testing showed that in many instances laboratories in other states were reading their tests one-half to one dilution lower than we were, and in frequent instances lower than the laboratory at Beltsville.

To protect our dairymen we adopted the regulation requiring a negative test in four dilutions, beginning at 1/25. The reaction to this requirement in exporting states was bad and it was also confusing to our people, as they could not understand why a cow negative to the test in some other state should not also be negative to the test in Florida. Out of the opposition which developed because of this apparently stringent regulation developed the plan of standardizing technique and antigen in the laboratories of the southeastern states. As soon as this plan was adopted we dropped the requirement of the negative test in the 1/25 dilution.

It is much easier now to obtain negative herd additions than it was in 1938. Whether this can be attributed to the general progress of Bang’s disease control in the southeastern states, or whether the shippers are becoming more conscious of the competitive necessity to deliver Bang’s-free cattle for interstate movement—at any rate, our records indicate that in 1939 immediate retest of 7,433 dairy cows showed 217 suspects and 46 reactors, and up to November 1st of this year, immediate retest of 7,421 cattle showed 145 suspects and only 22 reactors.

From our work thus far, we have gained considerable information and reached some conclusions.

We contend that the elimination of Bang’s disease from the state of Florida would present no problem were it not for the necessity of importing cattle for herd additions. It appears that we are dealing here with two general classes of herds and cattle. First, herds to which no herd additions are made, and second, those to which interstate herd additions are made regularly.

It is comparatively easy, using the test and slaughter method, to eliminate Bang’s disease from the first class of herds, but entirely another problem to eliminate it from the second class of herds.

Inasmuch as the majority of the remaining Bang’s infected herds in Florida are those constantly making herd additions, we adopted the plan of placing such infected herds under quarantine, and we permit herd additions to be made in the following manner only:

1. The original herd must show two negative tests over a period of not less than 60 days.

2. The herd additions must be isolated on arrival in Florida from the original herd and show two or more negative tests over a period of not less than 90 days before they can be added to the original herd.
Although the theory on which this requirement was based is good, its practical application works a tremendous hardship on our dairymen, and we are not overly optimistic of the ultimate result, and long for the day when we can be assured of receiving replacement cows from negative herds, or cows which have been vaccinated as calves.

THE HANDLING OF BANG'S DISEASE—
A REPORT OF PROGRESS

By R. R. Birch, Experiment Station, Ithaca, New York

The struggle of the veterinary profession in America to bring Bang's disease under control has reached a stage where we may profitably record its progress, examine the foundations on which this progress has been built, and look to certain modifications, born of experience, in our efforts to build for the future.

When we examine the cold statistics covering the federal and state official programs we cannot fail to be encouraged; and especially when we compare the doubt and chaos that prevailed even as late as ten years ago with the orderly era into which we are gradually though somewhat painfully emerging, we will realize that we have come a long way. The statistical picture which, I hope, will be presented by others at this meeting shows that the program, although begun hastily in an emergency created by a plan for reducing the numbers of cattle, nevertheless has been held closely in line with the best traditions of the veterinary profession in excluding or bringing under control other destructive animal plagues. It is trite to mention tuberculosis, Texas fever, foot-and-mouth disease, sheep scab, and contagious pleuropneumonia in this connection, but we cannot recall too often that our American farmers are protected against losses from diseases to which farmers in some other countries continuously pay an enormous tribute.

It is on our efforts to add Bang's disease to the list that I propose to focus your attention today, with special emphasis on certain intangible, or at least unmeasurable factors that have had and will have a controlling influence on our eradication program. Examination of the records will show that the test and slaughter plan has succeeded best in those areas where the incidence of the disease is low; where the herds are small; where the movement of cattle is at a minimum and out rather than in. Where opposite conditions have prevailed Bang's disease has been a tough problem and men who are thoroughly familiar with the situation know that effective control, faintly discernible, is yet a long way off. In effect we have driven in the enemy's outposts and felt out his positions but the attack in force is yet to come.

Bang's disease has been well charted for several years. Thanks to thorough and extensive researches and observations we have for some time known its cause, its manner of spread, its erratic nature, and other intimate and basic facts regarding it. We have had at our disposal an accurate test for the detection of infected animals, and more recently we
have been learning, in the hard way, the chief limitation of this test—its failure to detect infected animals while the disease is in the early incubative stages.

Backed by this growing knowledge progressive breeders began about twenty years ago to venture forth into testing programs designed to eradicate Bang's disease from their herds. They had learned, especially the breeders of pure-bred cattle, that the disease cuts in several ways and they were ready to try any plan that had even a remote chance of succeeding. In due time there began to appear in our breed journals advertisements offering for sale cattle from herds free from Bang's disease. This was an epoch-making development though at the time it claimed little attention. The belief persisted that all herds harbored some Bang's disease, but gradually it came to be recognized that the man who did not maintain a clean herd could not compete with his more progressive neighbors either in the rearing or in the sale of cattle.

Thus the program had carried with it a certain broad background of knowledge and experience and confidence, the intangible and unmeasurable factors to which I already have referred. Men, in the main, had ceased to condemn the agglutination test because all reactors did not abort, nor all aborters react; they had learned to retest doubtful animals; they no longer were puzzled when reactions built up rapidly or when recoveries ensued and reactions ceased; and they were slowly learning the stubborn truth—denied in part by abstract logic but supported in full by bitter experience—that the test of the individual is not a safe basis for the interchange of cattle from herd to herd or from state to state. Breeders—the wisest of them at least—had learned how to use the natural though temporary resistance of the calf in establishing clean herds, and they had learned that Bang's disease in the average dairy herd at least could be crowded out gradually and effectively, by a well-executed program including periodic testing, segregation of cows at calving time, and other precautions suited to the individual herd; and this without selling a single good producer solely because she was a reactor.

At a time when "test and elimination" and "test and slaughter" unfortunately have come to be regarded as synonymous terms; when there is the superficial assumption that our only alternatives lie between vaccination and test and slaughter, it may be worth our while to look back on the gains made by an elimination plan, far from perfect but in the main effective, that had laid a solid foundation before we had at our disposal the advantages of test and slaughter or of vaccination as we know it today. And when I say look backward to the accomplishments of this half-forgotten program I am not thinking principally in terms of history, but rather in terms of the assurance that is inherent in the record. There are thousands of breeders, who, come what will, are determined to maintain clean herds and these men are the chief support of the program today.

Our present test and slaughter program, and the program of vaccination which more recently has been building, are, we believe, properly to
be regarded, as aids superimposed on the original private program which had for its final objective the establishment, maintenance and official recognition of herds free from Bang's disease. We believe, as well, that in proportion as these newer factors contribute to that objective they will be of permanent value; in proportion as they divert us from it they will fail. We have immediately before us then the question as to how our test and slaughter plan, and vaccination, which we shall discuss presently, can best be tied in with the original efforts to control Bang's disease.

Fortunately the test and slaughter plan has been able to draw heavily from the experience gained in bringing tuberculosis under control; unfortunately the identical principles do not apply in all cases to both diseases. With tuberculosis the period of incubation is long and in general terms the old cases are the spreaders; with Bang's disease the period of incubation is shorter and the recent cases are the most consistent spreaders. Thus new cases of Bang's disease spring up rapidly, in some herds so rapidly that the agglutination test lags behind in detecting and eliminating them before they become spreaders. Then the purchase of replacements made well nigh imperative by the dwindling numbers in the original herd merely provides more fuel for the flame and doubles the hazards, frequently creating what has come to be designated as the "problem herd."

Unfortunately these "problem herds," frequently but not always a result of ill-timed entry with a test and slaughter program, are too often regarded as a result of failure to take up area testing. The assumption is that these herds constantly are being threatened by infection from neighboring herds rather than by residual infection lingering in them, or by infection brought in with purchased replacements, exposed but not yet reacting. Despite genuine exceptions to the rule there is abundant evidence that this is in the main an erroneous assumption. Area testing as the sole or chief preventive of problem herds will be a disappointment. Mostly, the difficulties lie in rather well-defined channels, and closer in. Problem herds will be fewer in number when we fully realize that there are circumstances in which the test and slaughter plan should be postponed, and less drastic measures temporarily substituted.

Let us not be understood as minimizing the value of area testing, for it has proved itself and it has a large and important place to fill in selected localities. We are merely stating that problem herds will persist in spite of area testing unless we look more carefully to their real causes; also we are seeking to correct the current fallacy that the individual breeder can do nothing to control Bang's disease in his herd unless all his neighbors are working in the same direction. If herds do not actually intermingle, the average breeder, working alone, usually can keep his herd free from Bang's disease. In those areas in which herds intermingle regularly the difficulties of the individual working alone with a test and elimination plan are insurmountable.

We have now to consider vaccination with special reference to the part it can be made to play in freeing herds from Bang's disease. Used judi-
ciously with this objective always in view, it may well become a truly constructive influence; used as a substitute for test and elimination plans or otherwise injudiciously it can only strike at the foundations of the progress we already have made.

We are all familiar with the efforts made in the past to immunize against Bang's disease. These have covered a span of about forty years during which enthusiasm and disappointments have alternated in successive waves. Bacterins, fully virulent strains and the so-called non-virulent strains, have been used most extensively. All have been reported favorably—and all are now in the discard.

We now know some of the reasons at least for the ill-founded enthusiasm and failures—faulty interpretations of results; vaccination of animals of all ages; incomplete knowledge of the significance of smooth and rough cultures; difficulty in bringing under control the preparation and use of vaccines, and their wide and indiscriminate use. We can easily look backward and see obvious reasons why many careful scientists and cattle breeders held to reservations regarding vaccination, and it is worthy of note that then, as now, those inclined to look before they leaped were regarded as being hopelessly behind in the march of events. I mention these things because it is important that we shall not repeat the old errors, either in over-enthusiasm, or in failure to evaluate and use new and proved methods.

With this background, we propose now to center our discussion on Brucella Strain 19, first reported by Doctor Cotton and Doctor Buck of the Bureau of Animal Industry. The careful and extensive work of these men, and their associates and successors, has shown this strain to be relatively high in immunizing power and relatively low in virulence when used on young calves. These findings have brought about the exclusive use of this strain in the preparation of approved vaccine, hence any information regarding its qualities as an immunizing agent should interest this audience.

In 1936, with the collaboration of Doctor H. L. Gilman and Doctor W. S. Stone, we began an experiment designed to test the value of vaccines prepared from cultures of Strain 19. Briefly the plan was to select calves between four and eight months old, vaccinate them, breed them at the usual age and expose them subsequently, during the last six or seven months of pregnancy, by keeping them in a large exposure pen in which virulent natural infection with field strains was maintained. A lesser number of controls, not vaccinated, but handled otherwise in the same manner mingled at all times with the vaccinated animals. Monthly agglutination tests were conducted, and careful examinations were made at calving time to detect Bang bacilli in the milk and uterine discharges, and, in cases of abortion, the organs of the fetus.

Thirty-five vaccinates and 23 controls have been followed in this way through the first pregnancy; 29 vaccinates and 16 controls through the second. The essential results follow:
Please observe that relatively large numbers of animals have been used; that an adequate number of controls has been kept; that natural infection with animals known to be spreaders of virulent Bang bacilli has been used to provide the exposure and that the high incidence of infection among the controls speaks for the virulence of the field strains that were used. These seem to us to be cardinal points to be demanded of any experiment designed to measure the immunizing power of a vaccine, for the omission of any one would invite false interpretations.

What may we glean from the experiment?

On the surface the results are highly satisfactory for the calf crop among the vaccinates (in the first and second pregnancies combined) far exceeds that of the controls; 98.6% among the former as against 75.5% among the latter. Our numbers are still too small to constitute an accurate measure of the degree of immunity produced by the vaccine, but they at least enable us to say, with ample supporting evidence, that a valuable though imperfect immunity was produced. This, we will do well to use—with due reservations—for there is more to the picture.

When the first pregnancy terminated, 8.6% of the vaccinates were eliminating Bang bacilli either in the milk, the uterine discharges, or both, and at the end of the second pregnancy 20% were spreaders, thus the drift is toward a higher susceptibility as the effects of the vaccine have time to wear off. Approximately 30% of the vaccinates are carrying through as confirmed reactors, a percentage one would not care to accept in a purebred herd. It should be emphasized that this high percentage includes vaccination reactors and exposure reactors combined. A sharp line cannot be drawn between the two but the individual agglutination curves suggest that there were several of each with the preponderance probably toward exposure reactions. The picture is one created by vaccination followed by known continuous exposure, as opposed to the usual one in the field consisting of vaccination with the exposure left to chance and frequently requiring years to reach all of the susceptible animals.

The difference is nicely shown if we compare the percentage of reactors in our experimental herd with that observed in two large field herds which we recently have tested. In these, all calves have been systematically
vaccinated for about five years, and approximately 10% of the animals of breeding age vaccinated as calves proved to be reactors. It is probable that the lower percentage of reactors in the field herds as compared with that in the experimental herd merely represents a lag referable to hit or miss natural exposure in the field herds. Undoubtedly there remain animals in them that will prove to be susceptible when finally they actually pick up the infection.

Our examinations among the vaccinates in the experimental herd indicate that the cultures isolated were representatives of the field strains used in providing the exposure, and not of Strain 19. Thus the spreaders signify failure of the vaccine to protect rather than infection brought about by its use.

We now have before us the problem of how we may use the data at our disposal in furthering our efforts to control Bang's disease. Please observe that for the moment we are limiting our discussion to cover orderly calfhood vaccination as originally suggested by the Bureau of Animal Industry. It has nothing whatever to do with excursions into the unknown involving a loose optimism too frequently leading in actual practice to the indiscriminate vaccination, for a price, of thousands of animals of breeding age, pregnant or open, reactors or clean, all comers accepted.

There is nothing in our data to support the assumption that herds regularly will be freed from Bang's disease through vaccination alone if actual exposure intervenes, though of course there will be exceptions to the rule, infrequent in large herds, more numerous in smaller ones. There is nothing whatever to warrant us in considering seriously the astonishing proposal that vaccinated animals be given a clean bill of health to be moved from herd to herd and from state to state without fulfilling the usual requirements regarding the blood test; there is nothing that even suggests to thoughtful men the blanket substitution of vaccination for the methods we now employ. Obviously if we were to do this we soon would have on the one hand herds carrying latent but unidentified infection, and on the other hand, clean herds. Interchange of cattle between the groups would leave us, in the long pull, perhaps a little better off than we are now, but hopelessly stalled at a dead level.

Our experiments, though, in common with those of others that have preceded them, do suggest some very useful places for vaccination, all in conjunction with our present program, and all confined to calves. It is worth our while to describe these uses briefly.

Vaccination, if it will hold to a level of efficiency indicated in the experimental work reported to date should prove very useful to men with badly infected but valuable herds who are using a test and elimination plan without slaughtering their reactors. On most dairy farms the heifers can be raised apart from the milking herd without great inconvenience, but when they drop their first calves they must go into the milking barn and remain there even though there are still reactors among the mature cows. This is a crucial period and if the immunity of the
heifers can be built up by vaccinating them as calves so as to protect
them reasonably well even to the end of the first or second gestation
period it will allow more time in which to move out the reactors remain-
ing in the milking herd. We suggest careful trials in this direction.

In a few large commercial herds representing extensive investments
difficult to protect it seems likely that a program involving vaccination of
the calves, testing them just prior to breeding and culling out vaccination
reactors may provide valuable protection. This practice in conjunction
with the usual blood-testing program in the mature herd makes possible
two distinct advantages—the young stock will be partially immune at
least and their chances of being exposed will be held at a minimum.

Vaccination, we believe, with strict official control and judicious man-
agement can be made to fill a useful place in reducing the dangers that
always accompany the movement of cattle from herd to herd. With our
present methods the dividing line between success and failure with any
plan involving test and elimination of reactors usually turns on this one
point. In general terms success is the rule where replacements are not
purchased; failure is the rule where they are. We believe that a system
including official identification of all vaccinated calves can eventually be
made to furnish a source of replacements much safer than we have at
present, even though we probably shall find the protection to be far from
complete.

Vaccination likely will find a place under range conditions where herds
must wander and intermingle and there is no other way. If it can be
supplemented with systematic blood testing by groups of cattlemen it
will reach a maximum of usefulness.

We are leaving official procedures regarding vaccination for others to
discuss and we hope the subject will be thoroughly covered today, but
we may remark in this connection that our records support the broad
general principle that a vaccinated animal that has ceased to react, is
entitled to the same status in sanitary control measures as is an unvacci-
nated non-reacting animal. This strongly suggests the possibility that
vaccination can be used on the calves in some herds in which indemnities
are paid.

We have stated here merely our own conception of how vaccination can
be used. We are left just a little cold when we reflect on how it may be
used. There's the rub. Our record to date is not reassuring. In truth we
are a little puzzled to know how to describe it in a paper carrying the
title "A Report of Progress." We have permitted vaccine to be distributed
indiscriminately and sold to anyone who could pay the price; we have
crept up on the age at which vaccination is done. Isn't nine months
essentially the same as eight? And isn't ten months about the same as
nine? Our breed journals are filled with advertisements and reports that
lead to indiscriminate vaccination; our drug stores are filled with vaccine;
our dairy barns are filled with the empty bottles. Men who have main-
tained clean herds for years learn with surprise and confusion of the
appalling chances they take in so doing; elements in the agricultural press
with the best intentions and the worst judgment advise vaccination without mentioning its limitations or stating how it best may be used. All this is not progress. The bright spot seems to be that we now are alive to the situation and have the opportunity, and hope, the determination to correct it.

There still is much that we do not know about vaccination with Strain 19. We do not know what will happen if animals vaccinated as calves are not exposed until several years later; we are not yet able to estimate accurately the incidence of persistent vaccination reactions; convincing data have not been published, or acquired, so far as we know, to establish its degree of pathogenicity for mature cattle; and while there is reasonable assurance that smooth cultures of the strain can be supplied indefinitely we have always to reckon with the possibility that the virulence may build up or the immunizing power die down. With these uncertainties before us, we will do well to hold firmly to our plans involving test and elimination, tying in extensive trials of vaccination where it stands to be most useful. That is the only way in which vaccination can ever be given a fair trial. If it can prove itself at all it can do so as an aid to our present methods; if it cannot prove itself, we will at least be left with reasonably effective methods in our hands, and a definite goal in sight.

Remarks of Mr. W. J. Robinson

PRESIDENT PORT: I understand we are favored with the presence, this morning, of the Director of the Department of Agriculture, of the State of Washington, Mr. Walter J. Robinson. We would like you to come up and say a few words, Mr. Robinson. (Applause).

MR. WALTER J. ROBINSON: Thank you, Mr. President. It is a long way from the state of Washington to the city of Chicago. I am reminded of the young man who came back home after a trip to Chicago. His friends asked him how he liked Chicago, and he replied, "It would have lots of possibilities if it weren't so far away." (Laughter).

We came out from Washington, this time, en masse. We have quite a representative group. It was natural to assume that we have a reason for coming. Of course, you can guess that our interest centers around the vaccination program. We are very much interested in these talks.

In the state of Washington we have conditions under which we are sure the vaccination program can be worked out in conjunction with the slaughter program, and we are sure we have conditions under which we have given it a wonderful trial. We have the unqualified approval of those who have tried it out. I believe in some territories there is a better opportunity to try it out than in other territories, because of isolated areas in which it can be tried out. As far as we know, it has met with unbounded success. We know we have a place for it.

Thank you for this opportunity to address you. (Applause).
A DAIRYMAN'S EXPERIENCE IN THE ERADICATION
OF BANG'S DISEASE

By MAYNARD ROSENBERGER, Manager, Adohr Milk Farms,
Tarzana, California

The Adohr Milk Farms, near Los Angeles, has been in the dairy business as a producer of cattle and milk for the past 24 years. That has meant 24 years' experience with Bang's disease. The first shipment of Guernsey cows from Wisconsin was spreading contagion when it arrived in sunny California in 1917.

At the present time our inventories show more than 5,000 animals, of which about one-third are Holsteins and two-thirds are Guernseys. Most of these are grade animals, although we have about 300 registered Holsteins, and over 700 registered Guernseys.

With the blood agglutination test becoming feasible about 1927, we began systematic efforts to exterminate the disease. Our experiences to date are briefly presented in this paper under four headings, namely:

(1) failure of the test-and-segregation method of eradication;
(2) vaccination of heifers in a relatively disease-free herd;
(3) vaccination of heifers in a heavily infected herd; and
(4) results of vaccination of reacting cows.

The first two points concern the negative Adohr herd while the last two deal with the entirely separate positive herd.

Failure of the Test and Segregation Method of Eradication

At the first herd test in 1927, about 35% reacted. These were moved to separate corrals and barns, with a ravine between the positive and negative herds. This method of segregation, with blood tests every three or four months, was continued for about two years. In 1929 an entirely new dairy was established several miles away, and all accumulated reactors were sent to this new Bang's dairy. At this time we started bleeding the entire negative Adohr herd every month, and immediately sending all reactors to the Bang's dairy. Occasionally animals were purchased, but most of our replacements have been from our own heifers.

As the Adohr herd was producing certified and grade A raw milk, every effort was made to eradicate the disease. We built a maternity barn with 30 stalls so constructed that all discharges gravitated to a drain in the center of the stall, with no direct contact with any of the other stalls. The barn was built of iron and concrete, and the stalls were cleaned and disinfected after each parturition. A careful watch has been kept on all heavy cows, and they have been placed in these stalls prior to parturition.

During the breaks we often bled the herd at 15-day intervals, immediately removing all reactors. During the past 11 years about 220,000 individual blood tests have been made. In addition to disposal of cows
for other reasons, we have removed over 1,600 cows from the Adohr herd
because of reaction to the Bang’s test. While the primary purpose of safe-
guarding the consumers of certified and raw milk has been well served,
the program, from an economic standpoint, was a dismal failure. Figure
1 shows, in the top line, the yearly percentages of new reactors, while the
bottom line shows the month-by-month percentage of these reactors.

The conclusion is simply this: that in spite of monthly disposal of
reactors, and enforcement of all practical sanitary measures, it has not
been possible to eradicate Bang’s disease from this large California dairy.

**Vaccination of Heifers in the Adohr Herd**

It is apparent that the disease was continuing to spread mostly through
our young cows which had been raised in a disease-free environment, and
had therefore developed little resistance to *Brucella abortus*. After much
discussion with our Medical Milk Commission we finally obtained per-
mission to vaccinate our replacement heifers for the Adohr herd. Vaccina-
tions were begun in 1937, using 5cc to 10cc of strain 19, the heifers
usually being from 5 to 9 months of age when vaccinated. The heifers
were kept in pastures where it was not likely that they were exposed to
much, if any Bang’s disease. The first of these began freshening in
January, 1939. As they freshened they were put with the older non-vacci-
nated cows in the Adohr herd. (However, a few which had not lost their
vaccination titers by the time they freshened were sent to the Bang’s herd.)

Nothing of significance would be gained by presenting separately the
percentages of abortions, of stillbirths and of premature weak calves. I
will therefore group them all under one heading, and call them “abnormal
parturitions.” The difference between this figure and 100%, represents
the percentage of normal full-term calves.

As a rough basis for comparison, let us first consider the abnormal
parturitions occurring in the older non-vaccinated Adohr herd in recent
years, as is shown in figure 2. We find from 5.3 to 7% were abnormal
parturitions, the average being 6.3%. Only in the last year, 1939, were
any appreciable number of vaccinated heifers freshening and included in
these figures.

Figure 3 shows that a total of 496 vaccinated heifers have calved one
or more times at the Adohr dairy, and that 5.4% of the first parturitions
were abnormal births.

When we started vaccinating heifers, we left a number of calves of the
same ages unvaccinated. These serve as controls. Since January, 1939,
252 unvaccinated controls have freshened at Adohr dairy for the first
time, with 5.2% abnormal parturitions. For the first pregnancy, there-
fore, the calving records of the vaccinated and non-vaccinated heifers are
practically identical.

To date, less than a third of the vaccinated heifers have completed
their second parturitions. These show 11.6% abnormal second partur-
tions, but this figure is not representative. Of the animals which are
pregnant but not yet due to calve, only the aborters, which are ahead of time have been counted. Nearly two-thirds of the non-vaccinated controls have completed their second parturitions, with 6.9% abnormal.

To date, judging only from the calving records, the vaccinated animals in the Adohr herd fail to show any superiority over the non-vaccinated group. However, only six-tenths of 1% of the vaccinated animals have reacted since freshening, while 4.4% of the non-vaccinated controls have reacted and have been sent to the Bang’s herd.

It is too early yet to form conclusions as to the value of vaccinating heifers in the Adohr herd, but it is possible to say that no apparent harm has resulted from adding vaccinated heifers to the negative non-vaccinated milking strings.

In a letter from Dr. C. W. Bonynge, director of laboratory for the Los Angeles County Medical Association, he states as follows:

"Adohr Milk Farms
18000 Ventura Blvd.
Tarzana, Calif.

This is to certify that between the dates of January 11 and November 7, 1940, one hundred and seven whey agglutination tests for Brucella were made on the three grades of Certified Milk produced by Adohr Farms. The tests were run on regular market samples obtained from their route men, at approximately ten-day intervals.

All tests were run in dilutions of 1/5, 1/10, 1/20 and 1/40 and in NO instance was a positive reaction found in any dilution.

C. W. Bonynge, M. D.
Director of Laboratory."

**Vaccination of Heifers in the Bang’s Herd**

Since 1929 all reactors at the Adohr dairy have been transferred to the Bang’s dairy. Up until 1936 all calves born at the Bang’s dairy were removed, and not returned unless they later reacted. In February, 1936, we began vaccinating groups of heifers born at the Bang’s ranch. At pasture these vaccinated heifers associated with dry and aborting cows from the Bang’s herd, and when fresh these heifers were added to the milk strings at the Bang’s dairy. This was done purposely, so that these heifers would be in constant contact with the viris all their lives.

As is shown at the bottom of figure 3, 274 vaccinated heifers have freshened at the Bang’s dairy, with 6.2% abnormal first parturitions. Because of a shortage of cows elsewhere, it was necessary to take over 50 of these vaccinated milking animals away from the Bang’s dairy. Incidentally, they all still showed negative blood tests when removed, in spite of their heavily-infected environment. Of those which remained, only 64 have completed their second pregnancy. These 64 cows show 20.3% abnormal births at the second parturition, but this figure is given only with the warning that it is not representative. As was the case at Adohr dairy, the aborters are ahead of time and have therefore been counted,
but those which will calve normally, but have not yet done so, are not included. I wish to state at this point that by the term abortion, everything is included from 60-day conception to maturity.

Of the vaccinated heifers which were negative when they freshened at the Bang's ranch, only 11, or 4%, have since become reactors. Of these 11 reactors, only 6 have records of abnormal parturitions, the others having each calved normally one or two times.

The conclusion we draw from this experiment is: that while we did not dare to allow non-vaccinated heifers to remain in the Bang's herd environment, it appears to be entirely feasible to keep vaccinated heifers in this herd. By continually adding more vaccinated heifers, and by gradually slaughtering low-producing reactors, we expect that within a few years the Bang's herd will have become a Bang's-free herd.

**Vaccination of Reacting Cows**

The vaccination of negative cows is not officially approved at the present time. However, with reacting cows many dairymen and veterinarians feel they have nothing to lose, and they vaccinate reactors in the hope it will decrease the number of abortions or hasten the recession of the reaction titer. We have prepared no data on the latter, but my impression is that at least for three years, vaccination does not help the reactions to recede more rapidly.

Table 4, line A, shows that reacting cows which remain unvaccinated gradually get over their tendency to abort. At the first parturition after reaction, 1,228 of our new reactors showed 55.5% abnormal births. By the fourth pregnancy after reaction, they showed nearly as good a calving record as do negative cows.

Line B, in figure 4, shows that the use of vaccine on reactors causes no great or consistent reduction in the percentage of abnormal births at any given parturition after reaction, as compared with the reactors which remained unvaccinated. The conclusion may be made that the use of vaccine on reacting cows does not do any apparent harm, and does not do any appreciable good.

**Conclusions**

1. Bang's disease could not be eradicated from the Adohr dairy by monthly blood testing and removal of reactors.

2. No evident spread of disease has resulted from adding vaccinated heifers to the negative dairy herd.

3. Although hundreds of vaccinated heifers are now in the herd, the milk-serum agglutination tests are all negative in dilutions of 1:5 or more.

4. No cases of undulent fever have been traced to this herd.

5. The monthly percentages of new reactors in the herd is practically nil at the present time.

6. Abortions have materially decreased at the Bang's dairy, since there have been few new reactors to place therein.
7. Due to the addition of vaccinated heifers, the Bang's herd now contains about 30 per cent negative animals, and in a few years may be entirely clean.

8. In groups of heifers which began to freshen about two years ago, the percentages which have subsequently reacted are as follows: 0.6 per cent of the vaccinated heifers in the Adohr dairy; 4.4 per cent of the non-vaccinated controls in the Adohr dairy; 4.0 per cent of the vaccinated heifers in the Bang's dairy.

9. No appreciable good or apparent harm results from using vaccine on reacting cows.

**Figure 1**

**Number of Vaccinated and Non Vaccinated Heifers Freshening**

<table>
<thead>
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<th>Month</th>
<th>Total</th>
<th>Non Vaccinated</th>
<th>Vaccinated</th>
</tr>
</thead>
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<tr>
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<tr>
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<td>50</td>
<td>4</td>
</tr>
<tr>
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<td>42</td>
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</tr>
<tr>
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<td>23</td>
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</tr>
<tr>
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</tr>
<tr>
<td>July 1939</td>
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<td>13</td>
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</tr>
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<td>48</td>
</tr>
<tr>
<td>November 1939</td>
<td>80</td>
<td>7</td>
<td>73</td>
</tr>
<tr>
<td>December 1939</td>
<td>24</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>January 1940</td>
<td>49</td>
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<td>39</td>
</tr>
<tr>
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</tr>
<tr>
<td>March 1940</td>
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<td>0</td>
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</tr>
<tr>
<td>April 1940</td>
<td>54</td>
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<td>54</td>
</tr>
<tr>
<td>May 1940</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>June 1940</td>
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<td>0</td>
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<tr>
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<tr>
<td>August 1940</td>
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<tr>
<td>September 1940</td>
<td>14</td>
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<td>13</td>
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<tr>
<td>Total</td>
<td>726</td>
<td>270</td>
<td>456</td>
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Of the vaccinated heifers 3 have since reacted to test for a percentage of .66%. Of the non vaccinated heifers 13 or 4.81% have reacted.

**Figure 2**

**Per Cent Abnormal Parturitions in the Adohr Herd (Includes Manor)**

<table>
<thead>
<tr>
<th>Year</th>
<th>PARTURITIONS</th>
<th>% Abnormal</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
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<tr>
<td>1936</td>
<td>1,242</td>
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<tr>
<td>1937</td>
<td>1,278</td>
<td>7.0</td>
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<td>1938</td>
<td>1,022</td>
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<tr>
<td>1939</td>
<td>1,295</td>
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<tr>
<td>Total</td>
<td>4,837</td>
<td>6.3 average for 4 years.</td>
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Parturitions and New Reactors Among Vaccinated and Non-Vaccinated Heifers

<table>
<thead>
<tr>
<th>GROUP</th>
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<th>REACTORS</th>
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<tr>
<td></td>
<td>Number</td>
<td>Total</td>
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<td>ADOHR</td>
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<tr>
<td>Vaccinated</td>
<td>1st</td>
<td>496</td>
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<tr>
<td></td>
<td>2nd</td>
<td>138*</td>
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<td>Controls</td>
<td>1st</td>
<td>252</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>159</td>
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<tr>
<td>BANG'S</td>
<td>Vaccinated</td>
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Per Cent of Abnormal Parturitions Following Reaction of Cows

<table>
<thead>
<tr>
<th>PARTURITIONS FOLLOWING REACTION</th>
<th>% Abnormal</th>
<th>1st 55.5</th>
<th>2nd 29.4</th>
<th>3rd 15.9</th>
<th>4th 9.1</th>
<th>5th 7.1</th>
<th>6th 12.0</th>
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<tr>
<td>A. While cows remain un-</td>
<td></td>
<td>No. of Cows</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>vaccinated.</td>
<td></td>
<td>1,228</td>
<td>432</td>
<td>226</td>
<td>106</td>
<td>58</td>
<td>47</td>
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<tr>
<td>B. After vaccination has</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>intervened.</td>
<td></td>
<td>No. of Cows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>66</td>
<td>301</td>
<td>212</td>
<td>106</td>
<td>58</td>
<td>47</td>
</tr>
</tbody>
</table>

A BEEF BREEDER'S EXPERIENCE WITH BANG'S DISEASE

By W. A. McGregor, Manager Andelot Stock Farms, Worton, Maryland

Previous to assuming management of Andelot Stock Farms, I had considerable experience with Bang's disease in one of the largest pure-bred beef herds in America. In 1926 we started blood testing and segregating all reactors on a separate farm. Frequent blood tests were made and all samples were sent to our state laboratory. Reacting animals were immediately removed to a farm some distance from the main farm. With a large herd of approximately one thousand breeding cows, over a period of some five years, we were never able to completely eliminate the disease from the cow herd but we were able, by keeping all heifers separate, to build up negative groups of young stock. From this experience, I came to the very definite conclusion that negative open heifers, with several negative tests between weaning and breeding age, could be kept negative with reasonable sanitary precautions.

In 1932, I took over the management of the Andelot Stock Farms in Maryland and started to put together a pure-bred Aberdeen-Angus herd. It was our ambition to build up one of the finest herds of the breed. With my previous experience, as outlined above, I decided to purchase nothing but open heifers. Very few of our Western breeders were doing any blood testing and I knew that it was almost impossible to buy on anything but a single test.
Making a trip into the Corn Belt, I found several of our best breeders in a financial condition where they just had to raise money, and very superior females could be purchased cheaply if I would take numbers. Prices were quoted whereby I could select most anything I wanted from outstanding herds. This, of course, meant I would have to take open heifers, bred heifers, and young cows. I was able to buy cattle that under normal conditions would not be for sale at any price, or would have cost two or three times as much as the prices then quoted. I decided to take extra precautions and take advantage of what looked like a real opportunity. I, therefore, went ahead and made purchases of all ages and in all stages of pregnancy.

All of the cattle which I selected were blood tested and only those passing a negative test were accepted. Those selected were again tested in thirty days and less than 5% reacted and were rejected. The cattle were shipped and put in pastures that had a history of having no cattle on them for five or more years. Within two months we had one abortion and then our trouble started. We immediately started testing and during the next twelve months had taken out, as reactors, approximately 40% of our original purchases.

A positive unit was set up, on a separate farm, and all reactors were immediately removed. This reactor unit was maintained for six years. A negative unit was built up from the non-reacting original purchases, plus purchases of open heifers, plus heifers born in both units. Our negative unit has been accredited for the past four or five years, and we have had no real trouble in keeping it accredited.

The management of our reactor unit is carried on as follows: In setting up this unit every animal showing a positive reaction was removed to this separate farm which is over a mile from any of our other pastures or buildings. Only the very best cows were kept for breeding, the balance going for slaughter. An outstanding breeding bull runs with this group the year round. The calves run with their dams until they are six or seven months of age and then are weaned. These weaned calves are held together for 30 to 40 days and are then tested. All calves showing negative tests are then removed to what we call a suspicious unit where they remain until they have passed two more negative tests thirty days apart.

It is rather a rare thing to find reactors among these calves. A few will show suspicious reactions but in almost all cases will become negative. During the season of 1939, we had only one heifer calf sustain a suspicious reaction. This heifer showed reaction in the 1-25 dilution every time she was tested up to the time she was 12 months of age. In March, 1940, she jumped up to the 1-100 dilution and showed the same reaction in April. She was not again tested until September when she showed a completely negative reaction. In November she reacted in the 1-25 dilution and was again tested three weeks later when she reacted in the 1-50 dilution. She is now in the reactor herd.

From the 1940 calf crop we have one bull calf and one heifer calf showing suspicious reactions in the 1-50 dilution. The bull calf has been
tested three times and has never changed his titre. The heifer calf has done exactly the same thing.

We produce about 40 calves each year in this reactor herd and it will be seen, by the above, that we have very little trouble with the calves reacting.

Now back to the positive group of cows. Every cow in this herd is there because she either showed a positive reaction or sustained a suspicious reaction over several tests. Attached is a chart showing the calving record of part of this herd. This is not a selected group as the cows listed are the first twenty cows on our records. I understand that this paper is to be printed in the annual report so I will not burden you with the details. The chart shows 18 cows that have been in our positive herd since 1932-1933 when we first started cleaning up under the blood-test method. We have taken the blood out of these cows once a year, only since 1938, and have no record of their reactions between 1932-1933 and 1938. This chart shows 18 cows all positive in 1933 of which only three remain positive as of October, 1939, while 5 showed suspicious reactions and 10 were negative. It also shows one animal, number 120, who was put in this herd in 1937 because she showed several consecutive suspicious tests, but on the last test, October, 1939, was negative. The chart also shows one cow, number 228, who was calved in the positive herd, sustained a suspicious reaction until breeding age, was sent to the positive herd in 1936 when she became of breeding age, calved normally in 1937-1938-1939-1940 and in the last test showed a negative reaction.

The calving record, as shown by the chart, is interesting. Of the 18 cows listed, 8 aborted their first calves, one carried her first calf and aborted her second calf and one carried her first two calves and aborted the third. One cow aborted in 1932, calved normally in 1933-1934-1935-1936, aborted in 1937 and then calved normally in 1938-1939-1940. For the 9 years, dealing with 18 cows, we had 10 actual abortions and 138 calves. I call this a pretty satisfactory breeding unit.

I won't go into further details of this chart as you can study it, if interested, when it is printed. I just want to say that we have produced about a 90% calf crop from this infected herd, have retained some of our best breeding cows and carried on our bloodline. These cows have been regular producers of outstanding calves.

Now there is one thing about the blood test that worries me as I am sure it does a majority of pure-bred breeders. As I see it, we are building up highly susceptible groups of cattle that can be set on fire very easily. Very recently I learned of a herd that had been accredited for some five or six years, which had a serious outbreak. This herd is under the management of a man who is one of our best breeders and who has taken great pride in the fact that his herd has regularly been re-accredited. No animals have been added except open heifers with a series of clean tests before they were of breeding age. Out of a clear sky one of his best cows aborted. He immediately had the blood drawn from the balance of the herd and picked off three reactors and two suspicious reactors.
Two of these reactors aborted soon after being removed from the herd. Two weeks later he again had a test made and found three more suspicious animals. He intends testing every two weeks until all of his herd has calved out. He tells me he has explored all possibilities and can find no reason for this sudden outbreak. I know him to be a most careful man who takes every precaution. Several other breaks of this kind have happened in our state but I am not familiar with the details.

As pure-bred breeders are we not all sitting on a powder keg with our accredited and highly susceptible herds? We sell breeding cattle from our accredited groups that go to farms on which no tests have been made but are supposedly free from Bang. The buyer has an outbreak and immediately blames it on us saying we sold him cattle with the disease, in spite of the fact that they come from our accredited herds. His proof—so-called—is that he had no trouble until he bought our cattle. The truth of the matter may be that his herd may actually have built up an immunity and passed the disease on to the highly susceptible animals purchased from us. Hearing of breaks in our accredited herds and also hearing of trouble in cattle we have sold from our accredited herds, becomes a nightmare. When a friend or a neighbor has a break in his herd we immediately begin to worry about our own. I firmly believe we have got to come to a combination of the blood test and calfhood vaccination for our own protection.

We have been hearing about calfhood vaccination for some years. Reports from the Bureau of Animal Industry and various state officials assure us that we can vaccinate our calves with reasonable assurance of success. We, as breeders, cannot understand why this has not been officially recognized and adopted. Recently I received some data from breeders of beef cattle who have carried on vaccination for some time. Here is what some of them say.

(a) A pure-bred beef herd in Ohio started with 19 bred heifers and 17 open heifers in 1938. In 1939 eight of the bred heifers aborted and eleven had live calves. All cows with calves and all open heifers vaccinated. In 1940—of the original 19 bred heifers—18 calved normally and one did not conceive. Of the 17 heifers vaccinated when still open—15 calved normally, 1 aborted and 1 took several months to settle but is now safe in calf.

In 1939—15 heifer calves and 8 bull calves were vaccinated with strain 19 between 4 and 8 months of age. All passed a negative test in June, 1940.

The manager of this herd writes: "We are sold on the results obtained so far and will continue to vaccinate and test our calves until we have developed not only an immune herd but also one that will remain negative to the test which I think can be done."

(b) A pure-bred beef herd in Michigan bought 45 pure-bred cows of which 31 aborted. The following year many of them again aborted, and they had trouble getting them settled. A blood test was made and 43 of the 45 reacted. The entire herd was then vaccinated. Some of the cows were six to eight years of age. Every cow dropped a healthy calf in 1939. The heifer
calves have all been vaccinated for the past two years and over 95% have passed a clean test before they were 15 months of age. This herd produced a 99% calf crop this year.

(c) A pure-bred beef herd in Kentucky showed that sixteen two-year-old heifers had been bred three periods and none settled. They were blood tested and all reacted. They were vaccinated and held thirty days before breeding. Twelve settled on the first service and the other four settled on the second service. All dropped healthy calves and only 2 showed any trace of Bang's after calving.

(d) A large range herd, running over one thousand cows, started vaccinating six years ago. The heifer calves are all vaccinated at weaning time and from a 56% calf crop in 1934 this herd produced a 91% calf crop in 1940.

An Illinois breeder purchased 100 of these vaccinated heifers. 98% passed a clean test within 9 months. All are now producing calves and there has been no abortion.

(e) A large Nebraska range herd of 1,200 cows has vaccinated their heifer calves for the past six years and has gone from a 60% to an 88% calf crop.

(f) A large pure-bred herd in Missouri has practiced calfhood vaccination for the past four years. They vaccinate at 3 months of age and report 90% negative at 12 months and 99% negative before they became of breeding age.

These are just a few of the many who are vaccinating. Hundreds of thousands of doses of Bang's vaccine are being sold each year and it is apparent that it is giving satisfactory results.

I am neither a veterinarian nor a scientist. I have had plenty of experience with Bang's disease and with the blood test. The blood test has proven to be a reasonably satisfactory method of cleaning up. Personally I don't believe all this written and spoken "rot" about the blood test being unreliable. During 1932-1933 we had hundreds of samples tested. These samples were split, one going to our state laboratory and one to the Johns Hopkins Laboratory. While there was some slight difference in the degree of suspicion there was not one case where one laboratory called a sample negative while the other called it positive. One writer, in a recent issue of a breed paper, would like us to believe that the blood test is not reliable. My experience is that it is reliable insofar as it tells us which animal is infected and which is not. This, to my mind, is of very great value in enabling us to segregate our infected animals and stop the spread of infection in our own herds. My complaint, and I believe I am voicing the opinion of the majority of intelligent breeders, is that the blood test is not enough. It leaves us with susceptible groups which are in grave danger of re-infection. We need something to go along with the blood test and I believe calfhood vaccination is the answer. I see that Dr. Mohler is to speak to us about calfhood vaccination. I hope he is now ready to recommend it officially and that the states will officially adopt it in conjunction with the blood test.
We, as breeders, should have frank and unbiased information on the
calfhood vaccination. We understand the federal government has now
carried on sufficient work to be able to give us this information. The test
and slaughter method is expensive and wasteful. Many a grand breeding-
female has gone to slaughter because she reacted. The test and slaughter
method is useless unless it is carried out on an area basis. What good
does it do me to test and slaughter reactors while my neighbors do noth-
ing? Many a clean or accredited herd has been set on fire by his
neighbor's cattle. Give us a chance to build up herds free from Bang's
disease and immunized against infection.

Under the blood test method, I have learned, at least to my own satis-
faction, a few things.

(1) Pregnant animals, with records of negative tests made only after
they become pregnant, are about as dangerous a thing to handle as is pos-
sible to buy. More breeders get into trouble buying bred heifers and cows,
than in any other way I know of. Here is one place where the blood test is
not too reliable.

(2) Open heifers, with several tests of the whole group before they be-
come of breeding age, are about as safe a proposition as a breeder can handle.

(3) The blood test, over a series of tests, is a reliable means of telling
us which animals are infected and which are not. It is not reliable with preg-
nant animals whose previous status is unknown.

(4) An untested herd, even though producing normal calf crops, may
be badly infected, and still have an immunity or herd tolerance which pre-
vents actual abortions. Why insist that only animals coming from accredited
herds be permitted to cross your state borders to enter such herds? The
chances are these negative animals will quickly pick up the disease.

In conclusion, I want to draw to your attention the difference in view-
point between the dairy cattle breeder, and the men producing beef cattle.
There is no health problem of spreading the disease to humans through
milk, as far as the beef breeder is concerned. The breeder of beef cattle
is only interested in producing calves. The calf crop is what makes or
breaks him. Whether you call his cows positive or negative is of minor
importance as long as they go on producing calves. We know from ex-
perience that a great majority of our reacting cows, even though they
may have actually aborted at some time or other, will go on and produce
calves. We think these reactor cows have set up their own immunity. We
know we can't keep our positive and negative breeding animals to-
gether. Segregation is expensive and in many cases impossible. We want
our breeding herds immunized against Bang's disease if that is possible.
We want you veterinarians to tell us whether we can immunize our herds
with vaccination. Breeders who have been vaccinating, report excellent
results, yet we have no "go ahead" signal from our officials. We are
looking to this meeting to get this vaccination question out in the open
and settled one way or another. We beef cattle men feel that the test
and slaughter method is too expensive and too wasteful of good breeding
stock. We feel that it is useless to test and slaughter unless it is done on an area or state-wide basis. We feel that our accredited herds are in grave daily danger of reinfection.

We want a safe, sane, plan of carrying on our business and from the information now available, some official but mostly unofficial, we want to try out calfhood vaccination. However we, and especially the pure-bred men, want to do this under the supervision and with the cooperation of our state live stock sanitary officials.

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<th>Cow</th>
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<td>1933</td>
<td>1934</td>
</tr>
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<td>+</td>
<td>A</td>
</tr>
<tr>
<td>28</td>
<td>++++</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>32</td>
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<td>+</td>
<td>A</td>
</tr>
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The Standardization and Control of Brucella abortus Vaccine


The importance of adequate control of veterinary biologic products marketed through commercial channels has long been recognized by the Bureau of Animal Industry. The Division of Virus-Serum Control was created for this purpose.
For many years the use of virulent cultures of *Brucella abortus* was practiced in infected herds for immunization of open cows and virgin heifers against Bang's disease, and commercial biological concerns were licensed to distribute such products.

In 1928 Cotton and Buck began their series of experiments in calfhood vaccination in which strain 19 *Brucella abortus*, an organism of reduced virulence, was used. They found that strain 19 produced a serviceable immunity to subsequent exposure to virulent Brucella organisms and, unlike virulent culture vaccine, it did not tend to localize in the udder of the vaccinated animals.

A test of various commercial Brucella vaccines, made late in 1931, disclosed the fact that most of these vaccines not only contained *Brucella abortus* organisms, but some also contained *Brucella suis*, the swine species. Realizing the danger of spreading the disease not only to cattle but also to man through the use of such vaccines, the Bureau of Animal Industry, in 1932, prohibited the use of virulent cultures and required that all commercial vaccines be prepared from avirulent organisms or organisms of such low virulence as to be acceptable to the bureau. Cultures of strain 19 were furnished all licensees and it has been the sole source of commercial vaccine since that time.

The highly encouraging results obtained with strain 19 *Brucella abortus* vaccine in the control of bovine brucellosis in both experimental studies and field trials have resulted in the extensive production of this product by numerous commercial firms.

In view of the extensive vaccination studies carried on by the Animal Disease Station, all laboratory tests of commercial Brucella vaccines prepared for veterinary use are conducted by this station.

Progressive changes in procedure utilized in these tests have been developed in line with actual requirements as they became apparent. The efficacy of present methods is indicated in the reduction of condemned samples observed over a period of five years. This is significant in view of the vast increase in the volume of samples currently handled.

In general, disposition is made on the basis of purity, viability, density and hydrogen-ion concentration. Additional examinations for possible dissociation are likewise made at periodic intervals.

**Purity**

The importance of purity as it relates to biologics in general is far too obvious to warrant extensive discussion. The presence of existing contaminants is readily apparent to the experienced technician. When such cultures are examined, Gram's stained smears as well as dilution plates readily indicate the existence of contaminating cells. Specific identification of contaminants is not routinely practiced and it is only in those instances where such a request by the producer appears justified that such determinations are made. The presence of a contaminant in any sample of a serial batch results in the condemnation of the entire batch.
Viability and Density

Viability determinations are based on a recognized optimum vaccinal dosage of forty to fifty billion viable organisms. Vaccines containing less than five billion viable cells per c.c., where five c.c. doses are indicated, are classed as unsatisfactory.

Supplemental determinations in which total cell concentrations, or density, are measured by photo-electric and centrifuge tube methods, afford presumptive evidence for subsequent correlation with viability counts.

Hydrogen-ion Concentration

The hydrogen-ion concentration of vaccine is of sufficient importance in relation to the duration of viability to warrant its consideration.

A detailed experiment is being carried out at the present time relative to the effect of pH on the duration of viability of vaccines held under varying conditions. It is confidently expected that the completion of these studies will narrow the limits now considered safe for maximum viability. An optimum reaction within the pH range of 5.9 to 6.8, based on several hundred tests, appears justified.

Since August, 1940, it has been required that all Brucella abortus vaccine prepared by federally licensed establishments must be tested and approved by the bureau before it may be released.

In the two-year period from December 14, 1936, to December 31, 1938, 563 batches of Brucella vaccine from 22 commercial firms were tested. Three hundred and eighty-one (67.7%) proved satisfactory. The remaining 182 (32.3%) were condemned as a result of low density, unsatisfactory viability, contamination or a combination of these factors.

From January 1 to December 31, 1939, 1,092 vaccines from 21 firms were tested, of which 855 (78.3%) were satisfactory while 237 (21.7%) were unsatisfactory. Of the latter, 94 (39.6%) were condemned for unsatisfactory viability and 143 (60.4%) for contamination.

From January 1 to November 1, 1940, 1,087 vaccines have been received and tested. Nine hundred and ninety-five (91.5%) have been passed as satisfactory and 92 (8.5%) have been rejected. Of the 92 condemned, 49 (53.3%) were contaminated; 29 (31.5%) unsatisfactory from the standpoint of viability, and 14 (15.2%) exhibited advanced stages of dissociation.

A summary of the preceding data covering a period of approximately four years indicates that tests have been completed on 2,742 vaccines. Of that number, 2,231 (81.4%) were satisfactory and 511 (18.6%) unsatisfactory.

Based on the average number of vaccines tested during the last ten months, it is estimated that approximately 1,300 vaccines will have been tested during the year ending December 31, 1940. This will exceed by over 200 the previous high of 1,092 tested in 1939.
The systematic control procedures now employed with the wholehearted cooperation of interested commercial firms has led to a reduction in the number of unsatisfactory samples submitted from 32.3% to 8.5% within the last four years.

Recent studies conducted by the bureau relative to the significance of bacterial dissociation, as it relates to vaccine cultures, have conclusively shown that advanced dissociative changes in strain 19 are characterized by corresponding variations in antigenic, morphological, and physiological qualities. Such changes must be considered as potent factors adversely affecting the quality of Brucella vaccines in which they occur. These facts emphasize the necessity of competent control of all vaccine cultures from the standpoint of dissociation. The use of cultures in which advanced dissociative changes exist must be avoided in the production of Brucella vaccine of maximum potency.

Preliminary examination of stock cultures employed by commercial establishments revealed the presence in several instances of advanced stages of bacterial dissociation. In view of this unsatisfactory condition, and since the selection of desirable culture types requires specialized technique, it has been considered advisable to supply all commercial firms producing vaccine with selected transfers of strain 19 at regular intervals. It is believed that such a procedure will further improve the quality of commercial vaccines, particularly from the standpoint of enhanced immunological properties.

The present six-months’ expiration date of Brucella vaccine has proved satisfactory if the product is maintained under proper conditions from the time it is prepared until used. Studies are now in progress on the effect of aging, under refrigeration and room temperature, on strain 19 vaccine. Should they suggest a procedure which might result in an improvement of the product, all producers of Brucella vaccine will be so advised.

TABLE 1
Summary of Commercial Brucella Vaccine Tests Covering 46 Months Ended November 1, 1940.

<table>
<thead>
<tr>
<th>Period Covered</th>
<th>Number of Vaccines Received</th>
<th>Number Passed</th>
<th>Per Cent Passed</th>
<th>Vaccines unsatisfactory because of—</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lack of Viability</td>
<td>Contamination</td>
</tr>
<tr>
<td>Dec. 14, 1936, to Dec. 31, 1938.</td>
<td>563</td>
<td>73.7</td>
<td>381</td>
<td>67.7</td>
<td></td>
</tr>
<tr>
<td>Jan. 1, 1939, to Dec. 31, 1939.</td>
<td>1,092</td>
<td>78.3</td>
<td>855</td>
<td>73.3</td>
<td>94</td>
</tr>
<tr>
<td>Jan. 1, 1940, to Nov. 1, 1940.</td>
<td>1,087</td>
<td>91.5</td>
<td>995</td>
<td>91.5</td>
<td>29</td>
</tr>
<tr>
<td>Totals.............</td>
<td>2,742</td>
<td>78.1</td>
<td>2,231</td>
<td>81.4</td>
<td></td>
</tr>
</tbody>
</table>
A SURVEY OF FIELD RESULTS WITH STANDARDIZED BRUCELLA ANTIGEN

By Howard I. Thaller, Asst. Veterinarian, Animal Disease Station, Bureau of Animal Industry, Beltsville, Md.

The production of Brucella diagnostic antigen by the Bureau of Animal Industry for use in the federal-state cooperative program for the control of Bang's disease was undertaken as a result of resolutions to this effect by the United States Live Stock Sanitary Association and other interested associations.

It should therefore be of interest to this association to learn of the progress made in this connection covering the quantity of antigen produced, the procedures used in maintaining a standard sensitivity, the results of comparative tests made with the various laboratories using this product, and the improvements that have been noted following the use of a uniform standard antigen.

Production of Antigen

The method of production as given in a previous report was the result of a careful study of recognized procedures in the preparation of antigen and no essential changes have been made in its preparation.

From July, 1939, to November, 1940, a period of 17 months, there have been distributed to the 53 cooperative laboratories in the United States, Puerto Rico, and Hawaiian Islands, 93 lots of concentrated tube antigen or sufficient quantity to prepare 55,500,000 cc. of tube antigen. There have also been distributed 110 lots or 496,000 cc. of plate antigen. These antigens were used to conduct approximately ten million officially reported tests for brucellosis in animals.

Methods of Maintaining Standard Sensitivities

The primary purpose in the production of these antigens by the bureau was that every laboratory might have a uniform agent upon which to base the disposition of animals tested. Every effort has been made in standardizing these antigens to fulfill this purpose.

More than 3,000 guinea pigs have been inoculated with cultures known to produce certain agglutinogenic response. The blood serums of these animals have been tested and the titers compared with known standards for the strains used. Two thousand eight hundred agglutination tests of the serum from cattle at the Animal Disease Station were conducted under practically the same conditions in testing the comparative sensitivity of each lot of plate and tube antigen.

To insure further a standard for the antigens produced, a group of serum samples was selected on which the end titer occurred within the range usually run (i.e. negative to 1-400). These samples were divided

into three groups, one of which was dried and sealed under vacuum, one preserved, and the third filtered through a Berkefeld filter. All were tubed in 1 c.c. quantities and stored under refrigeration. In testing each new lot of antigen, 50 of such samples were available with which to make comparisons with previously prepared antigens.

Samples are taken from each lot of antigen, stored under refrigeration and are systematically tested to ascertain whether aging of the antigen for any period of time has affected its sensitivity. None of the samples thus far tested has shown any change in sensitivity.

On numerous occasions various laboratories have been requested to return samples of antigen to determine whether or not a change in sensitivity had resulted due to shipping and storage. In no instance has such a change been noted.

The tube and plate antigens have been compared to eliminate a possibility of variations in results between the two types of tests. More than 7,500 such comparisons have been made in order to assure a uniformity in their sensitivity.

**Results of Check Tests with Cooperative Laboratories**

Many of the testing laboratories have been requested to submit periodically to our station serum samples in the “suspicious” range in order that comparative tests may be made. Over 7,000 such samples have been tested and in only a few instances in border-line reactions would our results have affected the disposition of the animal made by the respective submitting laboratories. These results are very encouraging in showing such a close agreement in the comparative tests.

The exchange of serum samples between the various laboratories, and between these laboratories and the Animal Disease Station has had a marked effect in standardizing the technique of testing and interpretation of results.

Another check test on the technique of preparing and reading the plate and tube agglutination tests in the various laboratories using the bureau antigens, was made recently. Thirty samples of bovine serum, 10 of which were in duplicate, were sent to each laboratory with the request that they be run by the type of test in current use, or by both if possible. Two of the samples were negative and the remainder had titers of from 1 to 25 to 1 to 400. Before these samples were mailed they were run twice by both the plate and tube methods by six technicians whose results were in such close accord that a definite titer could be given each sample of serum. The results of 38 tube tests and 32 plate tests on these 30 samples were submitted by the testing laboratories, and 96.6% or the titers returned were in practical agreement.

Of these 3.4% cases of disagreement, the “human element” and slight differences in technique and equipment are obviously involved, and steps have been taken to reduce these factors by correspondence and by contact with the few laboratories whose results were definitely lower or higher, as a whole, than the majority.
In a similar group of serum samples sent to the same laboratories in 1938 when each laboratory prepared its own antigen or purchased it from biological concerns, an agreement of only 87% was noted between results obtained by those laboratories and those by the bureau. An 11% improvement in agreement is thus noted since a standard antigen has been used.

During the past year only one criticism has been received relative to bureau antigen. Retests of our stock sample and comparative tests made in other laboratories with the particular lot gave uniform results.

The various points cited in this paper of our efforts to distribute a standard antigen cover only a portion of the precautions taken to assure that each lot of antigen shall be of equal sensitivity. Every step in its preparation is rigidly controlled.

We wish to stress the point that the sensitivity of the Brucella antigen is determined by our technique of running the respective plate and tube agglutination tests. A copy of these techniques has been submitted to each cooperating laboratory. It is very essential, in the interest of uniform and exact results, that the described techniques be followed in every detail. If this is done, it is believed that variation in results will be limited to the "human factor" which, it has been demonstrated, will occur in practically all biological tests, and which, to a large extent, is beyond the power of the bureau to control.

Summary

1. In the past 17 months previous to November 1, 1940, there has been produced and distributed by the U. S. Bureau of Animal Industry 55,500,000 c. c. of Br. abortus diagnostic tube antigen and 496,000 cc. of plate antigen.

2. More than 23,000 agglutination tests have been made in an effort to maintain standard sensitivities of the diagnostic antigen produced.

3. The results of comparative tests with all the cooperative laboratories indicate a practical agreement in 96.6% of the cases.

4. The disagreement percentage of 3.4 is in contrast with an error of 13% in similar comparative tests made by the same laboratories before Bureau antigen was supplied. An improvement of 11% is thus noted.

Calfhood Vaccination as an Aid in Cooperative Bang's Disease (Bovine Brucellosis) Control

By John R. Mohler, Chief, Bureau of Animal Industry, and A. E. Wight, Chief, and H. M. O'Rear, Senior Veterinarian, Tuberculosis Eradication Division

In the cooperative campaign against Bang's disease, the test-and-slaughter policy was adopted some six years ago to serve an emergency use in

(*) We wish to express our appreciation to Adolph Eichhorn, Director, and A. B. Crawford, Assistant Director, of our Animal Disease Station, for their valued assistance in the preparation of this report.
connection with reduction of cattle numbers and also of losses from this infection. Since then the same method has been continued until its use has become rather broadly accepted. Judged from general results obtained, from the satisfaction expressed by large numbers of cattle owners, and from the size of waiting lists, the method has been reasonably effective. Meanwhile there has developed much interest in the possibility of vaccination, particularly calfhood vaccination, as a further means of combating this malady. Especially within the last year, results of experimentation and field trials have been widely publicized, frequently with accompanying editorial comment. The encouraging nature of the results obtained under farm conditions as well as in controlled experiments, has been a great stimulus to public interest in calfhood vaccination.

We feel that the time is now rapidly approaching when certain decisions must be made. These decisions affect the method or methods which are judged to be best in dealing with Bang’s disease under the wide range of conditions present in these United States. Because of the character of its membership, including both research workers and administrative veterinary officials, the United States Live Stock Sanitary Association is conspicuously qualified for weighing the evidence in the case. Basic points of calfhood vaccination are its safety and effectiveness. Although we fortunately live in a democracy where the will of the people is supreme, proper decisions involving biological principles and procedures must necessarily be based on scientific facts rather than on public enthusiasm or wishful thinking.

Besides the scientific phases of the points at issue, certain other aspects in Bang’s disease eradication demand contemporary consideration. Such points include orderly procedures of conducting vaccination, possibly on a large scale; systems of record keeping which promise to be rather complex; and the important consideration of expenses and indemnities so as, on the one hand, to deal fairly with live stock owners and, on the other, to protect the public treasury against costly practices that may result from inadequate foresight.

Having outlined some of the major considerations, it is deemed advisable to review briefly the principal steps in our knowledge of Bang’s disease and methods of control and eradication acquired up to the present time. As in the case of other learned sciences, veterinary medicine has its folklore, some of which appears in library publications somewhat to the chagrin of modern enlightened practitioners. As recently as 1882, we find as a treatment professionally recommended for abortion (in horses, however) the following: “If symptoms of casting chance to be discovered in time, it may be prevented by promptly burning pigeon feathers . . . . on a pan of coals and holding them so that she will be obliged to inhale the smoke.” In more modern times there have been waves of enthusiasm and hope based on the alleged effectiveness of certain so-called specifics. But the ineffectiveness of such methods must not be allowed to destroy our faith in the resourcefulness of veterinary science in developing dependable means of preventing bovine brucellosis. Such a means gives added strength to our attack on the malady just as a good left hand, as
well as a powerful right, aids in fistic combat. We have therefore assem-
bled pertinent facts which we trust may contribute to the soundness of
the decisions to be made.

Cause of Brucellosis Reported in 1896

The discovery of the causative organism of Bang's disease, or bovine
brucellosis, was reported by Bang and Stribolt in Denmark in 1896 and
at that time the disease was widespread throughout European countries.
It is also apparent from early reports that contagious abortion of cattle,
as it was then known, was existent in the United States even prior to
1896. In the early years of the 20th century, cultural studies of organ-
isms recovered from aborting cattle in various scattered herds throughout
this country were made by Mohler and Traum in the Bureau of Animal
Industry and identified as the Bang's bacillus.

In 1911 Schroeder and Cotton reported that samples of market milk
sold in the District of Columbia, on injection into guinea pigs, caused
tubercle-like lesions from which a minute organism could be recovered in
pure culture and this was later identified as the contagious abortion bacil-
lus. The frequent occurrence of this bacillus in cows' milk and the simi-
larly of the biological aspects of this organism to that producing Malta
fever in goats, as well as in man, caused Eichhorn, then chief of our
Pathological Division, to ponder over the possibility of the former being
a factor in public health. He therefore suggested to Alice Evans, who
also was employed at that time by the Bureau of Animal Industry, a
comparative study of the organisms affecting these two species of milk
animals. This suggestion was followed by Evans in 1917 and in the fol-
lowing year she definitely established the relationship of Bacterium
abortus with Micrococcus melitensis of undulant (Malta) fever.

These and similar findings provided the stimulus for active and inten-
sive investigation of what we now term Bang's disease or brucellosis of
cattle, not only by the Bureau of Animal Industry but various other
research laboratories in the United States and other countries.

Little has been added to our knowledge of the nature of Bang's disease
since the early days of its study. The discovery of definite and practical
means of prevention, treatment, or cure has been more or less elusive in
spite of all efforts spent in this connection during the last 30 years. All
known methods of disease control, including

(1) chemotherapy;
(2) sanitary control;
(3) the test-and-slaughter method; and
(4) vaccines, bacterins, and immune serum,

have been tried and evaluated.

With the exception of chemotherapy, these methods possess virtue to
various degrees, and it is believed that the knowledge, accumulated
through these years of trial of the various expedients, leads us to hope
that we have reached the threshold where definite means of preventing and controlling and thereby eradicating brucellosis of cattle may be combined and placed in actual practice.

Chemotherapy

Probably the most interesting, if the least profitable, of the methods studied in connection with Bang's disease has been the use of drugs and chemicals in the treatment of infected animals. The discovery of quinine to be effective in treating malaria, and arsenicals in syphilis, stimulated chemotherapy in connection with practically all diseases, both human and animal. The fact that all drug treatment in connection with Bang's disease has so far proved ineffective should not be held as a criticism of the efforts made, as the hope is still present, in spite of repeated failure, that some drug or combination of drugs may be found that will cure cattle actively or chronically affected with brucellosis.

Among the earliest of the chemical treatments was carbolic acid first suggested by Bräuer of Germany in 1884, and later by many other European veterinarians. In our notes on practice delivered by Leonard Pearson early in 1896 before Bang's discovery of Brucella abortus had been announced, the following statement appears: "It is recommended to give subcutaneous injections of two drams of a 2% solution of carbolic acid every 10 days from the second month after abortion until two weeks before the time for the birth of the next calf."

A number of experiment station bulletins and articles by Taylor, Nelson, and many others were issued in the early part of this century advocating the subcutaneous injection of carbolic acid as well as the feeding of several ounces daily of dilutions of the drug for months at a time. Later it was commercialized by Roberts of Wisconsin, who distributed it in a disguised form as an anti-abortion serum for preventing and curing abortion in cows. Circular 29 of the Department of Agriculture, issued in 1909, showed that an analysis of this product proved it was not a serum and contained no serum. Instead it consisted of 98% water, 2% of carbolic acid and a slight quantity of oil of cloves to give it a serum-like color. Many users of carbolic acid in various forms believed that beneficial results were obtained, but under controlled experiments it was found to have insufficient value to warrant its use as a curative agent. One amazing factor in this connection was the tolerance the cow was shown to have for this drug.

In 1913, Rich of the Vermont Experiment Station, advocated methylene blue as a remedy and during the following two years the normal coloring of many barnyards and stable floors and walls was changed to blue, but the abortion bacilli in the treated animals lived on. During the succeeding years, report after report followed on the use of various drugs—iodine in the forms of potassium iodide and colloidal iodine, arsphenamine, urotropin, chloroform vapor infusions of the udder, collargol, butyl chloride, trypan blue, thionine, methyl violet, crystal violet, sodium cacodylate, hydrochloric acid, formaldehyde, and mercurochrome being the
most prominent of the numerous drugs tried. Acriflavine, due to its supposed selective action on the genital organs, was hailed as a curative agent, and Edwards and Coffman, in 1926, claimed to have secured successful results with it. These claims, however, could not be confirmed by Huddleson, Graham and Thorp, and Cotton and Buck. Just recently sulfanilamide and other sulfonamide derivatives have been shown to be effective in treating certain infectious diseases in man, and, indeed, have been reported by some physicians as beneficial in human brucellosis. However, sulfanilamide has been tried by the bureau, but was found to have no effect in reducing Brucella abortus either in virulence or numbers in the infected cow's udder.

The promise held forth in preliminary reports on various drugs in curing Bang's disease has had an aftermath in the patent medicine field and quackery. So-called "abortion cures" have gained popularity among livestock owners in various sections because they have been used during a period when the herd disease was becoming quiescent. The most difficult to suppress of these "cures" were two, one whose principal ingredient was cornstarch and the other brown sugar. The bureau, alone and in connection with other governmental agencies, has been effective in suppressing the activities of many of these illegitimate "Bang's remedy" concerns.

Sanitary Procedures in Herd Management

It was early demonstrated that brucellosis in cattle is primarily a disease of the pregnant uterus, and that exposure of normal cattle occurs principally following an abortion or normal parturition from the uterine discharges of an infected animal. From this knowledge evolved the practice of separating pregnant animals from the herd at the time of parturition or signs of impending abortion, and keeping them in maternity stalls until uterine discharges ceased. If no animals were added to the herd from outside sources, a herd resistance is acquired to the infection, which, together with other sanitary precautions, keeps the infection in a quiescent state, and in many instances eradication of the disease has been accomplished. This method of control has been used effectively for many years in several states.

Another method of control along somewhat similar herd management lines is the segregation method. This consists in separating the reacting from the non-reacting animals, and the gradual elimination of the reactors on account of poor production or age. Many herds have been freed from infection in this manner, but the method is practical only in exceptional herds.

The cardinal principle in connection with herd management is the suppression of exposure, and this principle is extremely essential in all methods of control.

The Test and Slaughter Method

The work in connection with the control and eradication of Bang's disease under the plan of testing cattle and eliminating reactors was started cooperatively by the federal government and the various states in
Calfhood Vaccination

July, 1934, and began as a reduction of surplus cattle program at the urgent request of many live stock owners. The benefits resulting from this campaign have been set forth in Miscellaneous Publication No. 384 of the Department of Agriculture.

This publication, which is available for distribution, does not contain any reference to calfhood vaccination because the subject has been and will be covered in other publications. In putting the test and slaughter method into operation the personnel and equipment of the Tuberculosis Eradication Division of the Bureau of Animal Industry were used. This project necessitated the establishment of many testing laboratories, the training of personnel in laboratory technique, blood drawing, and keeping of records, and many other details—altogether a formidable program to place in smooth running condition. The results have been gratifying and thousands of herds have been freed of infection. The incidence of infection in every state cooperating has been reduced. Since July 1, 1939, all antigen used in this program has been produced by the bureau, and this factor has resulted in a greater uniformity in the interpretation of the test.

On April 1, 1940, there were 268 counties in the modified accredited Bang’s disease-free area, and since that time 78 additional counties have been placed in that area, making a total of 346 counties, located in 20 states. These modified accredited counties, which are 11.3% of the total counties in the United States, have a total cattle population of approximately 2,942,500 exclusive of steers and calves less than 6 months of age. On November 1, 1940, testing on an area basis was being conducted in about 220 counties in 25 states in addition to the 346 accredited.

During the last fiscal year the federal government spent about $2,218,000 for indemnity payments to owners for cattle condemned on account of reacting to the Bang’s disease test, and during the same period the states expended about $2,500,000 for the same purpose. The operating expenses of the federal government amounted to about $2,228,500 and those of the states to about $465,000.

In almost all the States, provisions have been made for accrediting individual herds of cattle as free from Bang’s disease, and on April 1, 1940, there were 61,654 state-accredited herds, containing 1,174,191 cattle, in the Bang’s disease project. This number has been increased to some extent since that time.

From the above it will be observed that much progress has been made in the control and eradication of Bang’s disease in cattle in this country through the cooperative work conducted under the provisions of the test and slaughter plan since July, 1934. The provisions of this plan will undoubtedly be continued in the future, but as will be indicated later in this report the bureau is prepared to approve a suitable plan that will incorporate the vaccination of calves at the proper age as an adjunct to it.
Bacterin, Vaccine, and Immune Serum Therapy

In the early investigations of Bang's disease by the Bureau of Animal Industry, which were actively begun about 1910, bacterins and vaccines were tried.

Bacterin prepared from heated carbolized cultures of \textit{Br. abortus} was first used as a curative agent in infected cattle but very little, if any, benefit resulted. Later it was used in repeated doses in adult animals as a preventive, but no serviceable degree of immunity could be measured. Bacterins were soon discarded.

Immune serum was tried in several infected herds, but it, likewise, was found ineffective in altering the course of the disease.

Living \textit{Brucella} organisms were early shown to increase markedly the resistance of normal cattle to subsequent exposure and investigations in their use were carried out by a number of veterinary research laboratories in various parts of the world. Avirulent strains, strains of reduced virulence, and fully virulent strains were used in infected herds and the reports during the succeeding years contained claims of successful vaccination with various vaccines used. It was found that vaccines of no kind had any curative effect in infected cattle and, also, from a standpoint of prevention, the resistance induced was closely correlated to the virulence of the strain used.

In 1916, the British Board of Agriculture and Fisheries recommended the vaccination two months before breeding of all open, non-reacting cows in infected herds with fully virulent strains of \textit{Br. abortus}. This method was accepted by many as the most favorable use of vaccine and was accordingly practiced in a number of European countries. Confirmations of favorable results obtained with virulent cultures in open cattle were reported in this country by Smith and Little, and Hart and Traum, and in Europe by Stockman and the German Imperial Board of Health. Commercial biological concerns in this country were therefore licensed to distribute such vaccine and it was extensively used. Later studies by the bureau of vaccination with virulent cultures in open adult animals showed that in many instances the vaccine localized in the udder and that such animals were made chronic carriers of the organism.

Calfood Vaccination

Schroeder and Cotton, Buck, and later Cotton and Buck, in the Bureau of Animal Industry, study vaccination with avirulent, attenuated, and virulent strains of \textit{Br. abortus} for many years. In 1925, Buck tested the virulence of many laboratory cultures of \textit{Br. abortus} in his possession and one of these was strain 19. In cattle tests with this strain, it was found that it produced a serviceable immunity and that unlike fully virulent cultures, it did not localize in the udder.

Before 1925, vaccination was frequently advocated in open adult animals and heifers two months before breeding. But it was Buck who in that year began his first experiments in the vaccination of calves, at
which time he injected a group between 5 and 6 months of age with fully virulent *Brucella* organisms and exposed them during their first pregnancy, with a group of controls. This was undoubtedly one of the best demonstrations of effective vaccination against Bang's disease, as all the vaccinated animals resisted an exposure that caused abortion in all but one of the controls. Following this experiment, Cotton and Buck made a number of experiments in calfhood vaccination with strain 19, an organism of reduced virulence. A total of 70 calves between 4 and 8 months of age were vaccinated of which only 8 (11.4%) became infected, following severe exposure during the first pregnancy, but only one abortion occurred that could be traced to *Br. abortus*. Of 73 control animals, 57 (78%) became infected, of which 55 (75%) aborted.

Tests made of commercial vaccine in 1932 showed that the products were of various degrees of viability and virulence. Some vaccines included virulent strains of *Br. suis*, the swine species, which had been proved to be capable of localizing in the udder of cows. Recognizing the danger of spreading *Brucella* infection among cattle and also in man through the dispersal of virulent bovine and swine species of *Brucella* vaccines, the Bureau of Animal Industry, in 1932, changed its regulation relative to this product and all commercial concerns were required to use only those cultures of *Br. abortus*, that were non-virulent or of such low virulence as to be acceptable to the bureau.

Studies of strain 19 have disclosed variations in the antigenicity of these cultures due to dissociation. This has been recognized as an important factor in its immunizing action. Therefore, in the preparation of efficient vaccine, only such cultures of strain 19 should be used which on laboratory test prove suitable for this purpose. Such tested cultures are being supplied periodically to all laboratories engaged in the production of *Brucella* vaccine. Since the beginning of our tests on commercially produced vaccine in 1936, condemnations of serial batches have been reduced from 32.3 to 8.5% and only vaccines which meet our rigid requirements for viability, purity, and antigenicity are released for distribution.

**Field Tests of Calfhood Vaccination**

Of all the diseases with which we are familiar, Bang's disease, for reasons previously mentioned, is the most difficult to show the relative merit of any form of treatment. In our anxiety to seek relief from its ravages we are apt to grasp at any straw with the hope that it may prove a specific. The use of vaccine for calves is no exception to the rule and it was this knowledge that caused us to adopt almost five years ago a long-term program of investigation before we would attempt to draw any definite conclusions as to its efficiency. This study began in January, 1936, with strain 19 in approximately 260 infected herds in 24 states, and was based on the encouraging facts obtained in station-controlled experiments. The results of these trials covering this period, in which over 17,000 calves between 5 and 7 months of age were vaccinated up to December 1, 1940, have been
compiled to indicate the trend in this study, and will be presented in detail later today in mimeographed form. However, a brief summary of this information is as follows:

Of the calves vaccinated, 8,182 have now dropped calves involving 3 pregnancies, of which 5,673 were first, 2,026 were second and 483 were third pregnancies.

There were 7,872, or 96.2%, normal parturitions in these herds. Of this latter number 6,526, or 82.9%, calved normally and also were negative on post-parturition test, 399, or 5.1%, calved normally but were positive to the post-parturition test, while 947, or 12%, calved normally and were suspicious of the post-parturition test.

On the other hand 310, or 3.8%, abortions occurred in these groups, of which 182, or 58.7%, of the aborting animals were negative to the post-parturition test and 99, or 31.9%, were positive to this test, while 947, or 9.3%, of the aborting animals were pronounced suspicious. Consequently, on the basis of the blood agglutination test only 128 or 1.6%, of this group of 8,182 animals involved in the 3 pregnancies could be attributed to brucellosis.

We have another group of 44 of these vaccinated animals which have passed their fourth parturition, but the number is too small to be of much significance, although it is mentioned for whatever value it may possess. Of this group 41, or 93.2%, calved normally, while 3, or 6.8%, aborted, 2 of the latter being negative to the blood test and 1 positive. In other words, 2.3% of the 44 animals aborted and also reacted to the blood test.

It may be pointed out that among 1,346 animals that calved normally and revealed a positive or suspicious titer, approximately 500, or 37%, gave a negative reaction to the first retest applied 6 months later. In the first group of 97 animals that calved normally during the first pregnancy and disclosed a suspicious or positive titer, the fifth retest applied two and one-half years later indicated that 75, or 77.3%, of these animals had returned to a negative titer.

While it is naturally desirable in trials of this character to determine the length of time that animals which aborted and revealed a titer might continue to react to the test, yet it has been extremely difficult to persuade owners to retain such animals longer than an average of two subsequent retests. In most cases their personal interest apparently takes precedence over the experimental importance of the work. Attention is directed to the fact that some animals in all groups that revealed a reaction to the post-parturition test, following the second, third, and fourth pregnancies, in reality reacted to the post-parturition test following the first pregnancy and have not since lost their titers. However, the number of such animals is relatively small considering the total number of animals involved.
Exacting Rules and Regulations Necessary for Success

In considering the potential possibilities of *Brucella abortus* vaccine in the control and eradication of this malady, it should be readily recognized as a procedure that is not sufficiently simple in application to withstand promiscuous usage, and if viewed solely on a basis of simplicity, disappointment and disaster are bound to follow in its wake. Consequently it is apparent at this juncture that a warning should be sounded against any over-enthusiastic tendencies which obviate or subordinate cardinal principles that are of fundamental importance in a procedure of this particular type. Exacting rules and regulations will be required to govern its use, and a definite plan must be adopted with respect to the physical application of these principles, in addition to a close supervision of the preparation of the product, if any major degree of success is achieved and complications which tend only to confuse the situation are to be avoided.

This project was conducted as a cooperative proposition in privately owned herds, creating a situation that precluded the usual experimental procedure of maintaining control animals. Therefore, it was obvious, under such circumstances, that the herds to be selected must be chosen from those in which the disease, as determined by the blood agglutination test, was present in a sufficient number of animals in each herd to insure adequate exposure of the vaccinated animals to the disease. As a means to this end it was agreed that no herd would be accepted unless at least 15% of the animals in the herd gave a positive reaction to the test. However, upon application of the agglutination test, it was disclosed that these herds actually contained 5,531, or 29.2%, positive reactors, and 1,593, or 8.4%, suspects. All animals were properly identified and the reactors and suspects were retained in their respective herds for exposure purposes, after which the practice was adopted of eliminating a few each year as vaccinated animals came into production and served as replacements.

It is well to bear in mind that the main object in this particular study has been to establish, if possible, by means of calfhood vaccination with *Brucella abortus* vaccine and without segregation, herds composed of immunized, negative animals to replace the original herds which were rather extensively infected at the beginning of the experiment. It is also important to remember that these herds are individually owned and maintained as such on privately operated farms under the economic practices usually employed in the management of cattle on the average farm, where in most instances the monetary factor is a matter of paramount importance in the enterprise. Therefore it is utterly impossible under such circumstances to exercise the same control in every instance that would ordinarily prevail in a similar study under the regular routine procedure of a station-controlled experiment. A considerable number of persons are necessarily involved in these trials, and the scope of the study would naturally suggest that these herds are maintained under a wide margin of variable conditions. Even in view of this situation, it has been possible to establish and maintain a degree of uniformity and
rigidity which it is believed could yield results in an experiment of this type that would be reasonably accurate and dependable. The usual sanitary practices employed in animal-disease control and eradication were not applied in these herds and the only means resorted to in an effort to control and eradicate the disease was calfhood vaccination.

On July 1, 1940, 24.1% of the original reactors and 21% of the suspects still remained in these herds, a number of these cattle having aborted each year. Therefore, it is readily apparent that the vaccinated animals in these herds, which were in no manner segregated, have been subjected to a rather severe natural exposure, while in direct contact with these diseased animals. However, in reviewing the incidence of brucellosis in these herds another matter of interest is noted in the fact that following blood tests made during July, 1939, three and one-half years after the project was launched, 387 or 7% of the original positive reactors were then negative to these tests.

* Compliance with City and State Requirements

Dairymen who seek the vaccination of their adult cattle with or without the vaccination of their calves should be warned that the number of city and town health officers who are requiring milk from non-reacting cattle for their citizens is constantly on the increase. Too frequently have we learned that such owners have been deprived of their markets because their vaccinated cows had continued to react following vaccination. Moreover, regulations in a number of states require that cattle destined to such states must not be reactors to the blood test. Therefore, shippers of both dairy and beef cattle should be properly advised against promiscuous vaccination without supervision before they risk shipments in violence to the regulations of the state at destination.

Proposed Policy Involving Official Recognition of Calfhood Vaccination

As a result of disturbed world conditions sanitary officials in many states, as well as the federal government, are confronted with a problem of considerable proportions. The threat of an extended diversion of funds, ordinarily available for peace-time government functions but now required to meet the exigency of total preparedness, one of the gravest and most impelling problems of all America today, is an ever increasing probability. Under the extraordinary circumstances presented by this situation and in view of the potential possibilities of *Brucella abortus* vaccine as an aid in the control of brucellosis, it appears desirable to amend the present program to include calfhood vaccination as an adjunct to the test-and-slaughter method in those states where this procedure is desired.

An operative program to carry this procedure into effect should be simple and uncomplicated and the following general plan is proposed for this purpose:
1. All animals over 6 months of age in a herd under cooperative supervision, where the owner elects to adopt the vaccinal procedure, should be subjected to a blood agglutination test prior to the inauguration of such a program, and at least one test annually should be applied thereafter.

2. To facilitate matters in connection with the movement of animals in such herds, in addition to protection of the purchaser, a simple uncomplicated record of each herd is absolutely necessary.

3. The vaccination of all animals should be confined to calves between 4 and 8 months of age and this should be accomplished as nearly as possible during the sixth month of the animal's life.

4. The age of the animal and date of vaccination should be properly recorded and the identity of each animal should be properly established in each instance.

5. An animal in a herd where vaccination is practiced should not be disposed of for any purpose other than immediate slaughter while revealing a positive titer, except upon written permission by the cooperating State or Bureau officials.

6. A herd under the vaccinal plan may be certified as a HERD FREE OF BRUCELLOSIS for a period of one year when all animals in the herd over two years of age reveal at least two negative reactions to official blood agglutination tests properly spaced, when non-vaccinated heifers under two years shall similarly be proved negative to the test, and when vaccinated heifers under two years either show a satisfactory decline in titer or are removed for slaughter.

7. The subject of the joint payment of indemnity to owners of adult cattle that reveal a positive reaction to the blood agglutination test in a herd under the vaccinal procedure, is a matter that should depend upon the circumstances within a state. However, in instances where vaccinated animals over 2½ years of age (that were vaccinated between 4 and 8 months of age) disclose a positive reaction and the owner desires to dispose of such animals, a joint payment of indemnity is recommended.

8. Owing to a variation of conditions in different states it appears, except for a general operative plan of procedure, that minor details in a program of this character are matters which should be delegated to the cooperating state and federal officials in each of the various states.

9. It must be appreciated that one method by itself may not be applicable to all types of herds. In some herds the disease must be eradicated as soon as possible in order that the herd may be maintained on a paying basis. In other herds, another method may be considered a more profitable and therefore a preferable procedure. In still other herds, a combination of methods may work as the best solution of the Bang's disease problem. The live stock officials in the individual states, governed by the desires of individual stock owners, should assume the responsibility of determining the manner in which their respective interests could best be served. Naturally these officials have the privilege of (1) continuing the test and slaughter method (2) adopt-
ing calfhood vaccination as herein outlined, or (3) using the latter as an aid by integrating it with the test-and-slaughter method. In other words, those who are two-fisted may prefer to use both fists and not have one handcuffed. When the Bureau is acquainted with the desires of the various states, its duty will be to cooperate to its fullest extent with those that express a desire to suppress this malady in their respective domains along any of the three lines mentioned.

REPORT OF THE COMMITTEE ON BANG'S DISEASE of the UNITED STATES LIVE STOCK SANITARY ASSOCIATION

H. C. GIVENS, Chairman, Richmond, Virginia

MR. A. J. GLOVER,
Ft. Atkinson, Wisconsin

DR. J. G. HARDENBERGH,
Plainsboro, New Jersey

DR. C. P. BISHOP,
Harrisburg, Pennsylvania

DR. C. M. HARING,
Berkeley, California

DR. W. J. BUTLER,
Helena, Montana

DR. V. S. LARSON,
Madison, Wisconsin

DR. A. E. WIGHT, Washington, D. C.

Brucella Infections in Animals Other Than Cattle

Your committee wishes to call attention to the fact that in our efforts to control and eradicate Bang's disease by eliminating infected cattle as the principal reservoirs of the infection, we must not lose sight of possible reservoirs in other species of animals. The relationship of Brucellosis in animals other than cattle to the spread of the disease in cattle is not clear. The importance and practical significance of this aspect of the control problem are probably not great. Yet, unless we remain alert to the possibility, certain obscure sources of reinfection in otherwise clean herds or clean areas may be overlooked and remain to plague responsible officials and live stock owners.

The literature is well supplied with reports of natural infection with the genus *Brucella* in a wide variety of domesticated and wild animals. In his book, "Brucellosis in Man and Animals," Huddleson states that *Br. abortus* has been recovered from naturally infected horses, fowl, dogs, sheep, wild deer and wild buffalo. The melitensis species, the chief host of which is the goat, has also been recovered from the milk of infected cows in this country and abroad, and from aborted fetuses of sheep in several foreign countries. This type of brucellosis has been endemic for at least thirty years in several of the mohair producing herds in the Southwestern United States, where it has also been frequently a cause of human infection. The suis strain appears not only in its principal host but also has been isolated from the horse, the fowl, the cow, the dog and human beings. Huddleson states that these were all instances of natural infection.

It should also be recalled that the late Dr. C. P. Fitch called attention to the possibility that the common barnyard rat may acquire *Brucella* infection on infected premises. He cited the earlier work of Karkadinovsky abroad who isolated *Brucella*
abortus from eleven of thirty-four wild rats collected from three farms where the herds were infected with Bang's disease. Fitch, himself, was successful in isolating Br. abortus from only one of sixty-six rats examined but suggested that extermination of rats be one of the control measures to be recommended in freeing farms from Bang's disease.

These instances of Brucella infections in unusual hosts are restated here simply as a reminder that successful elimination measures against any disease agent must include efforts to recognize all natural reservoirs of infection that may serve as sources of re-infection.

Further Methods of Control

Calfhood vaccination, when officially authorized, is now recommended by the United States Bureau of Animal Industry as one of the preventive measures against Bang's disease. The question of when and where the vaccination should be officially authorized is at present a matter to be decided in individual states or groups of states in accordance with local conditions.

Your Committee is unanimous in recommending that research should be expanded to develop a vaccine which is superior to the one now widely used in this country.

Plan for Calfhood Vaccination

Your committee recommends that the following plan for calfhood vaccination be adopted by the United States Bureau of Animal Industry in states that desire to carry on calfhood vaccination:

1. Upon electing to adopt calfhood vaccination as a means in the control and prevention of Bang's disease, the owner shall be required to submit all animals in his herd over six months of age to an official blood agglutination test.

2. The officiating veterinarian shall be required to prepare a chart containing a complete record of each herd, each animal shall be properly identified, and the chart, together with such additional information as may be required, shall be submitted promptly to the cooperating state and federal officials.

3. The vaccination of animals with Bang's disease vaccine (strain 19) shall be confined to calves between four and eight months of age. Six months is the preferable age. The age, date when vaccinated, and proper identification of each animal shall be indicated in the chart submitted for each herd under supervision in this project.

4. Each herd under state and federal supervision, for the control and prevention of Bang's disease by the vaccination method, shall be subjected to at least one annual blood agglutination test.

5. No animal in a herd shall be disposed of for any purpose other than slaughter while revealing a positive or suspicious titer to an official test for Bang's disease, except upon written permit from the proper cooperating state or bureau officials.
6. A herd under the vaccinal plan may be certified as a herd free from brucellosis for a period of one year when all animals in the herd over two years of age reveal at least two negative reactions to official blood agglutination tests properly spaced, provided that all non-vaccinated animals under two years of age shall also be proved negative by test in accordance with the plan approved by this Association December 6, 1933, and the vaccinated heifers under two years of age in such herds shall show a satisfactory decline in titer, or be removed for slaughter.

7. At the expiration of such certification, certification may be renewed in accordance with the provisions contained in Article 6.

Proposed Interstate Bang's Disease Regulation

Your committee realizes that each individual state has authority to promulgate regulations for the importation of cattle and such regulations serve a useful purpose.

The fundamental considerations regarding all interstate transfers of cattle are found in the status of the entire herd of origin, as well as that of the transferred individuals. Greater uniformity of Bang's disease interstate regulations are desirable and in many instances obtainable, even though a state importing large numbers of cattle may modify the regulations to some extent to obtain a more effective regulation.

As a suggestion for interstate regulations, the following is submitted:

All cattle for dairy and breeding purposes, including calves six months of age or over, may be imported in the state provided they come directly from:

(a) Herds accredited as Bang's Disease Free in which all the animals in the herd were negative to an official Bang's disease test within twelve (12) months from date of entry.

(b) Herds located in Modified Accredited Bang's Disease-Free Areas in which all animals in the herd were negative to an official Bang's disease test within twelve (12) months of entry.

(c) Herds under federal-state supervision for the control of Bang's disease in which all animals in the herd were negative to an official Bang's disease test within three (3) months of entry. The animals in the shipment were negative to a test within thirty (30) days of entry.

(d) Heifers under fifteen months of age which have been vaccinated under official approval as calves between the ages of four and eight months and which originate in officially recognized brucellosis-free herds may be brought into the state provided they are accompanied by officially approved blood test records showing a decline in titer satisfactory to the live stock sanitary authorities of the state of destination.

(e) All cattle for dairy or breeding purposes six months of age or over not provided for in above classifications may enter the state provided they have passed a negative agglutination test for Bang's disease within thirty (30) days of date of entry in states where it is practicable. Such cattle shall be subject to quarantine and retest requirements of the state of destination.
(f) Female cattle and bulls of beef breeds for temporary feeding purposes, not conforming to the requirements of sections a, b, c, and d may be brought into the state if negative to an official test for Bang's disease within thirty (30) days of entry.

Cattle conforming to the above mentioned requirements must be accompanied by health certificate approved by the proper livestock regulatory official of the state of origin. The health certificate shall contain identification numbers or registry names and numbers or other satisfactory means for identification of each animal shipped, the names and addresses of owner, consignor and consignee, and shall be forwarded to the live stock regulatory official before arrival of cattle at destination.

Cattle brought into the state as free from Bang's disease shall not be confined in any public stock yard, sale stable unless they are segregated so as to prevent their exposure to infected cattle or premises.

Steers may be imported without certificate of test for Bang's disease.

Cattle of strictly slaughter type and to be used only for immediate slaughter may be brought into the state without a blood test certificate when consigned to public stock yards, or recognized slaughter establishments, or approved slaughtering centers. Such cattle shall be slaughtered within ten (10) days after arrival.

Your committee recommends the passage of House of Representatives Bill No. 6855, dated June 15, 1939, giving the United States Bureau of Animal Industry more authority in controlling the interstate movement of diseased cattle.

Eradication of Bang's

Your committee is glad to report continued progress in the control and eradication of Bang's disease in a large number of states. On October 1, 1940, there were approximately 12,588,000 cattle, contained in about 1,680,500 herds under supervision in the Bang's disease project. Significant are the following data on the percentages of the cattle population six months of age or over, except steers, that are under supervision.

In 10 states ......................... More than 50%
In 13 states ......................... From 26% to 50%
In 9 states ......................... From 10% to 25%
In 16 states ......................... Less than 10%
In the United States, 23.7%

Almost all the states have provisions for accrediting individual herds in the Bang's disease project, and on April 1, 1940, there were 61,654 herds, containing 1,174,191 cattle, that were accredited by the states as free from Bang's disease.

A considerable amount of the Bang's disease control work is now being conducted under what is known as the area plan. On November 1, 1940, a total of 346 counties, in 20 states, were in the modified accredited Bang's disease-free area, and this type of work is being conducted in additional counties in 25 states. The establishment of these modified accredited Bang's disease-free areas has been made possible by provisions adopted by this Association last year and approved by the Bureau of Animal Industry of the United States Department of Agriculture.
Since about September 1, 1939, all the antigen used in making agglutination blood tests for Bang's disease in official work has been furnished by the Federal Bureau of Animal Industry. This plan has proved to be satisfactory and has brought about much more uniformity in the results of these tests. Since August, 1940, it has been necessary that all Brucella Abortus vaccine prepared by the commercial firms licensed by the Bureau of Animal Industry be tested by that bureau and found to be satisfactory before it may be released from the establishment where it is prepared. These two actions taken by the federal bureau are highly commendable.

**Bang's Disease Shipments**

Your committee on Bang's disease at the last annual meeting recommended that producers and distributors of Bang's disease vaccine and Bang's disease antigen under a government license be required to report to the live stock sanitary officials of the various states into which they send Bang's disease vaccine and Bang's disease antigen, indicating to whom the vaccine or antigen was shipped, the amount shipped, and the date of shipment. Your committee again recommends that this procedure be carried out at the earliest possible date.

Your committee recommends that immediate vigorous steps be taken by the federal government and the several states to prevent the use of Bang's disease vaccine by laymen and to permit the use of vaccine only under official auspices with the requirement for tagging and reporting of all vaccinated animals. It is our belief that in no other way can we prevent its fraudulent use to create reactors eligible for indemnities and its indiscriminate use in mature cattle and clean herds. If, under our present laws, there is no recourse but to license biological houses that sell live Bang's disease vaccine to laymen, then we recommend that our Committee on Legislation be instructed to seek modifications that will correct the deficiency.

It is the belief of the committee that the United States Bureau of Animal Industry should be requested to rescind the licenses of all biological firms that ship Bang's disease vaccine into states in violation of their laws and regulations. We further believe that if the respective states have the right to specify the health requirements of animals entering such states, they have an equal right to specify what biological products may be brought into the states as well as disposition and administration.

**PRESIDENT PORT:** We will continue with the program and will open the discussion on Bang's Disease when we reconvene at 1:15 o'clock. We will stand adjourned.

The meeting adjourned at 12:15 o'clock.

**THURSDAY AFTERNOON SESSION**

The meeting convened at 1:20 o'clock, President H. O. Port presiding.

**PRESIDENT PORT:** Gentlemen, the meeting will please come to order.

**DISCUSSION ON BANG'S DISEASE**

DR. DURANT: Many of you may be surprised to see a veterinarian who is a poultry pathologist and a member of the Committee on Poultry Diseases, appear on this important program. I have three reasons for being here:
First, that with Dr. J. W. Connaway, for fifteen years I have devoted my entire time to the study of Bang's Disease in cattle and swine. Second, I have very decided ideas about the matter. Third, it is to Huddleston and his associates who showed that the rooster has Bang's Disease, that much credit should be given. The fourth and most important reason is that I, myself, have undulant fever. I do not say I suffer from undulant fever, but I have undulant fever.

I have been associated for twenty-five years very closely with Dr. Connaway, who was one of the first persons and, I believe, the only living person who organized the United States Live Stock Sanitary Association. All of you who know Dr. Connaway know that he has always stood for the eradication of diseases, and not for any modification of a program, which points ultimately to the eradication of a disease.

Before I came to Chicago I had information that probably something was going to be done herewith regard to calfhood vaccination. I immediately got in touch with Dr. Connaway, and we talked the whole matter over. We are agreed on the matter. In addition to that, I have a letter here which he wrote me after I reached Chicago, and which I think will place the whole matter before this association in a better way than I can if I attempt to say what I think about it.

For that reason, if you will allow me, I will take just a moment to read this letter which Dr. Connaway has written me, and then I will sit down and won't invade the premises of some other committee through the rest of this meeting.

December 2, 1940.

Dr. A. J. Durant,
U. S. Live Stock Sanitary Association,
Hotel Morrison,
Chicago, Ill.

Dear Doctor Durant:

I have looked over my notes very carefully and do not find any points of importance that you do not already have clearly in mind.

I agree with you thoroughly that a strong protest should be made against the adoption of calfhood vaccination as a part of the procedures now in operation for the control and eradication of Bang's abortion disease. The exploitation of this will distract the cattle breeders and dairymen from a proper reliance upon the essential things to be done in order to control and ultimately eradicate the Bang infection, and will prolong the existence of the disease in the cattle herds of the country years and years beyond the period that it should be eradicated and will continue the menace of undulant fever to the people of our country far beyond the time that disease should have been a forgotten human infection in America.

The part that has been taken by the veterinary profession, and by the United States Live Stock Sanitary Association in the eradication of animal diseases is indeed a worthy one. We have to but recall that pleuro-pneumonia in cattle was eradicated without vaccination, glanders in horses, dourine in horses. Texas fever is on its way toward extinction, although Dr. Francis and I developed calfhood vaccination for immunization against that dis-
DISCUSSION OF BANG'S DISEASE

ease; but we realized that the destruction of the fever-ticks was the proper solution of the eradication of Texas fever from United States territory. Tuberculosis is on its way toward eradication from the cattle herds of America. I myself tried in an experimental way the Von Behring calfhood vaccination for immunization against tuberculosis but found it to be a delusion and snare which promised no good to the cattle breeders of America. Hog cholera represents a fine example of an eradicable disease which has been perpetuated beyond its proper days of grace through the lack of the proper application of rational, feasible methods of disease control and eradication, and the over-exploitation of vaccination.

And now comes Bang's disease, which can be eradicated by the methods which have been put in operation of testing for diagnosis, isolation of infected animals and their ultimate destruction, conjoined with feasible, rational stock farm sanitation, but my prediction is that if calfhood vaccination is popularized and the production of the vaccine is put in the hands of the numerous commercial vaccine producers scattered over the country and authorized under federal license to sell it for use in the widespread vaccination of calves in America, the Bang abortion disease will be with us fifty years from now and hundreds, if not thousands, human beings will suffer from undulant fever contracted from the milk and other infected products of abortion infected cattle, that otherwise would have escaped this disease.

Very truly yours,

JOHN W. CONNAWAY.

DR. DURANT (Continuing): I have just one other thing to say, and that is that I have listened to Dr. Mohler's paper and to the other splendid papers on calfhood vaccination, and although I am amazed at the remarkable success which this vaccine appears to have, any of you who have read and analyzed the paper which was written in the American Veterinary Medical Association's Journal in September, by a veterinarian from Wisconsin, will recall that in his analysis of controlled experiments with calfhood vaccination, that there was not a wide difference in the results obtained in the vaccinated calves as compared to the controlled calves.

Thank you very much. (Applause).

PRESIDENT PORT: We will continue with the discussion, gentlemen. Are there any more questions? The papers delivered today are open for discussion.

DR. A. E. WIGHT (Bureau of Animal Industry, Washington, D. C.): I thought you were going to drop the subject. (Laughter). I just want to say that we did not have enough copies of that mimeographed progress report, but we can make more, and if you will take it up with the inspector in charge at the Bureau we will see that you receive as many copies as you desire. That press release was an abstract from our paper. That will appear in papers all over the country. We can get more of those also if you want them. I hope we can have copies of Dr. Mohler's paper available before the report of this meeting is made available.

COMMISSIONER HILEY (Connecticut): Is it in order that this meeting vote to adopt the recommendations of Dr. Mohler? If it is, I so move.
PRESIDENT PORT: It has been moved and seconded that the recommendations offered by Dr. Mohler in his paper on Bang's Disease be adopted by this association.

THE DEMONSTRATION OF TUBERCLE BACILLI FROM TISSUES OF CATTLE TESTED WITH AVIAN AND WITH MAMMALIAN TUBERCULOSIS*

WILLIAM H. FELDMAN, D. V. M., M. S., Division of Experimental Medicine, and HAROLD E. MOSES, D. V. M., M. S., Fellow in Comparative Pathology, Mayo Foundation, Rochester, Minnesota

The marked reduction in the incidence of clinically recognizable tuberculosis has been a natural and logically predictable consequence of the "test and slaughter" policy that has been faithfully adhered to in our national program for the eradication of bovine tuberculosis. The sound wisdom of this approach in eliminating a major disease has been demonstrated repeatedly. Bovine tuberculosis, although not eliminated, has been so reduced in our American herds that if the present trend continues it is reasonable to expect that this disease, which was once so prevalent, will eventually become a rarity.

As the testing program has continued and the tuberculous individuals have been removed from the herd, the possibilities for new infections to become established have been lessened. This result has been reflected in (1) a gradual decrease in the percentage of cattle that react positively to the tuberculin test and (2) a disconcerting increase in the percentage of cattle that react positively to tuberculin but in which confirmatory evidence of a tuberculous infection cannot be established.

It is not the intention here to indulge in a lengthy discussion of the theoretical and practical aspects of the so-called non-visible-lesions problem. Suffice to say that the "non-visible-lesions" question is becoming more important every year and that at the present time no entirely satisfactory explanation of the problem has been offered. We are aware of the prevailing thoughts that have been advanced to explain why an animal that reacts to tuberculin, which is considered a more or less specific substance, should be without recognizable lesions of tuberculosis. Many of the explanations that have been given are entirely tenable and perhaps even likely but are difficult to support by positive evidence. However, the lack of such evidence creates in the minds of many persons a reasonable doubt whether or not tuberculin is a diagnostic substance of absolute specificity.

*Read before the meeting of the United States Live Stock Sanitary Association, Chicago, Illinois, December 4 to 6, 1940.
Although we do not wish to weaken confidence in tuberculin as a product of tremendous value in detecting the presence of infection by the tubercle bacillus, it is nevertheless important that we embrace a realistic concept of this problem and honestly admit that at the present time there is no adequate explanation for the large majority of tuberculin reacting cattle that are without convincing lesions of tuberculosis at the time of slaughter. The problem is complex but sufficiently important, we believe, to justify a concerted and comprehensive investigation. Unless the problem is eventually solved by the elicitation of facts sufficient to provide a satisfactory explanation, it is conceivable that cattle of this country may continue to react to tuberculin long after infection with tubercle bacilli has ceased to occur.

In the furtherance of our interest in this problem we wish at this time to present the result of an incomplete study that had as its objectives (1) information concerning the sensitivity to avian and to mammalian tuberculin of cattle from a territory where tuberculosis of poultry is commonly present, and (2) determination of the type or types of tubercle bacilli presumably responsible for sensitivity to avian and to mammalian tuberculin in the cattle that were tested. The project was suggested a year ago by Dr. C. H. Fauks, at that time Inspector in Charge at Pierre, South Dakota. The splendid cooperation of Dr. Fauks and his associates has been invaluable and we are pleased to acknowledge their part in this investigation.

Material and Methods

The material had its origin from cattle within the state of South Dakota, and represented fifty-one tuberculin reactors from forty-nine separate herds comprising a total of 1,595 cattle. All of the animals were tested with avian and with mammalian tuberculin prepared in the laboratories of the Bureau of Animal Industry. The tuberculins were injected intracutaneously. Both caudal folds and both sides of the vulva were utilized as sites for the injection of the tuberculins. The avian tuberculin was injected into one caudal fold and into the corresponding side of the vulva and the mammalian tuberculin was injected into the other caudal fold and the corresponding side of the vulva. The results were recorded after seventy-two hours and the reactions observed again after ninety hours. The results of the tuberculin tests were recorded in the standard code designed for this purpose.

Animals that reacted positively to the tuberculin test were slaughtered under the supervision of the Federal Meat Inspection Service. At the time of the postmortem examination, tissues were selected for subsequent laboratory examination.

*Since Dr. Fauks' transfer to another station the work has been continued under the supervision of Dr. Neal Plank.

†The code used to designate the local tuberculin reactions is that adopted by the United States Live Stock Sanitary Association and approved by the Bureau of Animal Industry of the United States Department of Agriculture. The symbol $P_1$ indicates a circumscribed swelling in an area $\frac{1}{2}$ inch 0.5 cm. in diameter. Larger nodular reactions are recorded as $P_2$, $P_3$, $P_4$ and so forth. If the swellings are diffuse rather than nodular, the phrase "thick $2x$" is the basic standard. This signifies that the caudal fold is twice the normal thickness. Larger diffuse swellings are recorded as "thick $3x$," "thick $4x$" and so forth.
Unless lesions were found elsewhere, the routine procedure followed was to secure for laboratory examination one or more mesenteric lymph nodes and the retropharyngeal lymph nodes. When the material was received at the laboratory, a small portion of each tissue was preserved for subsequent histologic examination and the balance of the material was emulsified for the making of cultures and for the inoculation of guinea pigs. Summaries of the findings at necropsy of the fifty-one animals, compiled from the postmortem records, show that lesions that were considered to be tuberculous were present in twenty-seven or approximately 53% of the carcasses; so-called skin lesions only were found in nine, while in fifteen or approximately 29%, no lesions of tuberculosis were observed.

The presence or absence of tuberculosis among the farm poultry of each of the forty-nine farms was determined by veterinarians in the employ of the United States Bureau of Animal Industry and it was established that avian tuberculosis was present on fifteen of the premises.

**Cultures.**—Following treatment with oxalic acid to eliminate other than acid-fast bacteria, each specimen was used to inoculate four slants of egg yolk agar medium and four slants of glycerinated (3%) egg yolk medium. The slants were incubated for ten weeks before being discarded as negative. Positive cultures of acid-fast bacilli were transplanted and kept for subsequent typing. A total of 776 tubes of medium were inoculated.

**Animal inoculations.**—Each specimen was used to inoculate two guinea-pigs. All injections were made subcutaneously. One hundred and ninety-four guinea-pigs were used in this phase of the work. The animals were kept under observation for eight weeks and were then killed for necropsy. Tissues showing tuberculosis-like lesions at the time of necropsy were routinely cultured for tubercle bacilli.

**Typing.**—All strains of tubercle bacilli were examined for physical differences characteristic of the avian, bovine and human varieties of Mycobacterium tuberculosis. All were essentially similar and were considered typical of the bovine type of the organism. One strain for each of the cases yielding acid-fast bacilli was used to inoculate two additional guinea-pigs and two rabbits. From the results of these tests for pathogenicity it was possible to identify the respective strains, with a reasonable degree of confidence.

**Results**

From the tissues examined from the fifty-one animals, tubercle bacilli were demonstrated in only sixteen or approximately 31% (table 1). All of these positive results were obtained from tissues that were considered at necropsy to contain lesions of tuberculosis. In all instances the tubercle bacilli were found to be of the bovine type. Since there were twenty-seven animals in this group, the diagnosis of tuberculosis made at necropsy could not be confirmed by the laboratory in eleven instances. Tubercle bacilli were not demonstrated from the nine so-called skin lesions or from the tissues from the fifteen cases in which no demonstra-
ble lesions of tuberculosis were found. Therefore, although fifty-one animals showed a sufficient sensitivity to tuberculosis to be of diagnostic significance, tubercle bacilli were not demonstrated in the tissues of thirty-five or approximately 69%. The reason for the tuberculin sensitivity in this latter group of animals constitutes the most important aspect of our present concept of the bovine tuberculosis problem.

Among the possible reasons for the failure to demonstrate tubercle bacilli in the thirty-five cases may be mentioned the following: 1. The inadequacy of our methods. Cattle are large animals and the impossibility of examining minutely every tissue is obvious. 2. Sensitivity to tuberculin may have been due to dead tubercle bacilli, but this seems unlikely; or the sensitivity may have resulted from tubercle bacilli that had eventually become avirulent or nonviable. 3. Bacteria other than true tubercle bacilli on other obscure factors may have been responsible.

Tuberculin sensitivity.—As mentioned previously, all of the 1595 animals from which material was obtained for laboratory study were tested with both avian and mammalian tuberculins. On the basis of the results of the laboratory findings and of the nature of the findings at necropsy it will be convenient to separate the fifty-one cases into four groups for consideration of the tuberculin reactions.

Group 1. Animals from which tubercle bacilli were demonstrated.—As may be noted in table 2, the reactions to mammalian tuberculin were markedly more pronounced than the reactions to avian tuberculin. It is also important to note that in five instances no recognizable response to avian tuberculin occurred. Since bovine tubercle bacilli were obtained from tissues from each of the animals in this group, the reactions to the homologous tuberculin should be more intense than the reactions to the heterologous product. The data substantiate this presumption. Since avian tuberculosis was present on but one of the fourteen premises, the positive reactions to avian tuberculin were probably due to a reciprocal sensitivity rather than to a specific sensitivity.

Group 2. Animals with so-called skin lesions (table 3).—Although neither tubercle bacilli nor other acid-fast bacteria were isolated from the lesions in the subcutaneous tissues in this group, the reactions to mammalian tuberculin were for the most part pronounced and were sufficiently severe to be considered definitely positive. As in group 1, the most pronounced reactions occurred at the site of the injection of mammalian tuberculin. As a whole the reactions to avian tuberculin were inferior to those elicited by the mammalian product. No explanation is apparent for the reactions to avian tuberculin and the negative response to mammalian tuberculin in the animal in this group designated as number 2. Tuberculous poultry were not present on the premises from which this animal came and, as implied previously, avian tubercle bacilli were not demonstrated from the tissues examined.

Group 3. Animals without demonstrable lesions of tuberculosis.—Two features are of particular interest in the data concerning the animals composing group 3 (table 4). Although all of the animals reacted to mammalian tuberculin, six of the animals failed to react to avian tuberculin and
among those that did react to avian tuberculin, the response with one exception (number 5) was for the most part inferior to the reaction to mammalian tuberculin. It is also of interest to note that, while avian tuberculosis was present on but two of the premises from which the cattle in group 1 and group 2 came, this infection was present among the poultry on eight of the fifteen premises represented by the cattle in group 3. However, the significance of these differences is not apparent since no avian tubercle bacilli were isolated from any of the animals.

Group 4. Animals with granulomatous lesions from which tubercle bacilli were not demonstrated (table 5).—Group 4 is of especial interest because of the fact that in five of the eight animals in this group the only lesions present that were established by microscopic examination were those associated with ray fungi*. Microscopically none of these showed lesions of tuberculosis. Three of the animals from which these lesions came reacted to both avian and mammalian tuberculins and one reacted to mammalian tuberculin only. The fifth reacted to avian tuberculin only. Tuberculosis was present in the poultry of five of the eight premises from which the animals came; yet avian tubercle bacilli were not demonstrated from the tissues examined.

The incidence of sensitivity to tuberculin in the various groups considered previously is summarized in table 6. Although the number of animals that reacted to tuberculin represents 3.2% of the total number tested (1,595), the incidence of sensitivity to tuberculin varied in the different groups from 2% for group 1 to 5.3% in group 4. It is of especial interest to note that the lowest percentage of positive reactors occurred in the group from which tubercle bacilli were demonstrated and that the highest percentage of positive reactors occurred in the group in which five of the eight animals showed lesions of ray fungus infection. The possible significance of these apparent differences is obscure. It is pertinent to mention that there is a marked difference in the total number of animals tested in group 1 and in group 4 and if the probable error is considered in the percentage given for group 4 one should be cautious in drawing conclusions from these data.

It may be of some importance to mention that the only instances in which more than one animal in a herd reacted to tuberculin occurred in group 1. In this group there were two herds in each of which two positive reactors were observed. Among the remaining forty-nine herds presenting 1,342 cattle only one reactor occurred in each herd.

**Comment**

This preliminary report, while leaving many important questions unanswered, has disclosed a few facts and may, we hope, be the impetus for a more concerted attack on a very fundamental problem, namely the possible existence of the factor or factors other than tubercle bacilli that may sensitize cattle to tuberculin. The problem is of much importance, and success in its solution will be most likely when several laboratories

* Whether these lesions represented actinomyositis or actinobacillosis was not determined.
and many competent workers are engaged in its investigation. To consider research in this phase of the tuberculosis problem as futile and likely to be unproductive is to admit our inability to grasp the significance of the problem or to assume that the obstacles are too many and too great. However, more work is imperative if we are eventually to find the explanation for a situation in which a reasonable doubt exists as to the specificity of tuberculin as a means of detecting infections of cattle with tubercle bacilli. It is not impossible that other factors may be implicated, and progress in the understanding of the situation is most likely to occur if we assume an open-minded attitude rather than insist that a positive reaction to tuberculin is infallible as indicative of previous contact with one or more of the recognized types of the tubercle bacillus.

It does not seem likely that the tuberculin is at fault. The product prepared by the United States Bureau of Animal Industry is definitely dependable and of a high standard of purity. If a lack of specificity exists, this deficiency is probably inherent in all tubercle bacilli whose metabolism is requisite for the tuberculoprotein content of all tuberculins.

**Summary and Conclusions**

Attempts were made to demonstrate tubercle bacilli by culture methods and by the inoculation of guinea-pigs from the tissues of cattle that had reacted to avian or to mammalian tuberculins or to both of these products. The total number of cattle tested was 1,595, composing forty-nine separate herds in the state of South Dakota. Fifty-one animals reacted positively to the test and were slaughtered. Lesions considered at necropsy to be those of tuberculosis were present in twenty-seven carcasses, so-called skin lesions only were found in nine, while in fifteen or approximately 29% no lesions of tuberculosis were observed. In sixteen instances, all representing cattle in which lesions of tuberculosis were found at necropsy, tubercle bacilli were demonstrated. All strains were proved by animal pathogenicity tests to be of the bovine type. Although tuberculosis was present in the poultry on fifteen of the forty-nine premises, the avian tubercle bacillus was not obtained from any of the tissues examined. The investigation as outlined embraces a study of 100 cases. A report of the completed study will appear later. From the incomplete data it is concluded:

1. Many cattle sensitized by bovine tubercle bacilli will react to avian tuberculin administered intracutaneously. However, the reactions are in most instances less pronounced to avian tuberculin than to mammalian tuberculin.

2. Among animals that react positively either to avian or to mammalian tuberculin there occur a considerable number in which by the methods available the agent responsible for the sensitization cannot be determined or is obscure.

3. The possibility that factors other than tubercle bacilli may be capable of sensitizing cattle to tuberculin should be re-examined.

4. The agent most frequently responsible for detectable lesions of tuberculosis in cattle is the bovine tubercle bacillus. The avian and the human types of the organism are of minimal importance.
5. Regardless of possible shortcomings the intradermal tuberculin test when properly applied and intelligently interpreted remains the most reliable single method for the detection of infections of cattle due to the tubercle bacillus.

### TABLE I

Summary of Material Examined for Tubercle Bacilli From 51 Cattle That Reacted to Tuberculin

(Number of herds, 49; total number of animals tested, 1,595)

<table>
<thead>
<tr>
<th>Lesions at necropsy</th>
<th>Number of animals</th>
<th>Tubercle bacilli demonstrated</th>
<th>Positive cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Culture mediums</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Glycerinated</td>
<td>Non-glycerinated</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>27</td>
<td>1 Case*</td>
<td>15 Cases</td>
</tr>
<tr>
<td>&quot;Skin lesions&quot; only</td>
<td>9</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>None found</td>
<td>15</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

*Comparable material also yielded positive results on nonglycerinated medium.

### TABLE II

Reactions to Tuberculin of Animals From Which Tubercle Bacilli Were Demonstrated

(Number of herds, 14; total number of animals, 790; reactors, 2%)

<table>
<thead>
<tr>
<th>Number</th>
<th>Tuberculin Avian</th>
<th>Mammalian Avian tuberculosis on premises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High*</td>
<td>Low†</td>
</tr>
<tr>
<td>1</td>
<td>2x P1</td>
<td>P2</td>
</tr>
<tr>
<td>2</td>
<td>P1 P1</td>
<td>P1 P2</td>
</tr>
<tr>
<td>3</td>
<td>2x P2</td>
<td>P4 P6</td>
</tr>
<tr>
<td>4</td>
<td>Negative P3</td>
<td>P3 P3</td>
</tr>
<tr>
<td>5</td>
<td>P2 P2</td>
<td>P6 P5</td>
</tr>
<tr>
<td>6</td>
<td>Negative P4</td>
<td>4x P4</td>
</tr>
<tr>
<td>7</td>
<td>P2 P2</td>
<td>P2 P6</td>
</tr>
<tr>
<td>8</td>
<td>P1 P2</td>
<td>4x P6</td>
</tr>
<tr>
<td>9</td>
<td>Negative P1</td>
<td>P1 P2</td>
</tr>
<tr>
<td>10</td>
<td>P1 Negative</td>
<td>P5 P5</td>
</tr>
<tr>
<td>11†</td>
<td>P2 P1</td>
<td>P3 P3</td>
</tr>
<tr>
<td>12</td>
<td>P1 P1</td>
<td>P3 P4</td>
</tr>
<tr>
<td>13</td>
<td>Negative P2</td>
<td>P2 P3</td>
</tr>
<tr>
<td>14</td>
<td>P1 Negative</td>
<td>P3 P4</td>
</tr>
<tr>
<td>15</td>
<td>P1 P2</td>
<td>2x P4</td>
</tr>
<tr>
<td>16</td>
<td>Negative Negative</td>
<td>4x P4</td>
</tr>
</tbody>
</table>

* Tuberculin injected into caudal fold.
† Tuberculin injected into lateral aspect of vulva
‡ So-called skin lesion also present.
TABLE III
Reactions to Tuberculin of Animals With So-called Skin Lesions
(Number of herds, 13; total number of animals, 339; reactors, 3.8%)

<table>
<thead>
<tr>
<th>Number</th>
<th>Tuberculin</th>
<th>Avian</th>
<th>Mammalian</th>
<th>Avian tuberculosis on premises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High*</td>
<td>Low†</td>
<td>High*</td>
</tr>
<tr>
<td>1</td>
<td>P1</td>
<td>Negative</td>
<td>2x</td>
<td>P2</td>
</tr>
<tr>
<td>2</td>
<td>P2</td>
<td>P4</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>3</td>
<td>Negative</td>
<td>Negative</td>
<td>2x</td>
<td>P3</td>
</tr>
<tr>
<td>4</td>
<td>P1</td>
<td>Negative</td>
<td>3x</td>
<td>P2</td>
</tr>
<tr>
<td>5</td>
<td>P1</td>
<td>Negative</td>
<td>P2</td>
<td>P1</td>
</tr>
<tr>
<td>6</td>
<td>P3</td>
<td>P3</td>
<td>3x</td>
<td>P4</td>
</tr>
<tr>
<td>7</td>
<td>Negative</td>
<td>Negative</td>
<td>2x</td>
<td>P4</td>
</tr>
<tr>
<td>8</td>
<td>P1</td>
<td>P2</td>
<td>P2</td>
<td>P3</td>
</tr>
<tr>
<td>9</td>
<td>Negative</td>
<td>Negative</td>
<td>P3</td>
<td>P3</td>
</tr>
<tr>
<td>10</td>
<td>P1</td>
<td>P2</td>
<td>3x</td>
<td>P2</td>
</tr>
<tr>
<td>11</td>
<td>Negative</td>
<td>Negative</td>
<td>3x</td>
<td>P2</td>
</tr>
<tr>
<td>12</td>
<td>P2</td>
<td>P1</td>
<td>P3</td>
<td>P3</td>
</tr>
<tr>
<td>13</td>
<td>P2</td>
<td>P1</td>
<td>P3</td>
<td>P3</td>
</tr>
</tbody>
</table>

* Tuberculin injected into caudal fold.
† Tuberculin injected into lateral aspect of vulva.
‡ Recorded as tuberculosis at necropsy.
§ Ray fungous infection.
♯ Bovine tubercle bacilli demonstrated from well-marked caseocalcareous lesion of cervical lymph node.
Lesions also present in cervical lymph nodes:

<table>
<thead>
<tr>
<th>Number</th>
<th>Tuberculin</th>
<th>Avian</th>
<th>Mammalian</th>
<th>Avian tuberculosis on premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>P1</td>
<td>P2</td>
<td>3x</td>
<td>P2</td>
</tr>
<tr>
<td>11</td>
<td>Negative</td>
<td>Negative</td>
<td>3x</td>
<td>P2</td>
</tr>
<tr>
<td>12</td>
<td>P2</td>
<td>P1</td>
<td>P3</td>
<td>P3</td>
</tr>
<tr>
<td>13</td>
<td>P2</td>
<td>P1</td>
<td>P3</td>
<td>P3</td>
</tr>
</tbody>
</table>
### TABLE IV

Reaction to Tuberculin of Animals Without Demonstrable Lesions of Tuberculosis

(Number of herds, 15; total number of animals, 360; reactors, 4.2%)

<table>
<thead>
<tr>
<th>Number</th>
<th>Avian tuberculin on premises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avian</td>
</tr>
<tr>
<td></td>
<td>High*</td>
</tr>
<tr>
<td>1</td>
<td>Negative</td>
</tr>
<tr>
<td>2</td>
<td>P1</td>
</tr>
<tr>
<td>3</td>
<td>Negative</td>
</tr>
<tr>
<td>4</td>
<td>P2</td>
</tr>
<tr>
<td>5</td>
<td>3x</td>
</tr>
<tr>
<td>6</td>
<td>P1</td>
</tr>
<tr>
<td>7</td>
<td>Negative</td>
</tr>
<tr>
<td>8</td>
<td>Negative</td>
</tr>
<tr>
<td>9</td>
<td>Negative</td>
</tr>
<tr>
<td>10</td>
<td>P2</td>
</tr>
<tr>
<td>11</td>
<td>Negative</td>
</tr>
<tr>
<td>12</td>
<td>P1</td>
</tr>
<tr>
<td>13</td>
<td>P1</td>
</tr>
<tr>
<td>14</td>
<td>P1</td>
</tr>
<tr>
<td>15</td>
<td>Negative</td>
</tr>
</tbody>
</table>

* Tuberculin injected into caudal fold.
† Tuberculin injected into lateral aspect of vulva.
TABLE V
Reactions to Tuberculin of Animals With Granulomatous Lesions From Which Tubercle Bacilli Were Not Demonstrated
(Number of herds, 8; total number of animals, 151; reactors, 5.3%)

<table>
<thead>
<tr>
<th>Number</th>
<th>Diagnosis</th>
<th>Avian Tuberculin</th>
<th>Mammalian Tuberculin</th>
<th>Avian tuberculosis on premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ray fungus</td>
<td>High*</td>
<td>Low†</td>
<td>2x</td>
</tr>
<tr>
<td>2</td>
<td>Indefinite‡</td>
<td>P3</td>
<td>P2</td>
<td>P1</td>
</tr>
<tr>
<td>3</td>
<td>Ray fungus</td>
<td>P1</td>
<td>P1</td>
<td>P2</td>
</tr>
<tr>
<td>4</td>
<td>Indefinite‡</td>
<td>Negative</td>
<td>Negative</td>
<td>P2</td>
</tr>
<tr>
<td>5</td>
<td>Indefinite‡</td>
<td>P1</td>
<td>Negative</td>
<td>3x</td>
</tr>
<tr>
<td>6</td>
<td>Ray fungus</td>
<td>P1</td>
<td>Negative</td>
<td>P3</td>
</tr>
<tr>
<td>7</td>
<td>Ray fungus</td>
<td>3x</td>
<td>P5</td>
<td>Negative</td>
</tr>
<tr>
<td>8</td>
<td>Ray fungus</td>
<td>P1</td>
<td>P2</td>
<td>P3</td>
</tr>
</tbody>
</table>

* Tuberculin injected into caudal fold.
† Tuberculin injected into lateral aspect of vulva.
‡ At necropsy lesions considered to be those of tuberculosis were observed but a diagnosis of tuberculosis was not confirmed when the tissues were subsequently examined histologically.

TABLE VI
Summary of the Incidence of Reactors in the Respective Groups to Avian or to Mammalian Tuberculin

<table>
<thead>
<tr>
<th>Groups*</th>
<th>Number of herds</th>
<th>Number tested</th>
<th>Percentage of reactors to tuberculin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avian</td>
<td>Mammalian</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14†</td>
<td>790</td>
<td>1.4</td>
</tr>
<tr>
<td>2</td>
<td>13†</td>
<td>339</td>
<td>2.6</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>360</td>
<td>2.5</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>151</td>
<td>4.0</td>
</tr>
</tbody>
</table>

* Group 1. Animals from which tubercle bacilli were demonstrated.
Group 2. Animals with so-called skin lesions.
Group 3. So-called nonvisible lesion reactors.
Group 4. Animals with granulomatous lesions: tubercle bacilli not demonstrated.
† One herd of 45 animals is duplicated in each of these groups.
PROGRESS OF TUBERCULOSIS CONTROL
IN CALIFORNIA

By C. V. Duckworth, State Veterinarian, Sacramento, California

Two years ago I had the honor of addressing this association on the status of bovine tuberculosis in California. At that time I said that I hoped the next time I appeared before this group I could tell you that California had attained the modified accredited states. I now so inform you.

In retrospect the work does not seem so difficult as it did many years ago to prospect, but in reviewing what has been done we see exemplified the old adage that hindsight is better than foresight. We recognize errors that appeared at the time to be steps in advance. For instance in 1915 our Legislature enacted a law to the effect that all dairy products to be consumed in the raw state must be from animals negative to tuberculin. It also provided that reactor cattle were to be identified by tattoo marks in the ear, but it did not limit the movement of the animal except that it could not be maintained in raw milk herds. As a result of work being done on this basis reactors were found, identified and moved, with a resulting great spread of tuberculosis. Reactors were tested and re-tested because of the fact that the identifying tattoo was cut out of the ears. A little later live stock people began recognizing the value of tuberculosis control and a large amount of testing was done by individuals without regulatory supervision as to the disposition of reactors.

Other states were beginning to work on a cooperative basis with the federal government on an eradication program. An attempt to institute a like program in California foundered on the rock of legal opinion which in substance contended that the constitution of the state did not permit the payment of indemnity for reactors. A large portion of the market milk producing section of the dairy industry rolled up its sleeves, tightened its belt and went to work on its own to clean up tuberculosis, and the great good done by these people at their own cost and to their own loss stands out in my mind as one of the finest pieces of unselfish work that I have had the pleasure of witnessing. In 1929 after much discussion it was decided that the matter of indemnity would be taken to the Supreme Court for a judicial opinion instead of a legal interpretation as rendered previously. This resulted in a decision that indemnity could be paid, after which, at the next session of the Legislature, money was appropriated to begin the work, and in the fall of 1931 eradication began. In a state such as California, nearly 1,000 miles long and one in which agricultural activities are carried on from 200 feet below sea level to 10,000 feet above, and in which we have probably every nationality and creed, in some instances admixed one with the other, and in other instances strictly colonized it can be appreciated that differences of conditions and opinions would be encountered. We were confronted with doing work for those eagerly and anxiously cooperative as well as with those opposing on religious, medical, legal, financial and many other reasons which in most instances I have no doubt appeared valid to the opposing party.
Credit for the work goes to the men in the field who worked, in some instances, under the most adverse conditions—snow storms, cold; impassable roads did not stop them, nor did such withering temperatures as 110°-115° and even 120° in the shade. But, of course, to use the old Joe Martin joke, "They didn't have to stay in the shade." These men resisted threats of bodily violence with clubs, pitch forks, and even shot guns, and legally under threats of damage actions and dismissals from their jobs. Persistence, however, won out in California as it did in the other states. To date there have been in excess of 12,000,000 tests conducted, and approximately 450,000 reactors discovered, 325,000 of which were found on the cooperative eradication program.

California is the last state to become accredited, but when it is recalled that the work was not started on an eradication basis under control until fall of 1931 and that we received accreditation in the fall of 1940 it becomes apparent that the work was diligently prosecuted. Other states with large cattle populations had the advantage of starting earlier, and even though they took in some instances nearly twice as long to receive accreditation their accreditation was granted sooner than ours because of our tardiness at the beginning.

The logical question now presents itself—"Where do we go from here?" Do we sit back on our oars and rest, or do we still recognize and remember what we have long known, namely, that the enemy is insidious in its actions. That it is a fifth columnist personified and like the old advertisements we used to read in the paper about a certain product, "It works while you sleep." Gentlemen, I respectively submit that our job is far from done and that if we sleep while the enemy works we are due for a rude awakening. True we have rowed our boat through the roughest water, but any attempt to stop rowing at this time or any time in the near future will result in the boat being back in rough water to the detriment of our people both physically and financially. When tuberculosis was plentiful, herds badly infected, lesions readily demonstrable, the need of extensive experience and mature judgment was not nearly so apparent as it is today. Non-specific reactions, annoying little deviations from normal, infections other than the bovine type, acid-fast organisms prevalent in soil, and many other things demand our continued study and eternal vigilance. The veterinary profession and principally live stock disease control officials are indeed, to use the colloquialism, "On the spot." In retrospect the public has been a generous and considerate taskmaster and has put at our disposal that for which we asked, to reduce tuberculosis to a controllable incidence and now unless we embark on even more extensive studies and thereby do what is expected of us, namely to keep tuberculosis as low or lower than we have it at the present time, we shall have failed in our obligation. I am fully confident that we shall not fail provided we carry on our work in a logical defendable manner. We must, at all times, be in a position to give the live stock owner reasons, sound logical reasons, for everything we do pertaining to the control of tuberculosis.
We must endeavor to dissuade the press and overly optimistic persons from singing the praises of a job completed which is by no means completed.

It is my candid opinion that the remaining \( \frac{1}{2} \) of 1% or less will be as difficult to eradicate as was the percentage down to \( \frac{1}{2} \) of 1%.

Despite this we are entitled to recognize what we have accomplished to date and the assistance we have given the medical profession.

The medical doctor has learned and is doing what we learned many years ago, and that is to look for tuberculosis among those apparently well and free of the disease. Witness the great numbers of tuberculin tests being conducted on school children and in this connection witness, if you will, the great reduction of tuberculosis in the human family contracted from bovine animals. If you are strictly a humanitarian, measure the accomplishment in terms of suffering and anguish which has been so materially reduced through the bovine tuberculosis eradication program. If you are of a financial frame of mind think of the millions saved and will continue to be saved because of the diminishing human cases attributable to bovine sources that are no longer county, state, or government charges and each succeeding year will bring that saving higher.

I do not know if we can put our finger on any one man and say that he is responsible for this great accomplishment, this great nation-wide accomplishment, but I do know that a great amount of credit is due those who worked out the methods of procedure many years ago. To those men, be they living or dead, I pay my most humble respects. They have, indeed, been benefactors to their fellow men and are deserving of the commendation of the American people.

THE GENERAL LIVE STOCK TUBERCULOSIS SITUATION

By Dr. A. E. Wight, Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, United States Department of Agriculture

Since the last meeting of this association, it has been possible to complete the tuberculosis eradication work among cattle in the remaining 6 counties in California to a point where the degree of infection is less than \( \frac{1}{2} \) of 1%. Therefore each of these counties has now been placed in the modified tuberculosis-free area. It is gratifying to know that a further report on the progress of tuberculosis control in California is to be given today by Dr. C. U. Duckworth. The fact that the remaining two counties were placed in the modified tuberculosis-free area on November 1, 1940, was given much publicity throughout the United States both in the newspapers and the many live stock publications. However, it must be kept in mind that the required amount of periodical retesting of herds of cattle for tuberculosis and the prompt removal of reactors should be provided for; also, that necessary action should be taken to maintain herds under approved sanitary conditions.
In many sections of this country bovine tuberculosis existed to a considerable extent, especially in herds used in supplying milk to many of our largest cities. The cost of eradicating the disease, of course, has been very great. The total cost to the states, counties, and municipalities for operating expenses and indemnity since 1917 has been about $183,580,000, and the cost to the federal government for the same purpose since that time has been approximately $89,516,000, or a total of $273,096,000. The value derived from the results of this great campaign to the country is difficult to measure. In the November 16 issue of the Pennsylvania Farmer there is an editorial on this achievement written by a gentleman who has always supported this campaign and has been very helpful by favorable publicity so generously furnished from time to time. In the last two sentences of his editorial, he says, and I quote, "There is no way precisely to measure these things, no way to compare in dollars the costs and the benefits of the campaign for control. All we can say is that it has been successful, and it couldn't cost more than it was worth." Nor can some phases of the work be measured in money alone. I have in mind the practical removal of a great danger to human health that formerly existed when large percentages of cattle were tuberculous.

Testing for Bovine Tuberculosis

During the fiscal year ended June 30, 1940, there were approximately 12,222,000 tuberculin tests applied to cattle, and the total number of reactors disclosed was 56,343, or 0.46%. This is the lowest degree of infection reported as a result of all the tuberculin testing in any year since the work was begun in 1917. Those who have so faithfully cooperated in this important project of disease control are to be commended, and the cooperation of the cattle owners all over the United States in this activity is very creditable.

The combined state, territory, and county funds used for operating expenses and indemnity in the tuberculosis project during the last fiscal year amounted to approximately $4,000,000. The federal funds used for the same purposes for the year amounted to a little over $2,000,000.

The greater part of the tuberculin testing work during the past 12 months was conducted under the area plan. The results of this branch of the work have been very satisfactory, and it was possible to remodely all counties due for such action. As an illustration of what has been accomplished in the eradication of bovine tuberculosis under the area plan, reference is made to the work recently completed in two counties in Wisconsin where considerable infection existed when the work was started. Retesting of all the cattle in these two large counties was completed recently and the results were as follows: Out of 162,000 cattle tested, located in 7,500 herds, only 200 reactors were disclosed, or a little more than 0.1 of 1% of the cattle tested. Infection was found on only 90 of the 7,500 premises.

In some states there is much interest in accrediting herds of cattle as tuberculosis-free, especially on the part of owners of herds composed of registered pure-bred cattle, and according to the records of the United
States Bureau of Animal Industry, on November 1, 1940, there were approximately 271,700 herds fully accredited, containing about 3,893,000 cattle.

The average appraisal of cattle reacting to the tuberculin test during the last fiscal year was about $91.00, and the average salvage was $37.12, about $2.60 more than the average amount of salvage received by the owner during the previous year. The combined state and federal payments received by the owners of cattle that reacted to the tuberculin test and were slaughtered amounted to an average of approximately $36.60, which is about $1.60 more than the average received by the owners last year. Of the total reactors slaughtered, 6% were registered pure-bred cattle.

In order to comply with the state requirements in connection with the interstate movement of cattle, during the fiscal year 1940, tuberculin tests were applied to about 196,000 dairy and breeding cattle intended for interstate shipment, according to the records furnished to the Bureau of Animal Industry. Of this number only 32 reactors were reported, or about 0.02 of 1%.

**Avian Tuberculosis**

In many localities in the Central and North-Central states, tuberculosis of the avian type, which is readily transmitted to swine, continues to be prevalent. Veterinarians are regularly assigned to the avian tuberculosis project in 11 of the states in this section, and it is considered that progress is being made in its control and eradication. These veterinarians observed approximately 11,000 flocks of poultry, containing about 1,650,000 birds, and in applying the tuberculin test to many of these fowls they located 7,749 reactors. In states where there is considerable tuberculosis of the avian type, the veterinarians engaged in the tuberculin testing of cattle last year also observed about 126,600 flocks and they reported infection on about 5,000 farms.

The Federal Bureau of Animal Industry is producing a motion picture, with sound, on the subject of avian tuberculosis, which it is believed will be beneficial to the poultry interests in combating the disease and thereby to other interests in guarding the health of swine.

**Postmortem Results Show Less Tuberculosis in Cattle and Swine**

During the fiscal year ended June 30, approximately 9,530,500 cattle were slaughtered at establishments operating under federal supervision. Of this number and exclusive of known reactors to the tuberculin test, 8,384 showed some evidence of this disease, which is about 0.09 of 1% of the total. Of these 8,384, about 2,000 were either condemned as unfit for food or passed for cooking under federal supervision. This is 0.02 of 1% of all the cattle that were slaughtered under supervision, exclusive of known reactors, during that period.

During the same year approximately 46,674,000 swine were slaughtered under federal supervision, and 4,077,000, or 8.7%, showed some evidence of tuberculosis. It is interesting to note that of the total number of hogs
A. E. WIGHT

retained for further inspection on account of tuberculosis, only about 16,000 were condemned under federal inspection as compared to about 77,000 in 1917, when the tuberculosis eradication work was undertaken. This is a reduction of about 85% in proportion to the number that were slaughtered. There were about 18,000 carcasses passed for cooking under federal supervision in addition to those condemned. The slight lesions found in the other retained hogs were removed under federal supervision and the carcasses passed for food. As indicated in previous reports before this association, the location of centers of infection of tuberculosis among cattle and swine has been greatly aided by information received from the packing centers, which feature of the work continues to be a very valuable one to the eradication project.

Johne's Disease or Paratuberculosis

During the last fiscal year Johne's disease was reported, by either state or bureau veterinarians, to exist in 14 different states, and there were 383 cattle, out of a total of 4,428 tested for this disease, classified as reactors. This is 8.6% of the total number tested. The reactors were found on 96 different premises. In cooperation with the federal regional animal disease research laboratory at Auburn, Alabama, tests have been made of several herds in some of the southern states using the johnin produced at that laboratory. The results obtained were quite satisfactory.

Personnel

The state and territorial authorities employed an average of 287 veterinarians throughout the year, and the counties employed 180 veterinarians on full time. In the federal service about 280 veterinarians were engaged in the work, including those working on a part-time basis.

Conclusions

The follow-up work in all the counties is very important at this period of the eradication campaign. Special attention must be given to this in sections of the country where the disease existed to a very great extent. This feature of the work is greatly aided, as stated before in this paper, by reports from packing centers showing the retentions of cattle and swine on account of tuberculosis.

Although this paper, as usual, contains some statistical information on tuberculosis eradication, there are many who wish more data on the subject. Therefore, a special statistical pamphlet has been prepared and copies are now available to those who may desire such material. The statistical pamphlet also contains some results obtained in the control and eradication of Bang's disease or bovine brucellosis.

It has been my privilege to appear before this group a great many times to discuss this very important subject, and again I express my appreciation of the excellent cooperation that has been received from the various live stock sanitary authorities with whom it is our privilege and our duty to cooperate. The employees who have been identified with this project
are to be highly commended, and it is hoped that their efforts and good work will continue and be effective in still further reducing the incidence of bovine tuberculosis in this country. The live stock owners, packers, dairy organizations, stock yard companies, commission agencies, farm organizations, public health officials, the public press, the radio, and many other agencies through their cooperation have been of great assistance in bringing about the present condition as far as bovine tuberculosis is concerned in this country. The aid given to the work by this association during the last quarter of a century or more cannot be overestimated.

Report of Committee on Tuberculosis

R. A. HENDERSHOTT, Chairman, Trenton, New Jersey
H. M. O'REAR, Washington, D. C.
WM. A. HAGEN, Ithaca, New York
WM. H. FELDMAN, Rochester, Minn.
C. U. DUCKWORTH, Sacramento, Cal.
H. A. SEIDELL, Des Moines, Iowa

Your Committee on Tuberculosis this year is happy to report that the past few months has witnessed the accreditation of the last two counties in California. Today, in each county and parish in the United States and the Provinces of Puerto Rico and the Virgin Islands, bovine tuberculosis has been reduced to at least one-half of one per cent infection required for accreditation.

Your committee feels that it would be well to pause at this point and take stock of the situation which currently confronts the live stock industry with respect to tuberculosis.

(a) That tuberculosis in the bovine animal, while materially reduced, has not been entirely eradicated from this species.
The progress obtained to date has cost approximately 300 millions of dollars exclusive of the loss of the increased value of pure-bred animals and years of breeding, and that such an investment warrants the expenditure of the service money necessary for the retesting required to insure against the possibility of reinfection.

(b) Our approach to complete eradication will, of necessity, result in an increased percentage of No Visible Lesion reactors.

(c) That the efforts of research workers should be directed to a more intensive study of non-specific or pseudo tuberculin reactions to the end that either through possible improvement of the test fluid, the technique of applying the tuberculin test, or the reading of reactions, fewer non-tuberculous animals would be sacrificed.

(d) That increased attention must be given to the elimination of tuberculosis from other types of live stock as well as poultry and wild life. In this connection, a program of eradication of tuberculosis in poultry and swine should be intensified.

(e) That, to protect susceptible members of the bovine family, strict quarantine measures should be enforced in those herds in which proved
infection occurs. The quarantine should definitely prohibit the sale of any cattle from such infected herds except for immediate slaughter, until the herds have passed sufficient number of tests to warrant release from quarantine.

(f) That in infected herds a profound study of the conditions obtaining in the herd should be made to determine the source of infection, such study to include a critical examination for tuberculosis of all animal life maintained on the premises as well as the history of the health of human beings with which the cattle are in contact.

(g) That the present technique of injection should be carried out with great precision so as to eliminate this factor as a possible cause of indecisive reactions.

(h) That caution should be exercised to correctly evaluate the past history when making a reading of the tuberculin test.

(i) That records kept of tuberculin tests of herds should be such that, when animals shipped interstate react and show lesions notification should be sent to the live stock sanitary official of the state of origin.

(j) That in each case, when at slaughter animals reveal lesions of tuberculosis, a report be sent to the live stock sanitary official giving the tag number, recorded brand, description of animal, and name of consignee so that the herd from which it came could be retested.

(k) That more adequate control of truck movement of cattle and closer supervision over traffic of animals through live stock markets should be exercised.

Your committee would suggest to you the excellent report submitted by the Committee on Tuberculosis of the A. V. M. A. published in the November, 1940, issue of the Journal.

It is our opinion that the time has arrived to revise the uniform method of establishment and maintenance of modified accredited herds and areas. To this task your committee has devoted its efforts and recommends the following changes for your consideration and adoption:

UNIFORM METHODS AND RULES FOR THE ESTABLISHMENT AND MAINTENANCE OF TUBERCULOSIS-FREE ACCREDITED HERDS OF CATTLE AND MODIFIED ACCREDITED AREAS

PROPOSED REVISION BY THE COMMITTEE ON TUBERCULOSIS 1940

PART I

Individual Accredited Herd Plan

1. (a) A tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative successive annual physical examinations and tuberculin tests. Herds in which infection occurs shall be quarantined and shall be required to pass three negative tuberculin tests not less than 60 days apart to lift the quarantine; and further, such herd shall not be ac-
credited or reaccredited until it shall have passed a tuberculin test without evidence of reaction, not less than twelve nor more than fourteen months following the test on which infection was disclosed, such physical examinations and tuberculin tests shall be applied by a veterinarian regularly employed by the state or the United States Bureau of Animal Industry, or by an accredited veterinarian.

(b) When an accredited herd or a herd in the process of accreditation is to be tested at the expense of the owner or by an accredited veterinarian, the following regulations are to be observed:

(1) The tuberculin test shall be applied on dates approved by either the state live stock sanitary official or the inspector in charge of the Bureau of Animal Industry, or both, in the state wherein the herd is located.

(2) The accredited veterinarian shall not conduct such tests until after he has received written authorization from the proper cooperating state or bureau officials.

(3) The accredited veterinarian shall submit a report of such tests in accordance with the regulations of the cooperating state and federal authorities. These officials reserve the right to supervise any tests conducted by an accredited veterinarian.

2. The Tuberculin Test:

(a) The official test shall be the intradermic by the single injection, or the double injection of the caudal fold and vulva, or the subcutaneous and either or both of these methods in combination with the ophthalmic.

(b) A herd in which reactors have been found shall not become accredited unless the final or accrediting test has been made by a combination of either the subcutaneous and ophthalmic, intradermic and ophthalmic, or by the double intradermic caudal fold and vulva injection.

3. The entire herd, or any cattle in the herd, shall be tuberculin tested or retested at such times as deemed advisable by the cooperating state and federal authorities.

4. No animal shall be presented for the tuberculin test which has been designated as a reactor at any time.

5. Reactors to the tuberculin test shall be promptly removed from the farm and, after their removal, the infected premises shall be thoroughly cleaned and disinfected with a disinfectant approved by the U. S. Bureau of Animal Industry, and in a manner satisfactory to the cooperating state and federal authorities.

6. Herd owners are required to house, feed and care for the cattle under such sanitary conditions as will tend to promote good health, and to follow such recommendations as are made by the cooperating state or federal authorities.
7. Calves shall not be fed milk or other dairy products unless such products have been properly pasteurized.

8. Herd Records:
   (a) The herd owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the grade animal to be marked by a tag or other marking satisfactory to the cooperating state and federal authorities.
   
   (b) Each herd owner is required to keep a record of all additions and removals of cattle from the herd by sale, death, or slaughter.

9. All vehicles shall be cleaned and disinfected before they are used for transporting cattle to herds maintained under this plan.

10. Added Cattle: Herd additions must originate in tuberculosis accredited free herds or in herds of comparable status in a modified accredited area.

11. Accredited herd certificates may be issued by the cooperating state and federal authorities and shall be valid for one year unless revoked.

12. Failure on the part of an owner to comply with these methods and rules shall constitute sufficient cause for the revocation of the accredited herd certificate.

**PART II**

**Modified Accredited Area Plan**

13. The provisions of the Individual Accredited Herd Plan that relate to testing, removal of reactors, cleaning, disinfecting, and sanitation, shall apply to the Modified Accredited Area Plan. All infected herds shall be quarantined and tested as provided in paragraph I.

14. If, as the result of one complete tuberculin test within the designated area, the total number of reactors is less than one-half ($\frac{1}{2}$) of one (1) per cent of all the cattle within the area,* the area shall then be declared an official modified tuberculosis-free accredited area for a period of three years by the cooperating state and federal officials. *Infected herds shall be quarantined and tested as provided in paragraph I.*

15. If, as the result of a complete tuberculin test of all the cattle in the area,* the number of reactors is one-half ($\frac{1}{2}$) of one (1) per cent, and not more than one (1) per cent, the infected herds shall be quarantined and retested. If the total number of reactors found as a result of this retest within the area is less than one-half ($\frac{1}{2}$) of one (1) per cent of the entire cattle population within the area, the area shall then be declared an official modified accredited area for a period of three years. *All infected herds shall be quarantined and tested as provided in paragraph I.*

16. If, as a result of one complete tuberculin test of all the cattle within an area,* the total number of reactors exceeds one (1) per cent, all the cattle in the area shall be retested.

*Except as hereinafter provided in paragraph 21.
17. (a) Modified accredited areas, in which a complete area retest of all the cattle in said area indicates a degree of infection not exceeding two-tenths (0.2) of one (1) per cent, may remain in the modified accredited status for a period of six years from date of remodification, provided that all infected herds shall be quarantined and tested as provided in paragraph 1.

(b) Reaccreditation tests on six-year areas must include a test of all of the cattle in such area as provided in paragraph 17 a.

18. Modified accredited areas in which the original tuberculin test of all cattle in said areas the extent of infection did not exceed one-half (½) of one (1) per cent, may be reaccredited (and also modified accredited areas that have been reaccredited in which, on the last complete tuberculin test of all the cattle in said areas the extent of infection did not exceed one-half (½) of one (1) per cent may be reaccredited) if not more than one-half (½) of one (1) per cent react as the result of retesting all of the herds in which infection was disclosed at any time, and such other herds as the State livestock sanitary officials and the Federal inspector in charge may designate.

19. Modified accredited areas, which on the original test of all cattle in said areas the extent of infection did not exceed two (2) per cent, and also modified accredited areas that have been reaccredited, in which on the last complete tuberculin test of all the cattle in said areas the extent of infection exceeded one-half (½) of one (1) per cent, and was less than one-half (½) of one (1) per cent, may be reaccredited if less than one-half (½) of one (1) per cent react as the result of retesting at least twenty (20) per cent of the total number of herds, in addition to all of the herds in which infection was disclosed at any time.

20. Modified accredited areas in which the degree of infection exceeded two (2) per cent on the original test may be reaccredited by retesting all the cattle in such areas in accordance with paragraphs 14 and 15.

21. A county or area may become a modified accredited area in the range or semi-range area upon compliance with paragraph (a) or (b), and other provisions of this section:

(a) When all bulls, pure-bred breeding cattle, milk cows, at least 10 per cent of the semi-range breeding females, and such other cattle as may be considered necessary by the state and federal department cooperating are tuberculin tested.

(b) When all bulls, pure-bred breeding cattle, milk cows, barnyard cows, and home-fed cattle are tuberculin tested, and properly identified postmortem reports are produced showing that at least 10 per cent and not less than 25 animals of the breeding herd have been slaughtered within a year, and that such post-mortem examination failed to disclose lesions of tuberculosis.

If, under paragraph (a) or (b) of this section, a reactor or any other evidence of infection is revealed in any herd by postmortem reports, etc., including postmortem inspection at packing plants of those branded cattle that are sold direct from the range for immediate slaughter, then all of the
cattle in that herd or associated with the diseased animal shall be immediately tuberculin tested in accordance with the provisions of the Modified Accredited Area Plan. The area may then become a modified accredited area, and be reaccredited at the expiration of three years, if the total number of reactors and cattle found tuberculous upon postmortem examination from the area is not more than one-half ($\frac{1}{2}$) of one (1) per cent of all the cattle tested in the area.

22. The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper live stock sanitary official of the state of destination.

PHENOTHIAZINE AND ANTHELMINTIC MEDICATION, WITH SPECIAL REFERENCE TO PARASITIC DISEASES OF SHEEP

By W. E. SWALES, Associate Animal Pathologist, Division of Animal Pathology, Science Service, Department of Agriculture. Institute of Parasitology, Macdonald College, P. Q., Canada.

This paper records the results of a series of laboratory and field experiments commenced in 1935 and continued until the present time. It includes a number of personal experiences which have led the assayist along a route of practical research designed to show the value of applied parasitology in animal production. Although the conditions encountered are those met in Canada the data obtained in the work should apply equally well to some states of the Union.

In 1935 our knowledge regarding worm parasites of sheep in Canada was such that no definite means of control could be offered to the sheep owner. We knew of the presence of most of the species, but the histories of parasitic disease were indefinite and consequently our recommendations were somewhat general, based on pasture rotation, routine dosing of the animals throughout the pasture season with tetrachlorethylene or copper sulphate, and hygiene in winter quarters. Veterinarians and sheep owners were confused with the recommendations, some of which were inclined to be conflicting; the result was that the farmer who kept a few sheep as a side line decided that it was as well to let nature take its course—after all, sheep were of relatively low value.

Preliminary investigations showed that parasitic disease of sheep was far more common in regions east of the Great Lakes than it was in the prairie and west coast regions. A large scale survey in eastern Canada then showed very definite seasonal fluctuations in the number of individuals of each species which was present in lambs. For examples, Haemonchus, Moniezia and Trichuris reached a peak of abundance by the beginning of July, six weeks after the animals were placed on pasture. Oster-tagia and Nematodirus became most numerous between August and September, when the above mentioned parasites were rapidly decreasing in numbers. Cooperia, however, became abundant in late September and, during this month, Oesophagostomum made its first appearance. In October
and November, Trichostrongylus and Monodontus became very abundant and relatively large numbers of these parasites continued to be present in lambs examined during the winter months. Oesophagostomum did not reach its numerical maximum until March. In estimating these fluctuations, approximately 1,030,000 individual parasites in 357 lambs were considered, and since that time the observations over two more years have served to support the results.

The next problem was the determination of the effect produced by heavy infections in lambs. In this work the criterion adopted for measuring a serious effect was clinical disease producing a marked effect upon the average daily gain of lambs. An estimation of the gain over the thirty days immediately preceding slaughter compared to the gain throughout the whole season appeared to supply a practical indication of the effect of the infection discovered on postmortem examination. The data thus obtained indicated that infections with over 500 Haemonchus, over 20,000 Trichostrongylus, over 200 Monodontus or over 300 nodules produced by Oesophagostomum caused the average daily gain to drop below 0.2 pounds, when companion animals varied between 0.35 and 0.47 pounds. No evidence was obtained that infections of 360 Moniezia, 9,000 Nematodirus, 8,000 Ostertagia, 185 Trichuris had any effect measurable by these preliminary methods.

In examining lambs slaughtered in abattoirs in August the only statistically significant difference between lambs that were less than 30 pounds in dressed weight and classed as culls, and those that were over this weight and classed as market lambs, was in the infections of Haemonchus. This difference was 1,224.3 against 203.4 individual worms, the standard deviations being 1,555.1 and 397.2, with \( P = 0.05 \). Attempts to assay differences in abattoir lambs in the autumn were not so successful; heavy infections with Haemonchus were almost absent, but heavy Trichostrongylus infections were very frequently complicated by hookworm infections and extensive nodule formation. However, in one area an opportunity was obtained to study flocks of lambs raised from range ewes from western Canada; these lambs had not been exposed to Oesophagostomum and hence were completely free of nodular lesions. A scouring disease commenced in the late autumn and as a result the lambs lost weight and could not be sent to market. Autopsies performed on typical examples showed Trichostrongylus infections ranging from 35,000 to 79,000 individuals, the predominant species being \( T. \) vitrinus. Since that time further observations on Trichostrongylosis have been made and from field and laboratory tests it has been determined that this disease is a definite problem in Canada. However, no outbreak has occurred in flocks that have an adequate diet, all case histories having suggested overstocking on dry and inadequate autumn pastures.

Nodular disease is probably the greatest problem in eastern Canada. A test using fifty lambs from which most of the adult parasites were removed by anthelmintic medication showed that animals that had acquired over 300 nodules, many of which were clustered around the ileo-caecal valve, were extremely unthrifty. Feeding tests showed that such
animals gain less than 0.2 pound per day, while companion animals gained over 0.3 pound per day. Ewes become severely affected with nodules after two to three seasons, but preliminary observations have indicated that the location rather than the number of such lesions is the factor deciding the effect. The ileo-caecal valve appears to be the part of the intestinal tract that is most susceptible to serious injury; and when partial occlusion of the valve takes place as a result of nodule formation, serious disease occurs. This is particularly true when the animals are receiving a ration composed largely of dry and bulky materials such as hay.

Thus nodular disease is a paradox; the host tissue response to the invasion of the infective larva of *Oesophagostomum columbianum* results in the formation of the nodule, which is a local immune reaction, but which eventually becomes the cause of clinical disease.

Observations on the effect of the long winter on the free-living stages of nematodes showed that while most species could survive this five-month period to some extent, *Oesophagostomum* and, in some cases, *Haemonchus*, were destroyed.

It is apparent from the above observations that in the east we have three parasitic diseases that must be controlled if the sheep industry is to be protected. They can be classed as follows:

(a) Haemonchiiasis of young animals. This occurs in mid-summer, producing an anaemia which, if it does not result in death, seriously affects the economy of the affected animals. The infection is carried from year to year chiefly by the adult worms in the abomasa of young breeding stock.

(b) Trichostrongylosis, frequently complicated by the presence of numerous (over 200) hookworms. This disease is characterized by a dark, fetid diarrhoea, dry wool and unthriftiness; it occurs in the late autumn and is related to inadequate nutrition and over-stocking. Some pasture infection may survive the winter months.

(c) Nodular disease. This affects young animals in the autumn in badly affected districts, but is responsible for unthriftiness of breeding stock during the winter in most parts of the high summer rainfall area (eastern Canada). Each spring the pastures are free from this infection, but the adult worms in the colons of the breeding stock recontaminate the land; thus the lambs become exposed to a few infective larvae by July and to gradually increasing numbers throughout the rest of the pasture season. This slowly acquired infection results in an apparent acquired resistance, which in turn, results in the formation of a large number of nodules and the survival of comparatively few fifth stage worms.

Control Measures

The above data clarified the situation in regard to possible control measures. Correct anthelmintic medication was of primary importance. Large scale experiments with government flocks were conducted to test the relative efficiencies of copper sulphate solutions, various combinations
of copper sulphate and nicotine, tetrachlorethylene in capsules, tetrachlorethylene in a newly devised emulsion form, and various arsenicals given \textit{per orum} and \textit{per rectum}. In these tests a 2\% solution of copper sulphate containing 1.5\% of 40\% nicotine sulphate was found to be highly efficient against Haemonchus, while Tetrachorethylene in capsules or in emulsion was most efficient against Trichostrongylus and Monodontus. Results with arsenical preparations against Oesophagostomum were inconclusive, but showed little promise of adequate efficiency.

A test on the divided flocks of four farms showed that medication of all breeding stock with the copper-nicotine drench four days before they were placed on pasture and subsequent treatment of the lambs in July, not only controlled but completely eliminated Haemonchus, while Tetrachorethylene in capsules or in emulsion was most efficient against Trichostrongylus and Monodontus. Results with arsenical preparations against Oesophagostomum were inconclusive, but showed little promise of adequate efficiency.

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A practical and efficient method of preparing tablets of phenothiazine was evolved and this made possible a series of tests designed to demonstrate the use of this chemical in the actual control of disease.

It is obvious from the information to hand that the efficient control of oesophagostomiasis relies on the high efficiency of the drug used to remove the adult worms. Equal in importance is the time of year chosen for anthelmintic medication. Our data show that the greatest number of adult worms is present in the lumen of the intestine in late February or March; this is due, of course, to the continued emergence of the fourth stage larvae from the nodules during the three or four months after the end of the pasturing season. Thus phenothiazine, which is now known to be by far the most efficient drug for removing adult nodular worms, must be administered to adult breeding stock between February and the time the flock goes on to pasture. If this routine is adopted, and if the anthelmintic efficiency is such that no pairs of adult Oesophagostomum remain in the tract, then the lambs will not be exposed to Oesophagostomum and hence their intestinal tracts will remain free of nodular lesions. In order to attain such complete control a considerable amount of work has been done in an effort to ensure a constant high efficiency.

Phenothiazine is rapidly absorbed from the stomach of a sheep and oxidation derivatives may be detected in the blood stream less than twenty minutes after administration of the tablets \textit{per orum}. In less than half an hour an appreciable amount of potassium leuco phenothiazine sulphate is present in the urine. In our experiments with sheep dosed with the tablet formula, in which a laxative is included, we recovered the equivalents of over 80\% of the original amount of phenothiazine, nearly half of which was excreted with the urine. In constipated animals (it must be remembered that phenothiazine itself exerts a constipating effect) the amount of phenothiazine absorbed is much greater. We have accordingly adopted the tentative standard that for complete efficiency against Oesophagostomum particles of phenothiazine must be present in the
rectum of the treated animals eight hours after administration per orum, otherwise too large a proportion of the chemical is lost through the urinary tract.

Small wet particles of phenothiazine are necessary for effective destruction of worms, as it is apparent that the chemical is an ingestion poison which must be made available for worms in various parts of the tract and which may be protected by mucous. Preliminary results of the tests to determine reasons for constant high efficiency appear to confirm the hypothesis that rapid distribution through the tract of small wet particles is necessary. It was also apparent that large doses, that is, from 0.3 to 0.4 grams per pound body weight, would be necessary for the important early spring treatment of breeding stock for nodular disease control.

The results of the laboratory tests have been applied to field conditions during 1940, fifteen hundred breeding ewes having received the spring prophylactic treatment. The effects upon the parasite burden of the lambs are now becoming apparent, and a preliminary statement can be made. In flocks in which the ewes received at least 48 grams of phenothiazine in the form of explosive tablets, the incidence of nodular lesions in the lambs has been reduced by approximately 94%. In addition, and in spite of the fact that the lambs themselves have received no anthelmintic treatment, there has been no case of haemonchosis. There has been no significant effect upon the numbers of Moniezia, Nematodirus, Cooperia, Strongyloides, Trichuris and Chabertia. Ostertagia appears to have been reduced to a considerable extent, and although it is still too early to determine the effect on Trichostrongylus spp. with any degree of certainty, it is becoming evident that these parasites are not following the steep curves of seasonal incidence which were previously determined; no case of Black Scours has occurred in the above mentioned flocks.

When from 20 to 25 grams of the same formula was used in the prophylactic treatment of ewes the results have not been satisfactory. In one flock typical haemonchosis occurred and in two others the nodular lesions in the lambs became so numerous as to approach a level that would produce clinical disease.

By means of the single large doses Oesophagostomum was completely eliminated from only two farm flocks, but in others the greatest number of nodular lesions in a single lamb examined to date has been thirty. Of lambs examined since the first of August, 27.7% were completely free of nodular lesions.

Thus there is now little doubt that clinical oesophagostomiasis can be completely controlled in Canada by a single large dose of phenothiazine given each year to all the adult sheep in the flock before they go to pasture, if it is given in such a way that large numbers of small particles are made available and rapidly distributed throughout the intestinal tract.

It is still hoped that during the coming year the technique of complete anthelmintic efficiency will be perfected and that we will be able to demonstrate more general elimination of Oesophagostomum from large areas by means of a single treatment.
At the present time we do not believe that the routine treatment of
lambs in July and August with the copper nicotine drench for the pre-
vention of haemonchosis should be discontinued. However, we believe
that relatively small doses of phenothiazine should be used for lambs as
the pastures become sparse in the autumn and as soon as symptoms of
diarrhoea appear. In a limited number of field cases we have obtained
extremely good results from the administration of 20 grams to 90-pound
lambs suffering from what we now recognize as the diarrhoea of tricho-
strongylosis. In such cases, egg counts are not reliable indications of
parasite burdens, and the only criterion of success is the cessation of
diarrhoea, which usually takes place within 36 hours after dosing.

We believe that we now have means of preventing the occurrence of
the serious parasitic diseases of sheep in eastern Canada, and that many
of our data can be applied to other parts of the Dominion when necessary.

The greatest danger is in the possible misuse of such a valuable
anthelmintic agent as phenothiazine, and it appears to be our duty to
exercise some control so that promiscuous use of inadequate doses at
improper times of the year will not be general. Another danger, and one
which will always be with us, is that parasite control will be used to
replace, instead of augment, good husbandry.

REPORT OF COMMITTEE ON PARASITIC DISEASES

T. W. M. CAMERON, Chairman, Ottawa, Canada
B. SCHWARTZ, I. S. McADORY,
Washington, D. C. Auburn, Ala.
E. A. BENBROOK, J. R. ACKERT,
Ames, Iowa Manhattan, Kan.
D. H. RICKS, Oklahoma City, Oklahoma

At the New York meeting of the International Veterinary Congress, fol-
lowing a proposal of the late Dr. M. C. Hall, an international committee
was formed for the purpose of making proposals and co-ordinating action
on the control of parasitic diseases.

Dr. Hall was chairman and represented the United States; the present
chairman of your own committee represented Canada. Dr. Hall prepared
a book on The Control of Animal Parasites primarily for the use of this
committee and commenced the organization of the work, but his death
prevented his attendance at the first meeting held in Zurich, Switzerland,
in 1938.

Your present chairman, however, was appointed to succeed him, not
only as chairman, but to represent the United States, as well as Canada.
He attended the meeting and later published a second book, primarily for
the assistance of this committee, on The Principles of Parasite Control;
this booklet is, in effect, an extension of the headings given by Dr. Hall
on pages 17-19 of his book, and discusses the methods employed through-
out the world on the control of internal parasites of animals.

The committee, inter alia, decided to proceed with a world map show-
ing the distribution and intensity of the various parasitic diseases of ani-
mals with a view to future co-ordination and cooperation, and this map was to be presented at the next meeting of the International Veterinary Congress (scheduled for 1942).

Owing to unsettled world conditions, much of this work must remain untouched for some time, but the Parasitology Committee of the United States Live Stock Sanitary Association believes the preparation of such a map for North America is of sufficient importance to justify an immediate beginning.

However, it feels that it should be done in parts and that the first part should be limited to known pathogenic worm parasites having an important part in the etiology of clinical disease in cattle, sheep, hogs and horses in the United States and Canada. This will involve a considerable amount of labor and will probably involve the cooperation of individuals and organizations in addition to the members of this association. To reduce this work to its essentials, your committee has prepared a list of known pathogens in the host animals mentioned above and it invites discussion on its selection. These are appended to this report. It further submits the following resolutions for the consideration of the association.

1. THAT the Parasitology Committee of this Association be instructed to proceed with the preparation of a map of North America showing the distribution of the pathogenic parasites of live stock.

2. THAT the Committee take steps to cooperate with all other interested persons and bodies in the collection of this information.

**Known Pathogens**

**CATTLE:** Ostertagia ostertagi; Trichostrongylus spp.; Dictyocaulus viviparous; Fasciola hepatica; Bunostomum phlebotomum; and Cooperia punctata.

**SHEEP:** Fasciola hepatica; Fascioloides magna; Haemonchus contortus; Ostertagia circumcincta; Dictyocaulus filaria; Trichostrongylus spp.; Oesophagostomum columbianum; Chabertia ovina; and Bunostomum trigonocephalum.

**HOGS:** Ascaris lumbricoides; Stephanurus dentatus; Metastrongylus spp.; Macracanthorhynchus hirudinaceus; and Oesophagostomum dentatum.

**HORSES:** Strongylus vulgaris; Parascaris equorum; Sclerostomes (except S. vulgaris); and Habronema megastoma.

President Port: The meeting is adjourned. The meeting adjourned at 4:00 o'clock.
FRIDAY MORNING SESSION
DECEMBER 6, 1940

The meeting convened at 9:15 o'clock, President H. D. Port presiding.

CHAIRMAN CARPENTER: The Poultry Committee of the United States Live Stock Sanitary Association is making somewhat of a departure in carrying out the program here this morning. It is not necessary to say to this group that poultry diseases continue to cost the farmers of the United States many millions of dollars. The rate of mortality has been increasing; perhaps it is leveling off at the moment, but certainly during the past decade or so these losses have quite steadily mounted, until today the leaders of the poultry industry, and the veterinary profession, are considerably concerned as to the future.

Competition in the production of poultry meat and eggs is increasing. The hatchery industry has perhaps reached a leveling-off point, but during the past fifteen years it has developed to a point not dreamed of a few years before that. With such a development of mass production of baby chick comes many hazards, particularly of interest to the veterinarian.

As a profession we are behind the parade of industrial advancement in this field. Some say we stand at the crossroads with regard to poultry and turkey disease control. If that be the case, and if there be any merit in such a statement, I would like then, to take you back in your thinking to the time when the veterinary colleges in the land awakened to the fact that the dairy industry in this country, shortly after the turn of the century, required the services of trained veterinarians to prevent and control diseases of cattle.

Veterinary medicine immediately took a new turn upon this realization by veterinary colleges. I recognize that many of us smile when we use the hackneyed expression, "horse doctor," but it wasn't long thereafter until the small animal phase of veterinary medicine became just about as prominent as did the dairy disease phase of veterinary medicine, and again the veterinary colleges, beginning about 1910, proceeded to include in their curricula adequate instruction so that graduates were well qualified to serve the public in the disease control phase of that husbandry.

The same may be said for the diseases of hogs and sheep. However, with poultry industrialized at such a rapid rate, beginning about 1920, and the fact that in the fall of 1919 poultrymen received in some states as high as 95 cents a dozen for their eggs at the back door, brought with it many hazards which the practicing veterinarian was not equipped nor prepared to meet. It would not be such a problem today for the practicing veterinarian, if poultry husbandry were a specialty only in a few areas, as it was 20 years ago. However, with several hundred million chickens in the country, the average size of all flocks is relatively small in spite of the fact that many poultrymen own several thousand hens.
Since the great bulk of the poultry population is in the Midwest, and the average size of the farm flock is somewhere between 150 and 350 laying hens, it immediately becomes a problem for the general practitioner and not the specialist, and it is because of a combination of the things I have mentioned that your committee this morning saw fit to set up this type of a program, hoping that the questions and answers would bring to you in an interesting manner, the new and practical facts that can be used by both regulatory officials and practitioners. This plan led to the recommendation incorporated in our report, that these discussions be printed in a separate issue, which we estimate can be sold at a cost of about 10 cents a copy, and we trust that they will find their place with the rank and file of the veterinarians throughout the country.

I want, next, to introduce the members of the Board. Most of you know most of them. I do this for identification purposes. Their names have already been read as incorporated in our report.

I would like, first, to present to you Dr. R. M. Bethke, In Charge of Nutritional Investigations, Ohio Agricultural Experiment Station, Wooster, Ohio. (Applause).

Next, Dr. J. Holmes Martin, Chief in Poultry, Purdue University, West Lafayette, Indiana. (Applause). You will recall he recently resigned as Director of the U. S. Regional Poultry Research Laboratory at East Lansing, Michigan.

Next, Dr. F. R. Beaudette, Poultry Pathologist, Agricultural Experiment Station, New Brunswick, New Jersey. (Applause).

Dr. W. R. Hinshaw, In Charge of Turkey Disease Investigations, University of California, Davis, California. (Applause).

Dr. H. J. Stafseth, Professor of Pathogenic Bacteriology, Michigan State College, East Lansing, Michigan. (Applause).

And finally, your Chairman of this Committee last year, Dr. Erwin Jungherr, Pathologist, Storrs Agricultural Experiment Station, Storrs, Connecticut. (Applause).

Next, I want to explain briefly our procedure. It is our plan, this morning, and I may tell you in the beginning that many of the questions submitted will require only a “Yes” and a “No” answer, to keep this discussion alive and moving as well as interesting. We have many questions on about fifteen diseases. We do not expect that every member of the Board will be in complete agreement with every other member of the Board. We think that is healthy. I question if any member of the Board would like to ask you to believe what he believes, but the discussion will be offered in a manner in which you will be able to draw your own conclusions as to your particular attitude toward certain control measures of a given disease.

PULLORUM DISEASE

The first subject we will discuss is pullorum disease. We have listed six questions. When the six questions have been asked and answered, I
shall then ask the Board if any member disagrees with any statement made by any other member of the Board. At the conclusion of that we will ask for questions from the floor pertaining to that particular disease.

Now we will get under way. I do want to point out that it is necessary for each of these speakers to get to this microphone, and from now on I shall operate from the microphone at the right. The speakers have been asked to start traveling the minute they see their question coming up.

Dr. Stafseth leads off with an answer to the following question: Dr. Stafseth, how is pullorum disease spread?

DR. STAFSETH: Pullorum disease spreads along more avenues, I suppose, than any other poultry disease. I can hope to cover it only fairly completely. First of all, I suppose we should mention that pullorum disease frequently comes from the ovary of the infected hen, from the infected hen to the egg, and from the egg to the chick.

The next step we might take up is the incubator. Chicks in an incubator, and eggs in an incubator, can give off pullorum disease germs from which other chicks become infected. Then, we have such equipment and material as that used in the shipping rooms, where chicks might get contaminated from various sources. Finally, as far as the chick is concerned, the brooder house; one of the chief sources of infection, I think, is the brooder house, where a few infected chicks with open cases of pullorum disease can spread the germ to other chicks.

Then, of course, the person who handles the chicks or who looks after them walks into the brooder house and out again, and perhaps takes the germs through the premises, and on the premises growing stock can possibly pick up the infection. The same is true of adult birds.

So there is not only the hen-egg-chick contamination but there is chick-to-chick spread, and spread from one grown bird to another, and so on along many lines all the way down through.

Pullorum disease epidemiology resembles somewhat a tree. It has a number of branches, and the ramifications of this thing are almost unlimited. I don’t say that pullorum disease is the most contagious disease in the world, but it has so many ways of spreading that for all practical purposes it may be considered as such.

CHAIRMAN CARPENTER: Dr. Jungherr, what is the relative effectiveness of the tube and whole blood test?

DR. JUNGHERR: Much work has been done on the relative effectiveness of the tube test and the whole blood test, but no final answer can be given, definitely expressed in a mathematical formula. We believe that both tests are reasonably accurate, but neither test is 100 per cent accurate in the sense that every positive reactor found by either one of the tests can be confirmed by actual isolation of the organism. There is always a discrepancy of possibly 5 or 10 per cent.

The principal difference between the two tests is that the tube test lends itself much better to standardization than the whole blood test. In the tube
test we can select definite strains, we can standardize laboratory procedures as much as possible, and we can control the factor of the human element. In the whole blood test you have several factors at work which cannot be controlled, such as humidity and temperature, while the blood test is carried on, differences in the reading time, and possibly the amount of dust in the room; all these things make for discrepancies.

The tube tests are very frequently carried on by trained personnel, and the whole blood tests by personnel which has less training along this line. If we use the whole blood test, it would correspond to a setup in which we multiply the number of laboratories by the number of workers. Therefore, we feel the tube test is more effective, especially because we can control the human element to a certain degree.

CHAIRMAN CARPENTER: Thank you. Would you discuss briefly this question: "Suitability of whole blood test for obtaining 'pullorum clean' flocks?"

DR. JUNGHERR: In regard to the suitability of the whole blood test for obtaining pullorum clean flocks, first, I want to mention that both tests are recognized as being standard in the National Poultry Improvement Plan. The whole blood test has a very definite place as a finding test, and since it is also a standard test it must be officially recognized as being suitable for the establishment of pullorum clean flocks.

However, since the whole blood test is used in some states, and since the tube test is used in other states, we must recognize that the states in which the tube test is standard must be on their guard, especially from the standpoint of importing pullorum clean chicks recognized on the basis of the whole blood test, into pullorum clean stock which was recognized on the basis of the tube test.

So far the states in which the tube test is standard have been very hesitant to recognize flocks which have found recognition on the basis of the whole blood test as exactly of the same grade.

CHAIRMAN CARPENTER: What do you say, Dr. Jungherr, as to the sanitary value of the grade "pullorum tested" chicks and flocks, within the meaning of the National Poultry Improvement Plan?

DR. JUNGHERR: This question should be developed primarily from the standpoint of importation. We feel that the grade "pullorum tested" does not give any guarantee whatsoever against importation of pullorum disease. It is true that the grade "pullorum tested" is going to show a lower mortality from pullorum disease. However, this grade would be dangerous to import into a flock free from the disease.

We have to recognize that in pullorum disease one infected chick, either in the incubator or in the brooder house, can cause a large amount of infection. And if we allow a very small percentage of infected eggs to go into the incubator from a flock which is officially recognized as "pullorum tested," then the morbidity and mortality from pullorum disease during brooding may be very high.
This point has given rise to many disappointments. We have had an interstate case very recently, in which a diagnosis of pullorum disease was made in our laboratory, and later on we found out that the stock from which the chicks originated has been in the process of eradication, and corresponded to the grade "pullorum tested." The owner of the stock was very much upset by the diagnosis of pullorum disease.

CHAIRMAN CARPENTER: Dr. Stafseth, would you discuss briefly, please, how the course of pullorum disease is affected by faulty incubation?

DR. STAFSETH: By that I take it we mean everything that has to do with incubation, such as incubator sanitation, control of temperatures, and so on. Perhaps I can best illustrate by giving you an experience that we had in Michigan a few years ago.

A certain hatcheryman in the eastern part of the State started out the season with remarkable success. He had practically no pullorum disease, but as the season wore on it got worse and worse, until he was practically forced to close up or do something else.

One of our men went to see this man, and one thing that impressed him was the neglect of hygiene. He let the down accumulate. He stated that he never washed out his incubator nor fumigated it. Whereupon all that was recommended was carried out promptly.

The interesting thing was that the very next hatch gave as satisfactory result as the first hatch of that season, which showed that a clean incubator is a tremendously important thing.

As far as the control of temperature and moisture is concerned, that is obviously also important, because any unfavorable temperature, too high or too low, lack of moisture, or something of that sort, might predispose to development of pullorum disease.

CHAIRMAN CARPENTER: Again, Dr. Stafseth, what part does faulty brooding practice play in the course of the disease?

DR. STAFSETH: I think brooding is very important in the development of pullorum disease. We consider those things as contributory causes. Pullorum disease germs, of course, are the primary causes. I look upon chicks which are brooded improperly very much as I look upon the springs of an automobile: If there is a broken leaf in a spring, and it hits a bump, the whole spring may break. If all the leaves are in proper shape, and if the steel is good, they can take quite a few bumps and still get along all right.

So this works both ways. A chick that has no pullorum disease can stand a lot of abuse, and a chick that has pullorum disease might get by if it is not exposed to too many unfavorable influences. We have actual experimental data, as you know, to show that too high temperatures and too low temperatures will give higher percentages of so-called clinical pullorum disease, than will chicks of the same type with perhaps as much infection but properly brooded.
CHAIRMAN CARPENTER: To use a specific case, Dr. Stafseth, in a lot of 500 chicks from blood tested parents, perhaps if they were critically cultured at hatching time we might find one or two per cent infected chicks with pullorum disease. Now, under good sanitary practices and adequate feeding and not overcrowding, and correct temperatures, would you say that that poultryman might expect a high or a low mortality from pullorum disease?

DR. STAFSETH: Except in cases of exposure to highly virulent strains, I would say you might expect a low morbidity and low mortality.

CHAIRMAN CARPENTER: I think that is well answered, and there is no intent in the question to indicate that an infected chick is not a hazard, nor is it an indication that the poultryman or the hatcheryman can take the attitude that if he has his breeding flock at a level of 1 or 2% reactors, that he should not continue to proceed on a basis of lowering that rate. But the question comes up many, many times in the field, as to what happens when a hatcheryman sends out ten lots of 500 chicks to ten different poultrymen. They all come, as far as the hatcheryman knows, from his own hatching flocks, and all from blood tested parents, and perhaps his records would show that he found only 1 to 3% reactors totally when he had finished testing his flocks.

Eight of those ten poultrymen will report that results were fine, they brooded 90 to 95% of the birds to the time they were turned out as satisfactory pullets on the range. The other two may report mortality from 15 to 20 or 30%, possibly, and when taking some of these chicks to the laboratory for diagnosis, invariably we find pullorum disease as the cause of death.

DR. STAFSETH: May I add two very short stories in connection with this, to illustrate the point; The first one I am telling on somebody else, and the next I am going to tell on myself.

One time when I was in a certain locality in Michigan for the purpose of studying a turkey disease, a certain gentleman told me that he would like to see me about his chicks. He had just bought 1,400 chicks from a hatchery. He said he wanted me to help him inspect them. He had seven brooder houses, and we went through them all. Out of one house we picked about a dozen or so chicks that were "pasted up behind," as the poultrymen call it. He asked me if I wanted to remove them. I said, "Well, they might have pullorum disease. They don't necessarily have it, but they might."

This man was a man of action, and he immediately removed the chicks I told him to take out. I came back about a month later and asked him how many chicks he had lost altogether, and he said, "Approximately forty."

"Have you had any trouble with pullorum disease?"

"No."

Supposing, now, that these chicks had pullorum disease. If there were 14 infected chicks in one house, you can see what that might do to the other
250 in the house. Here is an interesting remark that this man made: He had seven brooder houses, all of which were new except one. The old one was located down in a hollow. It was so damp inside that when we walked through the litter it sounded as if you were walking through a barnyard. Strange to say, he had no trouble in that particular house. He made the remark to me after it was all over, "You know, if I had had to remove the 30 or 40 chicks from that house down in the hollow, I would have laid it to the insanitary conditions in that house."

In other words, he had in mind this very thing, that when a hatcheryman claims the buyer is to blame for the outbreak of a disease, it isn't always justified. Here is the other story:

Once upon a time I had an idea that I wanted to be a poultryman, so I started a poultry outfit with two other scientists. Being that neither of us were in a position to do any actual poultry labor, we had a woman look after the chicks. I was the sanitarian in the outfit. The other two men were the plutocrats. One of them is in this room. I won't mention his name. He put up the money. (Laughter). He had the farm too, by the way.

So, being the sanitarian, I gave orders to the woman as to what should be done. I told her she was to inspect the chicks every day, and many times a day, because I said there was pullorum disease in the flock. There was no pullorum disease free stock in Michigan, but the hatchery has done all that can be done to hold the disease down to a minimum. I told her that when she found a chick that looked like a ball on top of a couple of pins, or "pasted up behind," or with closed eyes, she should get it out of the flock quickly.

One day I went out there and I noticed a lot of sick chicks. They were still in the house. I asked her, "Didn't you have orders to take these chicks out? What were you doing?"

And she replied, "You know, I saw the chicks were 'pasted up behind' soon after you told me about it, but they looked so pitiful that I took them in the kitchen, took a little soap and water, washed their tail ends, opened them up and put them back in the brooder house." (Laughter).

That is the very worst of mistakes that can be made in trying to fight pullorum disease.

CHAIRMAN CARPENTER: Dr. Martin, some scientific work was done quite a few years ago on the inheritance of resistance against pullorum. Would you please discuss that briefly and show its practical application today?

DR. MARTIN: I think most of you are familiar with the work done at the Illinois Experiment Station, which Roberts and Card have carried on, in which they found that resistance to pullorum disease was definitely inherited, and by means of selection we could greatly increase the resistance within the strains of White Leghorns and White Plymouth Rocks, and even by introducing the disease into the chicks, the resistance was so great that the birds could resist many times the normal dosage they would receive under actual brooding conditions met in the field.
In other words, we could have taken the way out, in pullorum disease, of breeding for disease resistance. That gets back to the schools of thought that exist. Should we eradicate the disease or learn to live with it? I feel, very wisely for the industry, that we chose the eradication method.

Through the years that method has proved very successful, and the programs have gone on apace, and we know now that the results indicate that the pullorum losses have been tremendously reduced by means of testing and eradication.

But we should not lose sight of the fact that the work of the Illinois Station showed that we could start breeding for resistance to a specific disease, and by selection greatly increase that resistance. If a blood test or some other way of isolating the reactor, the carrier, had not come along, then perhaps this other way out could have been taken. Just how costly it would have been, how successful it would have been, is purely a matter of conjecture.

Along this line I might mention the New Hampshire chick. Those of you who are familiar with the programs in New England know that the New Hampshires are perhaps as free of pullorum disease as any breed we have, because the foundation stock consisted of New England flocks which had been tested for years. The work there was carried on in as thorough a way as anywhere in the country.

When those chicks which are descended from generations of pullorum disease-free stock come into the Midwest, where we are as yet unable to get the percentage of reactors down to the low level it is in New England, the first generation mortality is practically always higher than for Rhode Island Reds or New Hampshires that have been bred out here through the years. So it does show that we do have a higher resistance in our chicks in the Midwest than we have in those others. The important point is that in either case all of these recommendations that have been made in regard to avoiding exposure to pullorum, and taking care of the necessary sanitary and control measures, must be carried out.

CHAIRMAN CARPENTER: At breakfast this morning I heard several of the Board members say that they didn't expect to be in entire agreement with some things other members of the Board might say. Now comes the time to ask if any member of the Board wishes to ask any other member of the Board a question, or does he have any disagreement to any statements made? Hearing none, I will ask if there are any questions from the floor.

DR. DURANT (Missouri): I would like to ask the pullorum disease authorities what their opinion is in regard to the blue lights which are being recommended for incubators for the control of pullorum disease. The lights referred to are the ones which are being used in sterilizing meats and other food products.

CHAIRMAN CARPENTER: I will ask Dr. Stafseth. Was the question generally heard? Dr. Durant asks the question as to the applicability
of the use of blue light, such as is used in the sterilization—I believe you said, Dr. Durant—of meat products under refrigeration, and if that has a place in the field of incubation.

DR. STAFSETH: I wonder why Dr. Carpenter picked on me.

CHAIRMAN CARPENTER: You are nearest the microphone.

DR. STAFSETH: All right. Really, I don't know much about it.

CHAIRMAN CARPENTER: Does any other member of the Board know about it?

DR. STAFSETH: All I know is that we are carrying on some work along this line at the college, but it has been done in a little different section of the Department, under Dr. Mallmann. If it has any sterilizing effect at all, it might act on the free material in the incubator, but as far as I can see it would not have any effect on contamination in the egg. It would have a very limited use.

CHAIRMAN CARPENTER: Are there any other questions?

DR. TUCKER: I would like to ask if this “pasting up behind” is any indication of an infected baby chick?

DR. STAFSETH: Since I made that statement, I am going to answer it before Dr. Carpenter has a chance to talk to anybody else.

You know, every so often I made a reference to “pasted-up” chicks. I made the remark that it might not be pullorum disease, but it could be. Pullorum disease is a very common cause of this “pasting up behind,” but you know it could be something else.

CHAIRMAN CARPENTER: You would say, then, that it is a symptom of illness of chicks?

DR. STAFSETH: Yes, sir.

CHAIRMAN CARPENTER: As I pointed out in the beginning, ladies and gentlemen, we have with us some invited guests as officers and representatives of state and national hatchery associations. I failed to offer a word of welcome to them today. I want to make it clear that it is their privilege to ask questions from the floor, the same as members and other visitors of this Association; in addition, we have various agricultural press representatives here, and we would like to make this meeting yours as much as you would like to make it. Are there any other questions?

VOICE: I would like to know if this pullorum disease affects the turkey, the guinea hen, and wild birds, the same as it does a chick?

CHAIRMAN CARPENTER: May I say that we have a section on pullorum disease in turkeys, which will be taken up a little later on, if that is agreeable.

I will ask Dr. Beaudette, at the moment, about the occurrence of pullorum disease in birds other than turkeys.
DR. BEAUDETTE: I really think this question should have been asked of one of the other men, but since I am the victim I can say that pullorum disease has been described in ducks, English sparrows, pheasants, quail, guinea, bullfinch, and of course turkeys, foxes and rabbits.

CHAIRMAN CARPENTER: The second section is on infectious bronchitis. I will ask Dr. Beaudette the practical differentiation between bronchitis and coryza, commonly called infectious colds of chicks.

DR. BEAUDETTE: I should like to point out, first, that there are two kinds of coryza having different causative agents. One of these is caused by a hemophilic organism known as the coryza bacillus, and this disease is of relatively short course. A second type of coryza is caused by what Nelson has referred to as a coccobacilliform body. The course of this type of coryza is very protracted, so it becomes a case of differentiating between bronchitis, bacillary coryza, and coccobacilliform coryza.

If we are dealing with a disease in a very young chick, and I am referring to chicks two days old to a few weeks old, then we may almost rule out either of the coryzas because they do not commonly occur in very young chicks. If we are dealing with the disease in older birds, then we have to differentiate between these three infections. I should like to point out that bronchitis runs a very definite and short course, even within a week. So if we are dealing with a disease of very short course it may be bronchitis or the short term coryza.

On the other hand, if we are dealing with a disease of a very long course, then it must of necessity be this coccobacilliform type of coryza.

If there is an odor about the head of the bird this tends to incriminate coryza, and certainly eliminates bronchitis, although while it incriminates coryza, it does not exclude such localizing infections as cholera. Again, if there is a mortality in these adult birds, associated with the disease, that too would eliminate bronchitis, which, in my experience, never kills adult birds, while the coryza infection may kill adult birds.

In coryza we may have extensive involvement of the eyes and of the sinuses and nasal cavities, whereas in bronchitis there is usually no more than a nasal discharge associated with this disease. Of course, on post mortem examination we have in chick bronchitis, a collection of dirty mucous material in the bronchi with clouding of the air sacs. These changes are not seen in coryzas as they affect adult birds.

In the laboratory the diagnostician, of course, should make an attempt to isolate the coryza bacillus if he suspects that infection. The organism will grow on sealed blood agar plates, or it may be grown in an atmosphere of carbon dioxide. The coccobacilliform bodies seem to be more difficult to determine, and I confess I do not have a great deal of confidence in my own ability in identifying these bodies, notwithstanding the fact that I have had the advantage of seeing Nelson's own slides on this particular infection.
A definite diagnosis of bronchitis may be made by allowing a bird suspected of having it, to recover, and then inoculate the bird with a known strain of bronchitis virus, and if this does not provoke the disease we may assume that the recovered bird had bronchitis and hence had developed an immunity as a result of the attack.

CHAIRMAN CARPENTER: Would you give your estimate of the value of dusting and spraying for shortening the course of infectious bronchitis in chicks?

DR. BEAUDETTE: The dusts with which I am familiar contain chlorine as the active agent. Since this may be considered as a mild irritant, and since bronchitis is an acute disease, then it seems to me it is therapeutically unsound to use dust. As for the sprays, those available on the market frequently contain formaldehyde, and I would also consider this an irritant. Sometimes the base or vehicle is an oily substance which is apt to collect in the nostrils and in turn cause a collection of dust, and further obstruct the passages. So I would say that these are not indicated either. It might even aggravate the condition.

CHAIRMAN CARPENTER: What would you say as to the possibility of establishing flock immunity by vaccination with autogenous vaccines?

DR. BEAUDETTE: I presume you mean by this question the collection of material from birds affected in an outbreak, and the use of this material in an attempt to immunize the flock.

At the moment I can see no advantage to this, because we would not know how to apply the material. Certainly if it were injected subcutaneously or intramuscularly, it would not produce immunity. One might think of applying it to the mucous membrane of the vent, as we do in tracheitis. However, when it is put in the vent, some birds actually get the disease. I might point out, however, that eventually one might make use of a modified virus in bringing about immunity to this disease. It is not autogenous, of course, but I have observed in cultivating this virus in eggs that whereas when originally grown in eggs it does not produce early death of the embryo, and may not kill the embryo until after the fifth day of incubation, but with continued passage of this virus in the egg, it kills the embryo at an earlier date, until finally one is able to kill an embryo within 48 hours after inoculation.

One would think that if such an egg-propagated virus were put back into the chicken, that it would be correspondingly more virulent than the original field virus, but we actually find that disease-producing power has been lessened, so that sometimes an inoculation of this egg-passed material will not provoke a disease of any type, and yet it will produce immunity. I have established this very definitely by working with individual birds. A bird grown free of disease had its blood serum tested for neutralizing bodies. The bird was then inoculated with the modified virus, and this provoked no disease whatsoever, and fourteen days after this inoculation, the bird's blood serum then contained neutralizing bodies, and, moreover, the bird withstood an inoculation of a field virus. I have had an oppor-
tunity to do this only on small numbers of birds, but the difficulty that I see at the present time is that one has no control over this modified virus, that it may not always act in the manner I have just described.

CHAIRMAN CARPENTER: Is it hopeful, in your opinion, then, Dr. Beaudette, that some practical vaccination program may be available eventually, let's say, in the presence of an infection already having been identified in a hatchery or in a battery brooding plant?

DR. BEAUDETTÉ: I suppose it is within the field of possibility, but one has to remember that the incubation period of this disease is very short, sometimes as short as 18 hours. One could hardly expect immunity to develop early enough to be of any practical value in protecting against the disease.

CHAIRMAN CARPENTER: Would you care to say how many days, in your work thus far, it takes to establish such immunity?

DR. BEAUDETTÉ: I believe immunity would be established within nine days.

CHAIRMAN CARPENTER: How do you account for the oft-encountered high morbidity rate in very young chicks, and the low rate almost always experienced in pullets and hens? We will add “mortality,” too.

DR. BEAUDETTÉ: I think the answer to mortality would be very simple, because in baby chicks the exudate very often coagulates, whereas in the adult bird the exudate is very mobile and does not produce strangulation. The seemingly low morbidity in adult birds, as you put it, I think is only seemingly. If you examine these birds carefully you will find that many times they do have moist rales, or a slight nasal discharge, and this is evidence of mild infection.

CHAIRMAN CARPENTER: I am thinking from the practical poultryman’s point of view. He may experience a 20% mortality in chicks 5 days old, and the infection spreads from there to his laying hens. They may drop in production 5 or 10%, and give symptoms of difficult breathing for 2, 3 or 4 days possibly at the most, and then apparently return to normal rate of production and apparent health. The poultryman is much concerned to know if that is the same disease.

DR. BEAUDETTÉ: In our experience the drop in production is more than 5 per cent. On the contrary, we find flocks laying 50 and 60 per cent, and within a very few days they are laying 15 or 20 per cent, which in itself is evidence that the disease is pretty widespread in the flock.

CHAIRMAN CARPENTER: I think we can agree it is due to the age of the bird, and the time of the year, and the number in the flock.

DR. BEAUDETTÉ: I am talking about the fall.

CHAIRMAN CARPENTER: We will say in the spring the hatcherymen and the chick growers are more apt to experience chick bronchitis in their broods, spreading from there to hens which may be 12 to 15 months old.
DR. BEAUDETTE: The low incidence of the disease in a good many flocks may be due to the fact that those same flocks have previously been exposed to it, and have a higher percentage of immune birds in them.

CHAIRMAN CARPENTER: That could be, and I wanted that point developed. Thank you. Are there any questions from Board members on infectious or chick bronchitis?

MR. HANNA: May I ask what the practical recommendation would be for a flock that has heavy mortality in young chicks? Is there anything that can be done at all?

CHAIRMAN CARPENTER: The question is, what practically can be done or told the poultryman when the infection becomes present or identified in a flock of young chicks. What would you outline, Dr. Beauvette, as a practitioner? You are on the farm, and the client has chick bronchitis in his flock, the chicks are five days old, and they started coughing yesterday.

DR. BEAUDETTE: Good nursing measures. I should say a little higher brooding temperature, avoid crowding, avoid dusty litter, and yet give the chicks plenty of ventilation.

CHAIRMAN CARPENTER: How about adequate feeding, anything that would encourage the consumption of feed to build resistance?

DR. BEAUDETTE: I am not so interested in getting them to eat a lot, because the course of the disease is so very short that they can withstand, I think, a little decrease in feed intake during that period.

CHAIRMAN CARPENTER: Then let's go back to the two-day-old chicks that haven't yet learned how to eat. I am thinking in terms of giving them moistened feed to keep down the dust as they are eating it, making it easier for them to swallow.

DR. BEAUDETTE: I am sorry; I don't understand your question.

CHAIRMAN CARPENTER: Any comments on the part of the Board? Is it a practical recommendation for the poultryman to feed them a moist, crumbly mash three or four times a day, Dr. Martin?

DR. MARTIN: Yes, it is practical, and a number of men have done it with success.

CHAIRMAN CARPENTER: Any other questions? Hearing none, we will take up avian tuberculosis. Dr. Stafseth, is avian tuberculosis still quite prevalent as a nationally-known or recognized disease?

DR. STAFSETH: I don't know about the national aspect of the question, but I do know that in certain locations in our State it is still quite prevalent, and from reports of others there are similar conditions in other states. I don't think it is such a great problem to the commercial hatcherymen and breeders who have up-to-date sanitary equipment and who practice good poultry sanitation. It is mostly a farm flock problem, especially among those who keep a flock for a bit of necessary nuisance.
CHAIRMAN CARPENTER: Have you anything to add to that, Dr. Jungherr?

DR. JUNGHERR: I can't answer it from a national standpoint, but from the standpoint of the New England section I would say that avian tuberculosis in domestic fowl has practically disappeared as a problem. The only type of tuberculosis we have to cope with is in commercial pheasantry. Pheasant tuberculosis does exist, but we see very few cases of avian tuberculosis in the common fowl.

CHAIRMAN CARPENTER: Dr. Beaudette, the transmissibility of avian tuberculosis to other species of birds, especially pheasants and mammals as well.

DR. BEAUDETTE: Tuberculosis is very common in pheasants and we can understand this if we examine the practices on pheasant raising farms. It is the custom on a good many farms to use foster mothers, and since these pheasant farms are usually quite large, it means the use of a large number of foster mothers, that is, broody hens. Since broody hens are more apt to be of heavy breeds, and since heavy breeds come usually from general farms and not commercial farms, it means that a pheasant rearing establishment has to contact a good many general farms in order to get enough broody hens to carry on its operation.

The result is that from one of these farms, or perhaps more than one, some tuberculosis is brought in, and this in turn is transmitted to the pheasants which are reared there. There is another practice which favors further spread of the disease, and that is that all pheasant men, particularly the older men, believe that in order to rear good pheasants you have to trade cock birds. So there is a constant exchange of cock birds, with the result that tuberculosis on one pheasant farm gets onto another, and it is a vicious circle.

Then, finally, the pheasants when liberated may spread the disease back to poultry farms. That is something we are very much concerned about in our own state, where the incidence of avian tuberculosis is very low. I am glad to say, however, that we are getting pheasant breeders away from the use of foster mothers, and they are using artificial methods now in the rearing of pheasants.

CHAIRMAN CARPENTER: Now will you take the mammalian end of this transmissibility, please?

DR. BEAUDETTE: Everyone knows, of course, that avian tuberculosis is of quite common occurrence in hogs, and that it has been found too in other mammalian species. But it is of particular importance in the hog.

CHAIRMAN CARPENTER: Perhaps you will get some questions on that later, when we open it from the floor.

Dr. Hinshaw, what is the practicability of intradermal testing of our avian groups for the control or eradication of avian tuberculosis?

DR. HINSHAW: I think we should consider the intradermal tests especially for chickens as a finding test.
CHAIRMAN CARPENTER: You mean a diagnosis aid?

DR. HINSHAW: Yes. It should be used for that only. I think the B. A. I. has shown that it is of practical value to locate flocks where tuberculosis occurs. In turkeys we have found no satisfactory method of testing. We have tried various locations, and the best that we have done is to get about 75 per cent efficiency. The place we have found most efficient is in the web of the wing, the edge of the wing web. We have also used the mucous membrane in the region of the cloaca.

CHAIRMAN CARPENTER: Dr. Martin will give us his viewpoint on the importance of good poultry husbandry, and we mean, of course, turkey husbandry as well, in relation to the control of tuberculosis in our farm flocks.

DR. MARTIN: There is little good in locating these carriers if a good management program is not carried on after the carriers are eliminated from the flock. One of the quarrels that the husbandman has had with a lot of recommendations in the past has been that he is in many cases advised to get rid of his young birds at the conclusion of their first laying year. This interfered with any program of breeding for longevity, and continued high production, and many other things that he wished to carry on.

Fortunately, we now have the results of research at the Nebraska Station. I really ought to call on Dr. Van Es, who is modestly seated in the balcony, and have him tell of this work. But I do want to quote from his research bulletin published this year.

(Dev. Martin quoted Dr. Van Es' paper: "A given environment may be either reasonably sanitary or the very opposite without greatly modifying the incidence of avian tuberculosis after tuberculous fowls have been introduced.")

That, as I see it, is the catch. If there are tuberculous fowls on the farms, then all of our sanitation practices fail to eradicate the trouble. You must get those tuberculous fowls out of the way, then the sanitation practices will be of value. But that throws the emphasis back, of course, to testing and removing carriers.

The poultryman is on hand every day, and if he isn’t constantly on the alert, birds can begin to show up and become a menace to the flock. So continuous and close culling, I think, would be indicated as a practical procedure in the light of that research.

A second conclusion was that “healthy older fowls showed a rather well-marked resistance to avian tuberculosis when exposed by direct or indirect contacts in an environment in which the opportunities for doing so were ample.” We know when the bird gets older it will become more resistant, and it is safe to carry over such birds, assuming they have survived culling from a production standpoint and other points in which the poultryman is interested.

CHAIRMAN CARPENTER: Perhaps the California Station has done as much work on tuberculosis in turkeys as the other stations. I will ask Dr. Hinshaw to briefly make a statement of their findings.
DR. HINSHAW: First of all, I will say that all the work we have done in tuberculosis of turkeys has indicated that the avian type is the only species found in turkeys. We have had typed specimens from eight outbreaks by using guinea pigs, rabbits, and chickens, and in every instance the type has been the avian.

The disease is identical to that in chickens. We have found all of our outbreaks, as a matter of fact, on ranches where there have been tuberculous chickens present.

We found relatively young turkeys (3 to 8 months of age) with severe cases of tuberculosis. These had generalized lesions with about the same incidence as one finds in chickens. One peculiarity in turkeys was the large incidence in the ovaries of the females.

CHAIRMAN CARPENTER: Are there any questions on avian tuberculosis? Here is a good opportunity for regulatory veterinarians to discuss with these gentlemen any of their findings if there be a desire for such discussion.

The next section is on "pullet disease." While not new in the field or new in the experience of avian pathologists, nevertheless it recently appeared in literature for the first time as the result of some investigations carried on by Dr. Jungherr and his associates. I will ask Dr. Jungherr just what "pullet disease" is.

DR. JUNGHERR: The term "pullet disease" has been applied to a condition occurring in birds usually about 3 to 4 weeks after housing. The condition seems to be characterized by diarrhea or constipation, and, from the clinical standpoint, especially by cyanosis of the comb, known as blue comb. "Blue comb" is another popular term for the condition termed "pullet disease."

From the pathological standpoint we find that the disease shows in the most characteristic cases, hemorrhages in the liver and in the serous membranes of the body. There are also small yellowish areas in the liver which are due to focal necrosis. The condition is often accompanied by enlargement of the kidneys, and finally the chronic cases are indistinguishable from visceral gout.

The disease in some cases, we find, is accompanied by fever, but quite frequently we find subnormal temperatures in these birds.

CHAIRMAN CARPENTER: How prevalent is it, Dr. Jungherr, in your part of the country?

DR. JUNGHERR: The occurrence of the disease varies very much, according to what type of condition is meant by the term. If you consider as "pullet disease" only the acute type, characterized by focal necrosis of the liver and hemorrhages in the serous membranes, it is rare; however, the subacute and chronic forms are more common. Some investigators do not apply the term "pullet disease" to the subacute or chronic forms.

CHAIRMAN CARPENTER: Dr. Beaudette, along the Atlantic Coast is this disease prevalent?
DR. BEAUDETTE: The type Dr. Jungherr refers to as the subacute type is far more common with us than the one he refers to as acute.

CHAIRMAN CARPENTER: Moving into the Midwest—Dr. Stafseth?

DR. STAFSETH: The same situation as in New Jersey.

CHAIRMAN CARPENTER: Dr. Hinshaw, on the West Coast?

DR. HINSHAW: Maybe because of ignorance but I have not heard of any diagnosis on the West Coast.

CHAIRMAN CARPENTER: Wait, Dr. Hinshaw. I think a lot of people in the room have seen some "blue combs" on the West Coast.

DR. HINSHAW: I say it may be because of my ignorance in not knowing the disease, Dr. Carpenter.

CHAIRMAN CARPENTER: Haven't you had the experience in your laboratory routine diagnoses, particularly in the state laboratories out there, of finding birds which have died suddenly, which in some way, at least, fit the description as presented by Dr. Jungherr, and in which you found no causative bacteriological agent?

DR. HINSHAW: We find lots of non-specific diseases, but again I say I don't believe anyone has diagnosed any of the diseases as "pullet disease." I agree with you, Dr. Carpenter, they have shown the symptoms Dr. Jungherr has described.

CHAIRMAN CARPENTER: I think Dr. Jungherr would be willing to settle for it being in the realm of possibility of its being in the same category or syndrome of pathological findings; would you not, Dr. Jungherr? The very thing that Dr. Hinshaw has mentioned might be, in your estimation, the same thing that you have been finding in the East?

DR. JUNGHERR: I believe what Dr. Hinshaw refers to as non-specific diseases includes some of the conditions which we term "pullet disease."

CHAIRMAN CARPENTER: While you are at the microphone, Dr. Jungherr, what, in your opinion, is the economic importance of "pullet disease" to poultry farmers in New England?

DR. JUNGHERR: The economic importance of "pullet disease" rests primarily on the fact that the condition occurs in the best types of birds under the best housing and feeding conditions, and under the best type of management. It usually affects the heavy birds in the flock, and it is very disturbing to the poultryman to see his flock suddenly break down after he has had reasonable assurance from his experience on range, and from his experience during the first weeks of housing, that he can expect a reasonably good profit from his flock.

CHAIRMAN CARPENTER: I see a question here, Dr. Jungherr, which has already been referred to, but I will ask you this particular question again: Is "pullet disease" infectious?
DR. JUNGHERR: One of the characteristics of this syndrome is the fact that we are not able to demonstrate any infectious agent either by bacteriological examination or by transmission experiments.

CHAIRMAN CARPENTER: Will you please give us a brief differential diagnosis between “pullet disease” and other diseases with which it may be confused by practitioners in the field?

DR. JUNGHERR: I believe the question is of great practical importance, because we have to guard against that any disease which cannot be readily recognized is going to be put into this classification.

The first criterion is that we find lesions which are suggestive of an infectious disease, and yet we are unable to show an infective agent. We have to rule out pullorum disease, fowl cholera and fowl typhoid. Not very long ago we studied a case in which we would have been willing to make a diagnosis of “pullet disease” had we not obtained positive bacteriological findings. These showed we dealt with an acute case of pullorum disease. Such infectious conditions cannot be ruled out unless you have complete pathological examination.

CHAIRMAN CARPENTER: Dr. Jungherr, what can be done to prevent or cure this disease in the light of our present knowledge?

DR. JUNGHERR: In our experience, the disease can be handled fairly well if we make the diagnosis early. Acute cases can be helped by reducing the feed, and possibly by giving some readily available carbohydrates. We have used molasses and have obtained, apparently, some success with this treatment.

However, we have had cases in which the disease started in an acute form, and then trailed along during the entire summer, and in the fall the poultrymen experienced a large number of cases which would commonly be diagnosed as visceral gout. In our experience, if the first treatment is effective, then the losses are not so great. However, if the first treatment seemingly does not do the trick, then we may expect the disease to influence egg production and mortality during the height of the production period.

CHAIRMAN CARPENTER: I think, Dr. Beaudette, something might be said as to the appropriate use of the name that has been tentatively offered for this disease, and I would like to ask your opinion from a technical and professional standpoint. Do you think the name is one that should go down in the literature?

DR. BEAUDEETTE: Of course, the term “pullet disease” is not appropriate. It certainly is not scientific. At the same time, I think it is well to have some sort of “handle” to put on a disease of unknown origin so that we can get some idea of how extensive the disease is.

It is particularly important in this case, because the disease—or diseases (I am not certain it is a single entity)—has gone under a variety of terms, this being only one of them. It is also known as the “unknown disease,” “X disease,” “blue comb,” and perhaps it has other names.
In our laboratory we refer to the disease which Dr. Jungherr described as “acute,” as “X” disease, and the disease he calls “pullet disease” as “new wheat poisoning,” not with the idea that new wheat is the cause, but we often find it associated with the feeding of new wheat. The two may be alike, I am not certain, but for our own convenience we differentiate between these two conditions.

So I think it is a little premature to discuss the proper nomenclature until we know what the etiological agent or agents may be. At the time, I think it is well to discuss these problems and find out what we are talking about in the various states. That was brought out very clearly at a meeting in Massachusetts of the Northeastern group this spring, and it was brought out in the discussion that we have these two types of diseases.

Dr. Jungherr considers them, I believe, as probably being caused by the same agent. I think there might be two agents involved, although I am not certain of that; nevertheless, we can understand what the other is talking about if we give some sort of name to some disease of unknown etiology.

CHAIRMAN CARPENTER: It has been suggested that there is a similarity in the changes in the blood chemistry between “pullet disease” and milk fever in dairy animals. I want to ask Dr. Bethke if he has an opinion as to the possibility of this eventually being catalogued as a true, definite chemical upset which may be brought on or stimulated partially, at least, by the fact that a 5-month old pullet suddenly comes into production, and that act is somewhat comparable physically and chemically to a cow coming into milk production suddenly.

In other words, Dr. Bethke, these two operations—the production of eggs and the production of milk are all-important factors in reproduction, and certainly we recognize that blood chemistry does enter into those phenomena. Consequently, in your opinion, Dr. Bethke, does this offer a field of further research, and would you care to say anything in that connection?

DR. BETHKE: I cannot speak from experience, but as far as the hypothesis that has been developed, I would say it is a very fertile field for further research, because certainly the physiology of milk secretion and the matter of egg production are, I think, rather closely related. If there is any suggestion that in case of “pullet disease” you have a blood chemistry that might be somewhat similar to milk fever in cattle, I would venture a guess that it is a very fertile field for further research.

CHAIRMAN CARPENTER: Are there questions to be asked regarding this disease?

DR. JUNGHERR: I would like to comment on this question of blood chemistry.

We have considerable data on the blood chemistry of “pullet disease.” We have found that blood sugar is slightly higher. Calcium is somewhat lower, phosphorus and magnesium seem to be within normal range. The
one, and probably the most consistent finding we have made, is that uric acid in the blood is increased. We accept as a normal value about 5 milligrams per 100 cc. of blood; we find between 8 and 10, and sometimes as high as 25, milligrams of uric acid per 100 cc. of blood in "pullet disease." We have been able to recognize the disease by blood chemistry even in the absence of pathological findings. Such cases are usually accompanied by histopathologic findings.

CHAIRMAN CARPENTER: Are there questions or comments on this disease?

DR. HIGGINS: Did I understand correctly that "pullet disease" was only found after the birds had been in production?

CHAIRMAN CARPENTER: The question is, does Dr. Higgins understand that this disease is found only after the birds have been in production?

DR. JUNGHERR: No. The conception we have of the disease is that it occurs primarily during the early production of the first laying period. However, we have found it during the second laying period, and we have found it in 4-week-old chicks. At least the pathological syndrome was indistinguishable, and therefore, as Dr. Beaudette pointed out, the term "pullet disease" is not applicable, but we wish to withhold naming the disease until more is known.

In other words, we will have to name the disease either on the basis of pathological or etiological criteria, and so far we have tried to get along with the popular term.

DR. FENSTERMACHER: I would like to ask Dr. Jungherr the number of birds one could expect in an outbreak—one, or a few, or many?

CHAIRMAN CARPENTER: The question is, how many birds might be affected in an outbreak?

DR. JUNGHERR: The characteristic cases show a high morbidity. Our records show that morbidity may run between 50 and 60 per cent of the flock, taking even a flock of 1,000 birds; but the mortality is much lower.

The difficulty in evaluating the effectiveness of treatment comes from the fact that many of these birds seem to recover after slight changes in management, or possibly even slight changes in the weather. We have experimental data which tend to show that nephrotoxic agents are more active at a higher temperature than at a lower temperature. This would point to climatic factors as influencing morbidity and mortality.

CHAIRMAN CARPENTER: Time requires that we move along to our age-old friend, coccidiosis. I am not quite sure to whom coccidiosis is a friend, however.

Dr. Stafseth, what ages of poultry are mostly affected by coccidiosis, and at what time of the year is it most prevalent?
DR. STAFSETH: We have found coccidiosis in chickens in our state practically all year round, but, of course, we have different types of coccidiosis occurring at different times of the year. Especially during the wet season we find a great deal of cecal coccidiosis. Then we have the duodenal type of coccidiosis, and the necatrix, which operates in the middle of the intestines. The same is true of the maxima, which we see in late summer and fall. There being six or seven species of coccidia, you are assured of a supply more or less all the year round. I would not say that it causes a great deal of mortality in the wintertime, but it is there.

CHAIRMAN CARPENTER: Discuss while you are there, Dr. Stafseth, the possible effective medication against coccidiosis.

DR. STAFSETH: I don't know anything that I would rather get out of seth, the possible effective medication against coccidiosis.

CHAIRMAN CARPENTER: I didn't send in the question.

DR. STAFSETH: For cecal coccidiosis we still recommend the milk flush, crossing our fingers and praying silently that it will do some good. If it seems to work the poultrymen are satisfied, and we are temporarily disembarrassed.

For the types of coccidiosis that occur in the duodenal and middle intestinal portions, frankly I don't know of any treatment that I would bank on very much; in fact, I wouldn't bank much on the milk flush, either. There are a couple of treatments recommended, yes, several, but I have yet to see any positive proof of their efficacy.

One man recommends a magnesium sulfate flush which is given for about half a day. A half-pound of magnesium sulfate in a gallon of water is given in the morning before the birds have had any water, and after that follows a potassium dichromate treatment—one teaspoonful to the gallon of water. There are even those who have recommended iodine suspensoid, but I have not seen any results that I could really feel were due to the treatments.

CHAIRMAN CARPENTER: What is the value of disinfectants versus heat in the control of coccidiosis?

DR. STAFSETH: You refer to the flame?

CHAIRMAN CARPENTER: Yes.

DR. STAFSETH: I don't think the average disinfectant that is applied has any effect on coccidia. I have seen coccidia remain alive and capable of sporulating, in disinfectants for a long time. The most effective disinfectant is an acidulated chlorine solution, but you have to wear a gas mask, rubber boots and rubber gloves while using it. Another deadly thing to coccidia is the iodine suspensoid. If you don't want to use either one of these, I think you might as well rely on the mechanical cleaning, using plenty of water and perhaps some solvent and a brush and a lot of enthusiasm.
However, there is one danger in connection with cleaning against coccidiosis, as the poultryman refers to it, and that is this. If you are going to clean you'd better clean well, because the finest place in the world for coccidia to sporulate is on a recently cleaned surface. In deep decomposing matter coccidia do not sporulate readily, and probably that answers the question that so frequently comes up. Somebody has a very clean and apparently sanitary house, and they have a lot of coccidiosis, while someone else keeps poultry under insanitary conditions, yet has no trouble with this disease.

As for the flame, this to my mind is only something by which to impress a very ignorant person. Psychologically it may be very effective. From the sanitary point of view it is useless. Some of you have probably read the article that I wrote while I was in Mexico, where we tried out this flame disinfection for pullorum disease, and found it practically useless. We have tried to kill coccidia with flames, spraying coccidia on pieces of boards and desks, and we find that if there is a little film of moisture present the coccidia will sporulate afterward, even if we apply the flame until the boards burn around the edge of the moist area. I would not depend on heat at all.

CHAIRMAN CARPENTER: Dr. Jungherr, will you comment on sulfur in the control of coccidiosis?

DR. JUNGHERR: The question is the value of sulfur treatment. As far as I know, sulfur has not been credited with any value in the treatment of coccidiosis, but it has been credited with some preventive action. Preventive action of sulfur is probably in effect only during the time the sporozoites and merozoites of the coccidia pass through the lumen of the intestine. This is the very short period during which these coccidial forms move from one intestinal cell to another. We have not much practical experience with sulfur treatment, but we understand it does have a mild preventive effect.

However, it is in no sense a solution of the coccidiosis problem. If you give sulfur in effective doses you have the complicating factor of producing sulfur rickets, and increasing the requirements for vitamin D. Also it upsets the mineral balance. It is our feeling that sulfur treatment is not going to solve the coccidiosis problem.

CHAIRMAN CARPENTER: Do you think, Dr. Jungherr, from the research and experience of investigators in the use of sulfur to prevent the appearance, particularly, of cecal coccidiosis, that we could offer the poultryman, at the moment, any particular routine of employing sulfur to prevent the disease, we will say, during the span of time from three to seven or eight weeks?

DR. JUNGHERR: In our experience we find that cecal coccidiosis occurs primarily during the early growing age, during the first three to five weeks, and poultrymen have little trouble controlling it. As a matter of fact, very few cases come to the laboratory for diagnosis, because poultrymen spot it immediately, and apply control measures.
We have, then, no particular problem with cecal coccidiosis. Our main trouble is with the intestinal form of coccidiosis, and under these conditions we cannot advise sulfur treatment, because it would have to be given just before coccidiosis makes its appearance, and we cannot anticipate an outbreak of coccidiosis. The only possible time when it might be useful is when the weather is very moist, and birds have to be turned out on range. It is possible that just at that time when we contemplate turning birds out on range, we could use the sulfur treatment to some advantage.

But I want to emphasize again that I do not feel sulfur treatment in any way solves the coccidiosis problem. It is still a problem of sanitation and management.

CHAIRMAN CARPENTER: Dr. Bethke, milk has been talked about so much in relation to preventing, in the earlier days, and shortening the course or keeping mortality at a low level in relation to coccidiosis. I wish you would give this group the latest findings from the standpoint of milk and nutrition in relation to recoveries in coccidiosis, and just what part you think it plays in that particular field.

DR. BETHKE: In practice I think it is generally recognized that the use of milk flushes, plus reasonable sanitation, are of value in the control of certain types of coccidiosis. From a nutritional viewpoint, of course, we know that milk contains many valuable nutrients which are required by poultry.

There is a great possibility that some of the beneficial effects of milk flushes in the control of coccidiosis might be attributed to the nutrients that are supplied.

In addition to the nutrients that are supplied, it is also a fact that the liberal use of milk products in chick rations will produce a mild laxative effect, which, from a control standpoint, might be of value as far as coccidiosis is concerned.

CHAIRMAN CARPENTER: The thought is, Dr. Bethke, that in the opinions of quite a few people, the word "flush" is the red flag that is waved in many people's faces, because in their mind there is the thought of the old 40% milk mash, which originally was fed for some ten days or two weeks at a straight stretch. Now, most poultry raisers are no longer employing such methods, and many colleges warn against the continued use of milk over an extended period of time, because of later eventualities which may cause more harm than the benefit produced.

So if we understand you correctly, then, it isn't so much the flush, as the fact of the possibility of milk providing a fine type of nursing food during the time when the normal intake of food is lower, because the birds are sick from coccidiosis?

DR. BETHKE: That is right.

CHAIRMAN CARPENTER: Are there any questions on coccidiosis? Dr. Martin, very briefly, please will you discuss just how big a part management plays in this matter of coccidiosis control?
DR. MARTIN: I would hazard a guess that management practices are 90 per cent, with nutrition about 10 per cent. I feel that proper nutrition is of course essential to raise the threshold of resistance, but by and large, management is the big factor. As a matter of fact, in research at many institutions, the effectiveness in keeping out coccidiosis is used as a measure of the value of the sanitation practices. In other words, the sanitation practices are good if coccidiosis is kept out.

So, after all, we must adapt those practices to a practical or workable basis on the farm to keep coccidiosis out. Management, clean feed, clean ground, clean drinking utensils and clean poultry houses are all quite essential.

CHAIRMAN CARPENTER: While you were doing graduate work at the University of Wisconsin, I am sure you heard Dr. Halpin make the statement that coccidiosis is a disease with which we must learn to live. Can you subscribe to that?

DR. MARTIN: Well, not entirely, because I just got through saying, "keep it out." If we must learn to live with it in our animal world, we should try our best to keep it from getting severe in any particular flock. After all, we have the matter of a slight infection developing some resistance within the birds.

CHAIRMAN CARPENTER: Is that not a part of learning how to live with it?

DR. MARTIN: Very definitely.

CHAIRMAN CARPENTER: Here is another opportunity particularly for our hatcherymen and poultry friends to ask questions. If there are no questions we will go into the next subject, laryngotracheitis.

DR. BEAUDETTE: Generally speaking, laryngotracheitis is more common during the colder seasons of the year, and of this period the fall sees the highest incidence of the disease in an area where the disease has not existed for a long period of time. But under the influence of extensive vaccination, the highest incidence of the disease may not come until after the first of the year, when really severe weather sets in.

CHAIRMAN CARPENTER: Will you please give your ideas on the clinical differential diagnosis between infectious bronchitis and laryngotracheitis?

DR. BEAUDETTE: Since I discussed chick bronchitis as it affects chicks, I shall discuss the question from the standpoint of adult birds.

We have in both cases a disease which runs a relatively short course. Bronchitis is the milder disease. The symptoms at the onset may be very alarming, that is, marked moist rales in the case of bronchitis. These may obtain also in the case of laryngotracheitis. But death almost never occurs in bronchitis in grown birds, whereas it is very common in the case of laryngotracheitis.
In the space of two or three days the symptoms disappear very suddenly in bronchitis and there may be, for two or three days, a slight nasal discharge remaining, which also disappears, leaving the bird perfectly all right except for a lowered egg production.

In the case of laryngotracheitis, the mortality begins to make its appearance, and may reach up to beyond 50 per cent. In order to make absolutely certain between these two diseases, we can do immunity tests, that is, vaccinate the surviving birds with laryngotracheitis virus, and if no "take" shows, we know the disease from the bird recovered was laryngotracheitis. We can also inoculate other survivors in the windpipe with known bronchitis virus.

CHAIRMAN CARPENTER: What is the advisability of general vaccination in comparatively free areas?

DR. BEAUDETTÉ: I see no reason for this. Unlike the situation which prevails with respect to fowl pox, if the disease is relatively uncommon in an area, there is no reason for extensive vaccination. However, I do want to say that laryngotracheitis is more widespread than is commonly supposed. This comes about through the prevailing opinion that in order to have laryngotracheitis, a chicken must show respiratory symptoms and it must have blood in the windpipe. This is not true. Many outbreaks of laryngotracheitis may manifest themselves by a localized disease in the eye, or a mild discharge from the nasal cavity. It is only by having isolated the virus or by doing immunity tests that one can establish the presence of laryngotracheitis in such flocks.

CHAIRMAN CARPENTER: If the birds to be vaccinated are infected with other respiratory diseases at the time of vaccination, what is the possibility of establishing carriers?

DR. BEAUDETTÉ: If a sufficiently potent virus is used for vaccination, I see no hazards at all in producing carriers as a consequence of vaccination.

CHAIRMAN CARPENTER: The methods of preventing the shipment of carrier birds—what can you say about that?

DR. BEAUDETTÉ: This makes it mandatory, first, to establish the presence of the carrier. Laryngotracheitis is diagnosed by many people as so many other diseases, that I don’t think we had better make regulations regarding the shipment of carrier birds.

CHAIRMAN CARPENTER: Are there any questions?

DR. HINSHAW: Dr. Baudette, do you think there is a so-called healthy carrier of laryngotracheitis virus?

DR. BEAUDETTÉ: There is no doubt about that at all. We have established, and the results have been confirmed, that certain birds recovering from the disease in the windpipe continue to carry the virus there, and may do so for more than two years, perhaps throughout life. However, the successfully vaccinated bird does not become a carrier; that is, the virus does not persist in the vent.
CHAIRMAN CARPENTER: For how many days, Dr. Beaudette, might the virus be found in the cloacal membranes or the cloaca itself?

DR. BEAUDETTE: The disease has a very definite course. Within two days after vaccination, the inflammation is in evidence. It is more marked on the third day, still more marked on the fourth day, reaches its maximum intensity on the fifth day, and there is a marked decrease of inflammation on the sixth day, and in many cases it has entirely disappeared on the seventh day. No trace of inflammation can be seen on the tenth day. It is rare that one can find the virus within ten days after it has been put in the vent.

CHAIRMAN CARPENTER: Are there any other questions?

VOICE: Is there any danger in vaccinating a flock that may be infected with some other respiratory disease?

DR. BEAUDETTE: Not if the vaccine is carefully applied and a potent vaccine used. If a vaccine which will not produce a high percentage of takes is used, and it is necessary to re-vaccinate on the fifth day, or if coryza, or localized cholera infections are present in the flock, then I think there is a possibility of some loss. Otherwise I don't see that there is any hazard.

VOICE: Would you recommend the administration of fowl pox vaccine and laryngotracheitis vaccine simultaneously, or should those be administered in short intervals?

DR. BEAUDETTE: In our area, we recommend universal vaccination against fowl pox, and in those flocks where necessary to vaccinate against laryngotracheitis, the two operations are done at the same handling. The laryngotracheitis rather governs the lower age at which vaccination is done, that is, at about six weeks. Pox vaccination, providing fowl pox is used, limits the upper age, which is about three months in the case of Leghorns, about four months in the case of heavy breeds.

If one is using pigeon pox virus in place of fowl pox virus, then there is no upper limit, and the lower limit stays about the same. When the vaccinations are done at the same time, actually the reactions come at two different times. There is practically no reaction following laryngotracheitis vaccination. Any reaction will have disappeared by the seventh day, and it is about this time that the reaction from pox sets in.

CHAIRMAN CARPENTER: Dr. Beaudette, you said both operations may be carried out at the same time. By the same operator?

DR. BEAUDETTE: Well, I think this depends entirely upon the size of the flock to be dealt with. If it is a question of only a few hundred birds, the same operator may do both vaccinations, and there is not much likelihood of getting the vaccines mixed up, because the pox vaccine, providing it is applied by the stick method, is administered with two needles stuck in the end of a stick, whereas the laryngotracheitis vaccine is administered by means of a brush. So there is not much opportunity to get the vaccines mixed.
If one is dealing with a large flock, that is, with several thousand birds, then it is well to have one person vaccinate against fowl pox, and two persons vaccinate against laryngotracheitis, plus the crews passing the chickens. With such a setup it is possible to run through 1,000 birds an hour.

DR. TUCKER: I would like to ask Dr. Beaudette whether vaccination against laryngotracheitis is to be recommended after it has been diagnosed in the flock?

DR. BEAUDETTE: This is a dollar and cents proposition, and depends upon how long the disease has existed in the flock. For example, if only half of the flock is infected, I think it is well to vaccinate the remainder of the birds. If the outbreak is only just beginning, then most definitely one should vaccinate. If the birds are contained in several houses or several rooms in a house, one should remember to begin the vaccination in those rooms or houses where the disease has not yet made its appearance. It is wrong to begin the vaccination in an infected house because the operator in holding the bird between his legs in vaccinating it, gets his clothing contaminated, and thereafter spreads the disease in going from one house to another.

DR. CAMERON (Canada): How long will the virus live outside the body?

DR. BEAUDETTE: The question is, how long the virus of laryngotracheitis will live outside the body. This will depend entirely upon the environmental conditions. If virus gets into the litter where there is the smallest degree of moisture, it will not live for any length of time at all. We have some concrete information on this. Gibbs deposited virus in a test tube and protected it with a small bit of cotton, and planted the tube in a litter of a house. The virus could not be demonstrated in the tube within a week. Under those conditions the moist litter did not even have direct contact with the virus. So we may say that virus in the litter on a floor of a chicken house will not live for any length of time. Virus getting into the dust and cracks and crevices of a house might live a longer time, but not too long.

DR. ANDREAS: How long after you took all the live chickens out of a hatchery would you say you could put chicks back in without danger of transmission?

CHAIRMAN CARPENTER: The doctor means chick bronchitis rather than laryngotracheitis, I presume.

DR. BEAUDETTE: I recommend that in cleaning up a house in which an outbreak of bronchitis has occurred, that one should wash out the interior of the house with a hose, including the ceiling and walls, and if the house is kept moist for, we will say, three days in succession, then one can even dispense with the use of disinfectants, because the virus will not live that long under moist conditions.

However, to satisfy yourselves you may sprinkle a disinfectant around if you want. But the water alone will take care of it. The main point is to get the interior of the house thoroughly flushed out with water.
CHAIRMAN CARPENTER: We will move along to the next subject, blackhead. The thing that interests us most recently in blackhead control is phenothiazine. I will ask Dr. Hinshaw to talk on that as a control measure.

DR. HINSHAW: I will say, first of all, that I have had no personal experience with phenothiazine in blackhead outbreaks or with even the control of roundworms. You probably are familiar with the fact that McCulloch and his associates at Washington State reported that phenothiazine was exceptionally valuable, according to their experimental data, for the removal of the cecum worm from chickens (they did not use turkeys). For this reason they suggested the possibility of the use of phenothiazine in the control of blackhead.

We all know that the cecum worm is one of the principal carriers of the organism, *Histomonas meleagridis*. If this drug can be used on the ranches where the parasite is prevalent, it may have some value. The only other work I know of on the use of phenothiazine in turkey flocks is that by Dr. Fredericks. He feels, I believe, that he has seen some beneficial effects. I think its use is in the experimental stage, and we are not in a position at the present time to say if phenothiazine can control blackhead.

We have the other problem in the possible use of this drug on the parasites themselves. Time will tell whether it is valuable for that or not.

CHAIRMAN CARPENTER: Dr. Martin, will you please summarize, very briefly, our present control measures from the standpoint of husbandry and good management in blackhead?

DR. MARTIN: I wish to say, first, that this story of blackhead and its control is a beautiful example of the value of research and its subsequent application to control and the practice of good husbandry.

There is one point that I would like to bring out with regard to management: We all know the turkey industry moved West and still further West until it struck the Pacific Ocean. We tried to run away from the disease, and we ran until we could run no farther. Yet all that time experimental data was in the records, showing how we could handle this blackhead proposition.

Dr. Theobald Smith discovered the causative organism in 1895, and Dr. Moore of the Bureau of Animal Industry, in 1896, made this statement: "It is of the highest importance that the communicability of this disease through the excreta of infected turkeys should be recognized, and vigorous measures taken to avoid that means of spread.”

Some of us weren't even there to read the publication when it came out in 1896. In 1907 the Oregon Station said, "Food given to fowls should never come in contact with their droppings." In 1907 Dr. Cooper Curtis, of the Rhode Island Station, in publishing his results, said: "Turkey attendants should not attend to the ordinary fowls unless they understand the danger of carrying infection to the turkeys, and provide against it."
The transmission to turkeys from chickens, and the breaking of that cycle, are facts known 30 years ago. Think those things over. Yet there was a tremendous lag of almost 20 years before those results were put into practice, until sanitation, range rotation, keeping chickens away from turkeys, keeping young turkeys away from old turkeys, and other simple management procedures were brought into practice. I don't believe such a tremendous lag between research and application on the farm could occur in this day and age, because we have, right here, a discussion of phenothiazine "hot off the griddle" as you might call it.

I think this meeting, and the forward-looking attitude of the officers of your Association, bear testimony to the fact that we want to get into the field with this work, and get there as quickly as possible. We have in the comeback of the turkey industry an illustration of the value of such programs as we have here today.

CHAIRMAN CARPENTER: Any questions on blackhead? If not, moving on to the subject of tapeworms, Dr. Beaudette:

Generally speaking, why are taeniacides ineffective?

DR. BEAUDETTE: It has been observed that when taeniacides have been given to fowl they often cause the passage of what appear to be worms in the droppings. But if one holds the treated bird for a couple of weeks, and makes a post mortem examination, one finds mature tapeworms in the bird. This is accounted for by the fact that the taeniacide has only a shearing action, leaving the head of the tapeworm which generates a new body. Bill Hinshaw also asked me to comment on the toxicity of kamala.

We observed, several years ago, that when kamala was given to birds that were obviously severely infested with tapeworm, that it caused very heavy mortality. This may not be in evidence when the flock is in excellent condition, but certainly birds are depleted by the effect of kamala.

These tests were carried on by Dr. Black, in charge of our Vineland branch laboratory, and Dr. Goldhaft. Failure of the drug to remove tapeworms was called to the attention of the authorities in Washington; and I think these tests caused the investigators there to re-examine their experiments.

CHAIRMAN CARPENTER: Now we approach a field that is taking more and more of the veterinarian's attention, that of nutritional diseases. I might offer that the list of questions presented to Dr. Bethke is a compendium of our present-day knowledge on nutrition, but it will be impossible to ask all the questions submitted here.

Consequently, Dr. Bethke and I shall attempt a rapid-fire conversation in order to develop some of the important points. At the end of that rather brief summary we will provide an opportunity for questions, if some may have been overlooked that may be on your minds.

How long is the present list of vitamins of interest to poultry, Dr. Bethke? In other words, how many are there?
DR. BETHKE: There are approximately twelve or more vitamins or vitamin-like factors that have been shown to be required by poultry.

CHAIRMAN CARPENTER: Are any of these recent discoveries?

DR. BETHKE: They are. Some of these have been discovered within the past year.

CHAIRMAN CARPENTER: Of the list you mentioned, how many would you consider principal and important? In other words, which ones need the most attention from the standpoint of preparing adequate feeds for chickens and turkeys?

DR. BETHKE: The facts are that all of the factors need to be taken into consideration, although from a general point of view the three factors or vitamins which need special attention, in my estimation, are vitamins A, D and riboflavin.

CHAIRMAN CARPENTER: Would you give riboflavin its other name?

DR. BETHKE: Riboflavin is known commonly as vitamin G.

CHAIRMAN CARPENTER: And before that?

DR. BETHKE: As vitamin B2 of the vitamin B complex.

CHAIRMAN CARPENTER: We used to define vitamins as “unknown but required substances.” Just what are vitamins, in the light of present day knowledge?

DR. BETHKE: In the light of present day knowledge, we must define vitamins as definite chemical entities, just as we know that sugar or salt or other chemical compounds are definite chemical entities.

CHAIRMAN CARPENTER: Just what is the relationship between vitamin A and general disease resistance?

DR. BETHKE: Vitamin A is generally referred to as the anti-infective vitamin. That, in one sense of the word, is a misnomer, although there is evidence to indicate that vitamin A might play some part in connection with infection, inasmuch as vitamin A or a lack of vitamin A appears to affect the mucous membranes, particularly of the respiratory tract.

CHAIRMAN CARPENTER: Then vitamin A, you would say, is definitely a required essential for good resistance against all respiratory diseases of fowls?

DR. BETHKE: I would say vitamin A is a definite essential in that respect.

CHAIRMAN CARPENTER: Are chickens and turkeys capable of manufacturing vitamin A as well as utilizing vitamin A as such?

DR. BETHKE: In the strict sense of the word, turkeys and chickens can manufacture vitamin A.
CHAIRMAN CARPENTER: From what substances do they manufacture this vitamin?

DR. BETHKE: From carotene, commonly referred to as pro-vitamin A. Carotene being primarily found in the vegetable kingdom. It received its name from carrots, from which it was first isolated, and of course it is found in all green plant tissues.

CHAIRMAN CARPENTER: Would you say, then, that in some cases we add vitamin A to the ration, and in other cases pro-vitamin A?

DR. BETHKE: That is correct. Either source can be used as a source of vitamin A for chickens and turkeys.

CHAIRMAN CARPENTER: How long have we known about vitamin D in relation to its importance for maintaining health in the human family?

DR. BETHKE: Ever since the early 1920's.

CHAIRMAN CARPENTER: My question was "the human family."

DR. BETHKE: Specifically, as far as vitamin D is concerned, it was not named. We did not know it as such until the early 1920's. Of course, we did know from European work, along in 1915 and before, that sunshine and fish oils had some peculiar essential to human nutrition, although it was not known and not established until the early 20's as we know it now.

CHAIRMAN CARPENTER: Just how does vitamin D build healthy bone?

DR. BETHKE: Vitamin D builds healthy bones in that it assists in the assimilation of calcium and phosphorus, the two minerals which go to make up the major portion of the bone tissue. In other words, we might consider vitamin D as a cooperator with the two minerals, calcium and phosphorus. All three—vitamin D, calcium and phosphorus, are essential for normal bone formation.

CHAIRMAN CARPENTER: How does the present war affect the vitamin D market?

DR. BETHKE: As most of you gentlemen probably know, the present war situation has brought about a definite increase in the vitamin D cost, or the cost of the fish oil.

CHAIRMAN CARPENTER: What are the latest developments in producing vitamin D from other sources?

DR. BETHKE: There are a number of processes in the developmental stage. Others have proceeded to the point where we might term "synthetic vitamin D" is now available. The one particular form of synthetic vitamin D is irradiated cholesterol, that is, the animal sterol. It has been shown by experimental work, with poultry, to be as effective as the vitamin D found in pure cod liver oil when compared on the standard rate unit basis.
CHAIRMAN CARPENTER: What occurs if there is a shortage of riboflavin in the baby chick ration?

DR. BETHKE: If there is a shortage of riboflavin or vitamin G in the chick starting ration, we would expect poor or subnormal growth, and I think in most instances a certain percentage of the chicks would show a rather characteristic, curled toe paralysis; where the toes are curled inwardly and the chicks invariably walk upon their hocks. Some of these chicks that are so affected will recover spontaneously without any change in management or in feed.

CHAIRMAN CARPENTER: Might we say, then there is some confusion as to whether or not riboflavin is the only factor which may cause what is called in the field clinically as curled toe paralysis?

DR. BETHKE: There can be considerable confusion. Curled toe paralysis or riboflavin deficiency has been and frequently is confused with perosis, or sometimes referred to as “slipped tendon” or “enlarged hocks.” Some have even confused it with fowl paralysis.

CHAIRMAN CARPENTER: What occurs if there is a shortage of flavin in the laying ration?

DR. BETHKE: About the only thing we can expect will be a decrease in egg production.

CHAIRMAN CARPENTER: A serious decrease is evidence if there is a marginal amount of vitamin G?

DR. BETHKE: I would not expect a serious decrease. That all depends upon your definition of “serious.”

CHAIRMAN CARPENTER: In the hatching egg ration, what occurs if there is a shortage of flavin?

DR. BETHKE: Riboflavin is very essential in the ration of breeding stock, inasmuch as it is required by the growing embryo. If the breeding ration is deficient, or if it contains an inadequate amount of riboflavin, we can expect a marked increase in the number of dead embryos or dead-in-shell.

CHAIRMAN CARPENTER: You might say, then, that feeding for hatchability is an inside job?

DR. BETHKE: Feeding for hatchability is an inside job, definitely. (Laughter).

Within the past year, the California Station has shown that a chemical entity known as choline is in some way apparently associated with the prevention of perosis in turkeys as well as in poultry. That does not necessarily imply that manganese is not essential. The fact of the matter is that manganese is a factor, and apparently choline is, also.

Then, we must not forget that the amount as well as the proportion of calcium to phosphorus in the chick ration are factors, regardless of whether we have an adequate amount of manganese present or not. An excess of
either calcium or phosphorus in the ration, in the presence of adequate amounts of manganese, will tend to remove the manganese from the scene of action, or from becoming available to the chick. That is probably the reason why rations containing very high amounts of mineral matter will frequently cause perosis, even though manganese has been added.

CHAIRMAN CARPENTER: Are the requirements for vitamins A, D and G for turkeys the same as for chickens?

DR. BETHKE: The requirements for vitamins A, D and G are not the same for turkeys as they are for chickens.

CHAIRMAN CARPENTER: How do they differ?

DR. BETHKE: By and large, the vitamin requirements of the turkey are greater than those of the chicken. Specifically, the turkey requires approximately three times as much vitamin A as does the chicken. The vitamin G requirements are approximately 25 per cent greater in turkeys than they are in chicks. In vitamin D requirements, up until the past year, we have assumed that turkeys required from three to four times as much as the growing chick does, but recent work by Dr. Jukes at California shows that the turkey, during the first four weeks of life, requires approximately ten times as much as a baby chick does during the same period of life.

CHAIRMAN CARPENTER: From what you have told us, it seems that disease resistance, rate of growth of baby chicks, rate of production and rate of hatchability, are all influenced by adequate feeding of the vitamins to which you have referred—A, D and G.

How is the feeder going to be certain that he is feeding adequately, in light of our present knowledge, to meet these requirements?

DR. BETHKE: About the only recourse the feeder has is to purchase his feed from some dependable and reliable feed dealer or feed manufacturer who knows what it is all about.

CHAIRMAN CARPENTER: In the preparation of commercial feeds, then, is it possible and practical that ingredients rich in vitamins A, D and G, be tested at the point of manufacture before being added to prepared feeds? Is it a practical something that can be handled in the field of manufacture?

DR. BETHKE: Yes, it is a practical thing that can be handled in the field of manufacture.

CHAIRMAN CARPENTER: Is this a common practice today?

DR. BETHKE: It is a common practice for those manufacturers who are sufficiently large, or who have sufficient tonnage that the costs involved become, you might say, infinitesimal. It is not practical for the average small or crossroads feed dealer.

CHAIRMAN CARPENTER: Can it be said that generally all sick birds of a given age and breed superficially look alike?

DR. BETHKE: I don't understand—
CHAIRMAN CARPENTER: To a farmer, his birds appear sick. Maybe they are not growing well; maybe there is an actual mortality. He does not know if it is a nutritional disease or an infectious disease. The question is, do all sick birds look alike from a farmer's point of view?

DR. BETHKE: In most respects my answer to that question would be "Yes."

CHAIRMAN CARPENTER: Finally, Dr. Bethke, since it is highly important to the flock owner and the veterinarian both, when witnessing sick birds, to know if an infection is present or if they are sick because some essential vitamin was omitted from the ration or present in inadequate amounts, does it not seem that the veterinary profession needs to be as well informed on nutritional diseases as they are on those caused by some infectious agency?

DR. BETHKE: My answer to that question would be very definitely "Yes."

CHAIRMAN CARPENTER: Thank you very much, Dr. Bethke, for the information you have brought us this morning. We have some other questions to ask you, sandwiched in with those remaining.

Are there questions on nutritional diseases that you would like to ask either from the Board or from the floor?

DR. McCULLOCH: I would like to ask what possibility there is in these vitamins being destroyed in feed stores?

DR. BETHKE: There is evidence that some of the vitamins are lost or destroyed during storage, vitamin A in particular. As far as vitamin D is concerned, it is relatively stable. Vitamin G or riboflavin is also relatively stable. The one to pay particular attention to, of course, is Vitamin A. We also know that vitamin E, which presumably is required by birds, will also be destroyed in storage.

CHAIRMAN CARPENTER: I would like to have more of you ask questions from the floor.

DR. McCULLOCH: I would like to ask a question regarding the calcium-phosphorus ratio that is most satisfactory?

DR. BETHKE: The question is asked, "What is the most favorable calcium to phosphorus ratio in a chick ration?"

I would say somewhere in the neighborhood of from 1½ to 2 times as much calcium as there is phosphorus present.

CHAIRMAN CARPENTER: Is that the complete ration or the mash ration, on the basis of half grain and half mash for layers?

DR. BETHKE: I would say that particular ratio would primarily apply to the mash that is consumed by the chicks. For laying birds, I think we should approach a ratio of, roughly, somewhere around 2 or 3 times as much calcium as there is phosphorus present, and in addition, give the
birds access to some other calcium supplement, such as oyster shells, and things of that type.

CHAIRMAN CARPENTER: Are there any further questions on nutrition? Hearing none, our program shows that there appears a paper by the title of "Eradication of Pullorum Disease from Turkey Flocks," by Doctors W. R. Hinshaw and E. McNeil, of the University of California. I want to say that this paper will be printed in its entirety in the proceedings, but to get it before you, rather than to read it, I shall ask Dr. Hinshaw the following questions:

What are the main sources of infection of pullorum disease in turkeys?

DR. HINSHAW: The main source of pullorum disease in turkeys has changed in the past ten years. This disease was introduced into turkeys by chickens. It was not known until 1928, when Hewitt reported the disease from turkeys in Minnesota. All the outbreaks that we have records on, up to 1935, were transmitted to turkeys by chickens, either in the incubator or by the brooding process. Since that time, however, this disease has become established in turkeys, and although chickens are a very important means of transmitting it at the present time, the disease is established in turkeys, and it has the same life cycle as it does in chickens.

CHAIRMAN CARPENTER: Do turkeys become carriers of pullorum disease as readily as chickens?

DR. HINSHAW: Apparently they do. At least, now that the disease has become established, we have the same situation existing. We have the carrier problem exactly as we have it in chickens.

CHAIRMAN CARPENTER: May the same antigen be used in testing turkeys as that used for testing chickens?

DR. HINSHAW: The organism is identical to that found in chickens; therefore the antigen can be made with identical strains.

CHAIRMAN CARPENTER: I take it from what you say that perhaps in the plate method or the whole blood method the same is not true?

DR. HINSHAW: We have found in our experimental work that the whole blood test for turkeys is approximately 50 per cent as efficient as it is for chickens, for detecting carriers which yield Salmonella pullorum on autopsy and bacteriological examination.

CHAIRMAN CARPENTER: What percentage figure would you care to use on the tube method?

DR. HINSHAW: On the tube method, I would say it is of identical efficiency as with chickens.

CHAIRMAN CARPENTER: In an infected brood, is the mortality rate in turkeys as high as it is in baby chicks?

DR. HINSHAW: To quote some figures we have, the average mortality in 56 outbreaks involving 44,000 poults was 41 per cent. I think in general
we can say that the mortality is about the same as it is in chickens. It varies from 5 or 6 per cent up to 100 per cent, depending upon the factors that Dr. Stafseth has described to you earlier today, as affecting mortality in chickens.

CHAIRMAN CARPENTER: Are the general preventive procedures the same in turkey poult's as for chickens?

DR. HINSHAW: I would say they are identical.

CHAIRMAN CARPENTER: I don't know whether this next question is entirely aimed at turkeys or not. Do you believe in having a pullorum tested class?

DR. HINSHAW: I will only answer in connection with turkeys. I won't get into controversy on the matter. As far as turkeys are concerned, we do not believe that any such class as a pullorum tested class should be tolerated, if and when the National Poultry Improvement Plan goes into effect for turkeys. This is based on our past two years' work, the results of which are reported in the paper which is to be printed in the proceedings. To me a certificate issued on the basis of a test with reactors removed is only a certificate that infection exists in the flock.

CHAIRMAN CARPENTER: There has been a request for Dr. Stafseth to comment upon pullorum disease with regard to insanitation on the premises.

DR. STAFSETH: I am beating this fellow to the punch. He threatened to ask me, so I am going to answer him before he has a chance. (Laughter).

In a recent bulletin published in Nebraska there are some statements concerning the spread of pullorum disease. I think most of you who read it will get the impression that pullorum disease is not contagious in the sense that it is spread by insalubrious environment.

A few years ago Cornell or Kentucky set up pens with reactors and non-reactors, keeping these birds together and watching for any evidence of spread—I have forgotten which it was, either Kentucky or Cornell got transmission, or it was the other way around. Dr. Van Es came along and did the same thing. He set up a pen which contained some reactors and non-reactors, and he didn't get transmission, and hence he got the idea that the disease does not spread by contact.

There is a fundamental error in the setup of these experiments. The mere placing of a few reactors with non-reactors, is insufficient because there may be no open cases, hence, no transmission by contact.

We know that there are some birds which have the germs in their intestines, and pass them with their droppings. If such birds were picked on purpose—which I admit is a difficult thing to do because you have to examine a large number of birds to find open carriers—I am willing to bet my brand new hat that you will get transmission of pullorum disease as a result of insalubrious environment.
CHAIRMAN CARPENTER: Perhaps Dr. Hurt or Dr. Hinshaw, of California, would like to make a quick comparison between the insalubrity of the climate of Nebraska versus the insalubrity of those of another state. (Laughter).

DR. DURANT: Mr. Chairman, I would like to ask Dr. Hinshaw if he took some of the germs that he isolated from the ovaries of turkeys, and inoculated day-old chicks, and reproduced typical pullorum disease?

DR. HINSHAW: The question asked is whether or not we have transmitted pullorum disease to chicks with organisms isolated from turkeys. My answer is, "Yes," with typical symptoms and typical pathology.

DR. GOLDHAFT: Doctor, if a poultryman reports his first outbreak of laryngotracheitis of his poultry flock, and he does not understand how the infection was brought on the premises, can a veterinarian recommend a practical and economic test that the infection may be present in the old stock, and that they may be the carriers transmitting the infection to the new population, to guide his procedure the following year?

DR. BEAUDETTE: I am not sure that I understand the question. I believe it is this: When an outbreak has taken place in a flock, and the poultryman has no idea as to how it got in, might the source of infection be the adult stock, and if so, could the veterinarian establish this?

If you recall, I discussed this very question in another manner. I pointed out that the opinion is too prevalent that for the diagnosis of laryngotracheitis one must have blood in the windpipe. I pointed out that those cases are probably in the minority, that in many outbreaks of laryngotracheitis it is a question of a disease of the eye, or a running nostril or even caseous material in the windpipe, and these cases escape diagnosis as laryngotracheitis.

I stated it can be established as laryngotracheitis by demonstrating the presence of the virus or by another test. This latter one is the one the veterinarian can use to establish the disease. It is only necessary to vaccinate an adult bird and take a reading on the fifth day. If the "take" is present, the bird has never had the disease. If the "take" is not present, it establishes that the bird has had the disease. It might have been 3, 5, 7 or even 10 years ago that the bird had the disease, but immunity is still there.

CHAIRMAN CARPENTER: Thank you, Dr. Beaudette. The subject of fowl pox needs very little discussion by this group. I shall ask if there are any questions on fowl pox immunization by use of either chicken strain or pigeon strain, fowl pox vaccines. Are there any questions?

DR. FOGLE: To what extent are we justified in using this chick embryo pigeon strain in the summer time to get immunity the following winter? That question has come up. For years and years some country veterinarians have been using a goodly amount of the chicken strain. One manufacturer in particular quit producing the chicken strain.

CHAIRMAN CARPENTER: Dr. Beaudette, will you explain it?
DR. BEAUDETTE: As I get the question, it is one of the relative merits of—

DR. FOGLE: How much can be promised in the way of immunity in the pigeon strain?

DR. BEAUDETTE: Oh, pigeon strain! I don't believe it is a question of whether egg propagated virus gives as much immunity as scabs propagated on the breast of a pigeon, because there should be no difference. The immunity provoked by egg propagated virus should be just as strong, if not stronger, and certainly as solid as that produced by the other virus. If it is a question of the relative merits of the two vaccines, that is another question, and I think it should be discussed here.

We have had criticism from the field on the use of pigeon virus. It is maintained that this does not give as strong immunity as fowl virus, and this we concede in a measure. But a good many of the seeming failures of pigeon pox virus to immunize have not been due to the fault of the vaccine. It is very often due to the method of application.

In the first place, a pigeon virus must be applied by the feather follicle method, and birds must be well feathered, because this virus has a particular affinity for the type of cell that is found in the feather follicle. Again, a large number of feather follicles must be painted, and the virus must be applied in the right direction, that is, against the feather follicle openings. Very often it is painted on in the opposite direction, and the first stroke merely closes the follicle, and subsequent strokes do not affect the follicles themselves.

We had one case of a poultryman doing his own vaccinating and complaining that after he got through he had no immunity. A careful inquiry developed the fact that he found one of the bottles dried up and he threw it away, and used the other. In reality he threw the virus away and painted the chickens with glycerin. (Laughter).

For successful vaccination against pigeon pox, it requires, first a liberal application of virus, and I think most commercial laboratories put up an insufficient quantity of virus for 100 birds. I would rather put 100 doses on 50 birds.

Secondly, it must be applied by the brush and not by the stick method. Thirdly, the bristles of the brush must be directed into the feather follicles and not with them. In the fourth place, the birds should be well feathered so that there are openings to the feather follicles.

I think it might be well to discuss this question of the use of pigeon pox and fowl pox.

CHAIRMAN CARPENTER: If it can be done briefly, yes.

DR. BEAUDETTE: Pigeon pox should be used only under certain conditions. When flocks are laying and develop pox, an emergency vaccination is necessary; and then we are forced to use pigeon pox. The other condition is in those flocks in which blackhead is known to exist, because
if we put fowl strain pox vaccine on flocks that carry blackhead parasites, they will die of blackhead. When this is once discovered in a flock, subsequent vaccinations should be made with the pigeon virus and not the fowl strain.

CHAIRMAN CARPENTER: We have discussed coryza in relation to chick bronchitis and laryngotracheitis rather thoroughly, so instead of taking the group of questions which we have here, I will ask for questions on infectious colds, or coryza. Are there any such questions? We must begin to watch our time now.

Dr. Hinshaw has done quite a sizable piece of work with a turkey disease on the West Coast, which has since been reported from other areas of the country, and this disease, I believe, he has tentatively named “infectious catarrhal enteritis.” Along with that disease there is another parasite which has received a lot of attention, called trichomonads, or the disease, if it be a disease, as trichomoniasis. I will ask him to tell us what he has to offer on these two at the same time.

DR. HINSHAW: Dr. Beaudette suggests, first of all, that we ought to have a discussion on the appropriateness of the name; I agree with him.

CHAIRMAN CARPENTER: May we leave that to the committee, to save time? (Laughter).

DR. HINSHAW: Dr. Carpenter is taking me seriously.

This disease, which we have called infectious catarrhal enteritis, subject to reclassification by the committee, is caused by a protozoan parasite belonging to the genus Hexamita.

As the name indicates, it is infectious catarrhal enteritis, found principally in poults under ten weeks of age, and causing the greatest mortality from one week of age up to four or five weeks of age. It is characterized principally by the lack of tone in the intestines, and the appearance of very thin, watery contents. If any diarrhea is noted at all, it is of a foamy, watery nature.

The disease is one of the lower digestive tract rather than the upper. It is principally confined to the ileum and the jejunum, and in severe cases to the duodenum. In the acute outbreaks the causative parasite is found throughout the intestines, in large numbers, especially in the ileum and jejunum.

Many people, including myself, considered this disease for years to be caused by one of the two species of trichomonads which we find in the lower digestive tract of turkeys. These two species of trichomonads (T. eberthi and T. gallinarum) are the same as found in chickens and were described many years ago. We should not confuse these two species with the one lately called by some investigators as Trichomonas gallinace, which is only found in the upper digestive tract. We have mistakenly considered this disease caused by these trichomonads. We recognize the trichomoniasis in the upper digestive tract, but we do not recognize trichomoniasis in the lower digestive tract. We base this on the fact that we have been able to
incorporate millions of trichomonads into susceptible poults, without ever being able to reproduce the disease. It is only when we have introduced Hexamita along with the trichomonads, that we have been able to produce the disease.

This has been diagnosed by myself in two outbreaks in Utah and Dr. Madsen has diagnosed other outbreaks in that state. I know it has been diagnosed in Washington and Oregon, and in talking to some of the men at this convention, it apparently has been diagnosed definitely in other states.

The thing I want to impress upon you is that as far as our work is concerned, we do believe there is a disease known as intestinal trichomoniasis. It is certainly not caused by the two species of Trichomonas we are working with in California.

CHAIRMAN CARPENTER: Give the clinical differential diagnostic symptoms of blackhead, trichomoniasis and hexamitiasis.

DR. HINSHAW: As stated above we do not believe there is such a disease as intestinal trichomoniasis. Blackhead is so characteristic that I do not need to give any differential characteristics.

CHAIRMAN CARPENTER: I think Dr. Hinshaw will be very glad, after the meeting is adjourned, to discuss this with anyone who may be interested in it.

I understand, Dr. Durant, you have diagnosed hexamitiasis in Missouri, and there is an indication that it may be already present in the East in other states, and in the Midwest. This is a very serious economic disease when it is met with in poultry and turkey flocks.

DR. DURANT: May I say just one word about that? I know this audience is not supposed to contribute anything, because we have this array of authorities on the platform to discuss all these questions. However, I would like to say that in Missouri we recognize two diseases, intestinal trichomoniasis and hexamita infection. The trichomoniasis kills the birds at about three weeks of age, and is a very definite infection of the upper intestinal tract.

CHAIRMAN CARPENTER: I think we are going to hear more from Dr. Durant in literature on this. It does show you that we are making progress in research and practical application in research in chicken and turkey diseases.

We are down to our last subject, fowl paralysis. I notice Dr. Carl Brandly in the room, the Senior Pathologist at the United States Regional Poultry Laboratory, East Lansing, Michigan. He wrote me he would not be able to be here, but since he is present, I am certain the Board will not mind if we direct our questions to Dr. Brandly. If he will come to the platform at this time we will appreciate it.

Dr. Brandly, I want to say to the group that fowl paralysis still is the senior adult disease from the standpoint of the poultryman's pocketbook. Great work is being done by these investigators at East Lansing. It may be a five or ten year program, and may be comparable to the report which
was issued yesterday by Dr. Mohler on the success of calfhood vaccina-
tion, but certainly fine progress is being made, so I shall direct two or 
three questions to you.

What is the modern concept of the fowl paralysis complex?

DR. BRANDLY: Before I answer that, I want to register an objection— 
in fact, several objections. I was taught early in life that remarks from 
the gallery weren't appreciated.

CHAIRMAN CARPENTER: You are not in the gallery now.

DR. BRANDLY: I came to listen and not to talk. I think there are 
others here who can answer these questions better than I can. However, 
since we have a second Clifton Fadiman here, there isn't much I can do 
about it. (Laughter).

The fact that the disease is referred to as the fowl paralysis complex or 
the avian lukosis complex shows that there may be a considerable con-
fusion as to nature and relationships of the disease in its various expres-
sions and manifestations. The fact that some feel it is neoplastic in nature 
does not imply that it is not infectious, for the reason that we have other 
diseases, including the fowl tumors, (Rous sarcoma, Fujinama tumor, etc.) 
which are infectious in the sense that they may be transmitted by filtrates 
or virus-like agents.

While the disease does not seem to be due to bad nutrition, it is not 
caused by worms or other parasites, although they may provide a channel 
of entry for the disease; also, as far as we know, the claim that bacteria or 
their products, atmospheric or other environmental conditions may initiate 
the disease, has not been substantiated.

CHAIRMAN CARPENTER: Stepping to our last question, doctor, 
what control measures, if any, are we able to give the breeder of poultry. 
based on breeding from immune or resistant stock?

DR. BRANDLY: Eight or nine years ago Bieley and Palmer suggested 
that inheritance factors had a considerable bearing on resistance and 
susceptibility to so-called fowl paralysis, and the possibility of breeding for 
resistance has been approached. There are some who suggest that the 
practice of breeding from survivors of the avian leukosis complex has 
been followed with considerable success by some poultrymen, although this 
has not been entirely substantiated by experimental work.

CHAIRMAN CARPENTER: Thank you, Dr. Brandly, for your con-
tribution. Are they any questions on fowl paralysis? We have just two 
minutes.

First, I want to thank the Board for their contributions to this program. 
Our auditors shall be the judges as to its significance, and whether or not 
this is a method of getting before the veterinary public the factors that are 
puzzling and troubling both the scientific worker and the worker in the 
veterinary field with poultry disease problems.
We think we are making progress. It won't be done overnight. Control of poultry diseases by the veterinarian must be brought about by a combination of more training in our veterinary colleges so that our boys are capable of doing a general practice job, including poultry, and also a refreshing of those of us who have been in the field five, ten, or twenty years, so that we may keep abreast of modern findings as they apply to the problems of practice. By cooperation and collaboration of state and national veterinary medical associations this can be done. Finally, we need the best possible type of cooperative effort by the leaders in this industry; this, I feel, is assured.

The poultry industry is so well organized as an industry, through various groups, from the baby chick end of the business to the egg producing end, and on into turkey production, in which there has been recently set up the National Federation of Turkey Growers, that consequently as veterinarians in the field, whether we be in practice or whether we be in regulatory work, we must follow research findings, and go along with the utilization of this knowledge. We must seek this information and put it into practice in the field.

In the final analysis, control of poultry diseases is a veterinary problem, and no one is more anxious to see that brought to its fullest realization than is the poultry industry.

Speaking for the Poultry Committee, we wish to thank you for your excellent attention. We appreciate your attendance, and we appreciate the time and the opportunity we have had to present this type of program today. As a final word may I again say that if the Executive Committee of this association sees fit to approve our recommendation contained in our report, a complete and separate pamphlet containing this discussion of the morning will be made available probably through institutions and organizations who are interested, at a very nominal price to cover the cost of handling, mailing and printing.

Thank you very much. (Applause).

ERADICATION OF PULLORUM DISEASE FROM TURKEY FLOCKS

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Davis

Introduction

The problem of eradication of pullorum disease from turkey flocks confronts the livestock disease control agencies of many states. This disease, first reported in turkeys in 1928 by Hewitt (1), has now become a major cause of mortality in many turkey growing areas. Until about 1935, it was primarily confined to broods of poults that had in some manner contracted the infection from chickens; and all of the references to
outbreaks previous to 1936 gave evidence that the disease was not established in turkey flocks, but transmitted in commercial hatcheries doing both a chicken and turkey egg hatching business, or in brooding chicks and poults together. Brunett (2), however, as early as 1930 reported the isolation of *Salmonella pullorum* from the ovary of an adult turkey and suggested the possible transmission through the egg. Hinshaw (3) in 1933 reported the isolation of *S. pullorum* from the ovary of a reacting hen turkey and from the testis of a reacting male. Johnson and Anderson (4) in 1936 were the first to show definite evidence of transmission to poults from adult turkey carriers. Hinshaw (5) in 1937 reported the isolation of *S. pullorum* from 5 out of 945 eggs laid by carriers which were survivors of outbreaks contracted by contact with infected chicks in incubators. Until 1935 there were no cases of pullorum disease in turkeys in California that could be traced directly to turkey carrier transmission. Since then the disease has become widespread in turkey flocks and there is now ample evidence that the disease in turkeys has the same cycle of infection as in chickens, Hinshaw (6). Previous to 1937 an intensive campaign was made to get California turkey growers to realize the danger of hatching turkey eggs in incubators with chicken eggs, and in brooding chicks in close proximity to turkey poults. This preventive program had the effect of prolonging the time before the disease became established in turkey flocks, but, as in most disease prevention programs, it was impossible to get the full cooperation of all agencies involved; and for the past few years there has been an increasing incidence of infected turkey flocks, until now the problem of eradication is an acute one.

It is especially important that California growers eradicate the disease from their flocks, because of the large volume of turkey hatching eggs that are shipped from this state. It was with a realization of this fact that the manager of the Ramona Turkey Growers’ Association appealed to the University of California in the spring of 1939 for aid in developing a program of eradication.

The Ramona Turkey Growers’ Association is made up of growers living within a 50-mile radius of Ramona in San Diego County. This area, located only a few miles from the Mexican border, has a sub-tropical climate favoring early egg production in turkey flocks, and turkey eggs are hatched almost every month in the year. In 1939-40 the 80 members of the association had approximately 22,000 breeder hens from which 600,000 hatching eggs were sold to midwestern and eastern hatcherymen. During the season which begins as early as September in this area, all eggs are collected and brought to the main office at Ramona. Here they are candled, graded, and packed for shipment. The size of flocks is governed by the by-laws of the Association, and ranges from 100 to 1,000 breeder hens. Since all eggs are pooled for shipment, one can realize the dangers involved if even one flock is infected.

It developed during our first year’s work that 3 or 4 large flocks had been responsible for losses which cost the Association several hundred dollars in replacements, and for half of the 80 ranches becoming infected by use of pooled eggs in the 1938-39 season.
As a result of the manager’s request, the university entered into a cooperative project with the Association to ascertain whether it is possible to eradicate pullorum disease from turkey flocks, and to obtain information pertinent to the problem. This Association is typical of many California groups, and it was felt that if the disease could be eradicated from its flocks it would be possible to duplicate the results elsewhere.

The purpose of this paper is to describe and report progress on this eradication project, which is now in its second year of operation.

The Program

The program for testing and inspection of flocks was patterned after the National Poultry Improvement Plan (7) for the U. S. Pullorum Passed Grade. It was understood by the members from the beginning that this program was to be unofficial as far as any regulatory organization was concerned, and that its purpose was to eradicate pullorum disease and that it was not a sales promotion scheme. The program as inaugurated July 1, 1939, and accepted by the board of directors of the Association is reproduced below.

RAMONA TURKEY GROWERS' ASSOCIATION PULLORUM DISEASE ERADICATION PROGRAM

In cooperation with the University of California, the Ramona Turkey Growers' Association has developed the following plan for elimination of pullorum disease from its flocks.

The Pullorum Disease Control and Eradication Program of the National Poultry Improvement Plan (U. S. D. A. Miscellaneous Publication, No. 300, Jan., 1940) has been used as a guide in developing the program.

This program is sponsored entirely by the association and although patterned after the National Poultry Improvement Plan is not operating under it. The term “Association Pullorum Passed” is a newly coined term to define the status of flocks that have the equivalent (but unofficial) status of the U. S. Pullorum Passed grade.

The following rules and regulations will govern the operation of the plan.

1. In order to qualify as an Associated Pullorum Passed Flock, the testing of birds for carriers shall be done by a State Department of Agriculture laboratory. The standard tube agglutination test, using a 1-25 dilution, shall be used for culling reactor birds from the flocks.

2. All turkey flocks to be used for the production of hatching eggs shall be tested and retested until one negative test has been obtained.

3. No eggs will be accepted from a flock until it has received one negative test.

4. Upon receipt of the laboratory report, all reactors must be immediately removed from the flock by the grower and disposed of under the direction of the inspector.
5. Cleaning and disinfection after the removal of the reactors shall be applied at the discretion of the inspector.

6. All breeders shall be kept isolated from the other birds on the premises. No untested fowl shall be kept on the premises after they start laying eggs. This applies to all fowl. If the chickens or other fowl are kept on the premises for the production of hatching eggs or market eggs they must be of the same pullorum disease tested status as the turkeys.

7. No association eggs for replacement shall be hatched by any hatcheryman who accepts eggs from any other fowl (chickens, guineas, ducks, quail, etc.) from flocks other than those having an equal pullorum disease status.

8. No eggs, poult or breeding stock shall be purchased or introduced into association flocks without approval of the inspector.

9. The association will not accept eggs or poult from growers, groups of growers, or associations either for sale to customers or for the use of members unless they come from flocks of equal status.

10. The National Poultry Improvement Plan shall be used as a guide to determine management and application of measures not included in this report.

11. This program is to be used only until the State Department of Agriculture Official Program is extended to the Ramona area, and accepted by the association.

Procedure

The blood samples are collected by a crew of 3 men employed by the association, but under our supervision. Mr. A. P. Holly, Jr., an American Poultry Association Judge and Certified Flock Inspector, is in charge of this bleeding crew, and at the time the blood samples are collected he grades the birds and selects the breeders. He also acts as the Official Association Inspector, and cooperates with us in inspection of ranches throughout the season. The agglutination tests are made by the San Diego Poultry Diagnostic Laboratory which is supported by San Diego County Poultry and Turkey Growers in cooperation with the State Department of Agriculture and is under the direction of Dr. P. D. DeLay. The cost of testing has been assumed by the association except for some experimental retests, for which the university has paid. Complete supervision of the program, including cooperative work with the laboratory, and all field work has been assumed by the university. Headquarters have been maintained at San Diego laboratory.

The testing was started in July, 1939. Since many ranches had turkeys which had been hatched as early as the previous November, and were already laying, the problem of clearing infected flocks was more acute than had been anticipated. It is the custom of this community to have several age groups during each season, and 50% of the 80 ranches were found to have at least one infected age group after the first test. As soon as it was determined that it would be impossible for all the members to
conform with the program for the 1939-40 season, a substitute plan for infected ranches was adopted. Under this plan, all infected groups of birds had to be tested once each month throughout the hatching season, or until a negative test was obtained. Some growers tested as many as eight times under this revised plan. As in most turkey growing areas last year, a surplus of eggs was obtained, and this surplus was sold for food purposes. This condition aided our program because we were able to divert a large percentage of the eggs from infected flocks to this trade. Growers were also encouraged to sell badly infected pens of birds as a means of eliminating infected eggs.

Another part of the program and probably the most important one was the adoption of a plan for owners of infected flocks to buy replacements for 1940 from flocks free on the first test. To further promote this phase of the project, two hatcheries agreed to accept only eggs from free flocks.

During the present season it has been possible to test most of the flocks as they reach an age of 4 months, and this has enabled us to get several tests made before the birds start to lay if reactors were found on the first test. Such progress has been made that the association is able this year to conform to the program. In other words, all flocks will have an equivalent, but unofficial, status to the U. S. Pullorum Passed grade.

Frequent ranch visits have been made, and a thorough inspection service has been in effect. The number of visits made to an individual ranch has varied with the conditions on the ranch and the status of the flock. The cooperating hatcheries have been inspected at frequent intervals, and have been furnished lists of growers approved by the association for eggs for local replacements. Frequent conferences have been held with member groups and with the board of directors to stimulate interest in eradication, and to answer questions about the program. One of the most acute problems that we had to contend with during the first year, was the misinformation on the “pro’s and con’s” of eradication given to growers by unqualified persons. In many instances these propagandists were persons who, because of business reasons, were not in sympathy with the program. Our educational program of 1939 plus the progress made, has eliminated most of these difficulties.

Autopsy of reactors, and bacteriological examinations of these, constituted another part of the program. Arrangements were made with a Ramona killing establishment to purchase drawn birds, and for use of the killing plant for eviscerating reactors. Special attention was given to low titer reactors in flocks whose histories indicated freedom from the disease. Tissues for bacteriological examination were either put into enrichment media or packed in powdered borax and shipped to Davis for final study.

An important phase of the inspection service has included the obtaining of complete hatching and mortality records, together with laboratory diagnoses of causes of mortality. The hatching records of every lot of poults used for replacements have been secured from the hatcheries. These records have included lists of the exact sources of eggs, the date of
hatching and the records of all other eggs hatching at the same time. Frequent visits were made to the ranches during the past brooding season, and large numbers of poults were taken to the laboratory for autopsy. Poults were secured for autopsy regardless of the amount of mortality, and during the brooding season 76 of the 80 growers received diagnostic service at the San Diego laboratory. By this method we were able to foresee infected flocks, and to advise elimination of infected broods as an aid towards the 1940 program.

As might be expected we did not get complete cooperation of all parties concerned, and as will be brought out in the discussion, this lack of cooperation accounts for the few 1940 failures to have flocks free on first test.

Comparison of the Testing Results for 1939-40 with Those of 1940-41

When the 80 flocks (28,810 birds) had been tested once in the 1939-40 season, half of them (8,718 birds) were free from pullorum disease. This year, 58 flocks which were on last year’s program have been tested, and 47 were free on first test. There were 17,181 birds in these 47 free flocks while in the 11 infected flocks there were 3,948 birds. Thus 81.03% of the flocks and 81.2% of the turkeys were free on first test. This is in contrast to 50% of the flocks and 30% of the turkeys free on first test in 1939-40. The fact that 21 of the 47 free on first test flocks of the present season were reared on premises where infection existed last year is further evidence of the success of the program. At the end of the 1939-40 season there were 24,354 turkeys remaining after culling reactors, selling infected pens and mortality. Of this number, 16,623 or 68% were free, as a result of the testing program. These were in 64 flocks or 80% of the total number.

The association is starting its 1940 egg season with all the flocks free from pullorum disease. This has been accomplished by retesting flocks until free and by sale of infected flocks. Table I summarizes the results of testing and gives the status of flocks at the beginning and end of the 1939-40 season. The total number of tests made was 67,522, and the total number of reactors removed was 2,257. Table II presents a comparison of the results for the two seasons.

A Study of the Infected Ranches of 1939-40

As mentioned above, there were 80 flocks tested in 1939-40, and 40 of these had one or more infected groups on the premises while the other 40 had all groups free on first test. Our problem for 1939-40 was therefore concerned with the 40 infected ranches. Since it is the custom in the community for some growers to have several age groups during the season, and for these groups to come from different egg sources, they do not all have the same chance of exposure to the disease. We have good evidence that the majority of losses on the 40 infected ranches in 1939 were the result of purchase of eggs from 3 ranches.
On the 40 infected ranches, there were 104 age groups, of which 64 were infected and 40 were negative on first test. In these 104 age groups there were 20,092 birds, of which 14,376 (71.5%) were in infected groups and 5,716 (28.5%) were in non-infected groups. The non-infected groups were reared concurrently with, but segregated from the infected groups and did not pick up the infection during the entire season as shown by retests of several of them during the breeding season. This is evidence that there is little danger of transmission from pen to pen if segregation and sanitation are practiced.

There were 850 reactors (5.2%) in the 64 infected groups on the first test. Calculated on the basis of the total 20,092 turkeys on the 40 infected ranches, the average percentage of reactors was 4.2 on the first test. Calculated on the basis of the 28,810 birds tested on the 80 ranches the average was 2.9%. A summary of the range of percentage of reactors found on first test in the infected groups is given in Table III. This varied from 0.77 to 63.4%. The latter was in a group of 41 turkeys. The data in this table represent the true status of the percentage infection in groups known to have suffered from pullorum disease. It will be noted that 56.3% of the 64 infected groups had less than 5% reactors on first test, and that 78.2% of these groups had under 10%. Twenty-four of the 40 infected flocks were cleared by retest or by culling infected pens or by both. From two to seven tests were necessary to accomplish these results. Of the 24, ten were free after two tests; one after three tests; three after four tests; five after five tests; one after six tests, and two after seven tests. Two flocks were cleared by selling infected pens after the first test and then finding the remaining groups negative.

Classified according to the percentage of reactors in the total number of birds tested on the 24 ranches (9,394 birds) which cleared by retest, 21 (8,359 birds) had at the first test more than 2% reactors with an average of 4.03, and 3 (1,035 birds) had less than 2% with an average of 0.87. These ranches were cleared of reactors by a combination of procedures, selected after a survey of each case and by frequent consultation with the owner. Repeated testing of infected pens, and the selling of infected pens, together with the practice of a sound sanitary program were the two important methods. Whenever the history indicated that younger age groups than the infected groups would be free on test, the owner was advised to sell the infected pens before testing the younger groups. By such a procedure several flocks were given a negative test. In other instances where only one group was maintained, the birds were divided into small pens, preferably 10 days to 2 weeks before testing. If reactors were found in some pens and not in others, the owner was advised to sell the infected pens and retest the non-reacting pens again in a month. This plan has worked better than any other.

A total of 16 flocks (10,698 birds at time of first test), still had one or more groups of birds with reactors at the end of the 1939-40 season. There were 32 age groups on these 16 ranches, 11 (34.4%) of which were free on first test. At the time of the first test the average percentage of reactors was 4.7. At the end of the season the average was 1.9%. The
ERADICATION OF PULLORUM DISEASE

A study of the 1940-41 program

The real test of the success of this type of a program is the results obtained with the progeny. The fact that 600,000 hatching eggs were sold to out-of-state buyers without a single complaint of losses from pullorum disease is the best indication of the program's success. Just as important is the fact that there were no local outbreaks of pullorum disease where eggs from flocks negative on first test or by retest were used for replacements, and hatched in incubators containing only eggs of like status. With very few exceptions, we were successful in our attempts to get flock owners to buy eggs for replacements from growers free on original test and to have them hatched in hatcheries using only eggs of like status. These exceptions account for the small percentage of failures in our 1940-41 program.

In 1939-40, flocks on 80 ranches were tested and 40 of these were found to be infected by the first test. In 1940-41, 58 ranches* have been com-

* The difference between the 58 and 80 growers is accounted for by the fact that a few have resigned and the rest are no longer keeping turkey breeders.
pleted and 47 or 81% of them have had no reactors on the original test. Of these 47 free flocks, 21 were reared on premises which were infected in 1939. In no instance have we had any indication that poults from known free sources brought on premises where infection existed in adult stock are likely to become infected if even ordinary precautions are taken.

Of the 11 flocks which had infected birds when tested in 1940, 3 were negative and 8 positive in 1939. As stated above, the reasons for infections in these flocks are known, and lack of cooperation on someone’s part was responsible in each case. Non-cooperation of hatcheries was responsible for 6 of the 11 outbreaks; one was the result of purchase of outside eggs from an infected flock; 3 were due to using eggs from flocks not negative to the test but showing a low percentage of reactors; and one from a combination of purchase of eggs from an infected flock and having them hatched in a questionable hatchery. In five of the cases the purchasers of the poults were in no way to blame for the losses experienced.

In order to conform with the program, 5 of the 11 ranch owners have sold their flocks, and will either buy breeders from free on first test sources, or will not keep breeders this year. Two more have sold their infected pens and are keeping only the groups of birds that were free on first test. Four have their flocks free by retest. Therefore, all the flocks in the association’s program have conformed to the ruling that all mature turkeys on the premises must be negative to the test in order to qualify as a producing flock for this season.

Eleven of the 24 growers who had their flocks cleared by retesting and culling infected groups in the 1939-40 program used their own eggs for one or more groups of poults for the 1940 replacements. Ten had no losses from pullorum disease, and their entire flocks were negative on first test. One of the eleven had severe early mortality from the disease. This grower against our recommendations had the eggs hatched in a hatchery which accepted all grades of both chicken and turkey eggs, and the hatchery is suspected as the source of this outbreak.

In 1939-40, 28,810 birds were tested in 80 flocks and 850 or 2.9% reactors were found on the first test. In 1940, 21,129 birds in 58 flocks were tested and 152 reactors or 0.7% were removed by the first test. There were 3,948 birds in the 11 infected flocks of 1940. These 11 ranches include one which had a total of 882 birds with 8 reactors in a single group of 184 birds. All the remaining groups were free on first test. The infected group was hatched in a hatchery where it is known that pullorum disease existed.

A second flock consisted of 739 birds, which was composed of two age groups. One of these comprising 196 birds was free on first test. The 543 birds in the infected group had 16 reactors (2.9%) on the first test. Both of these groups were hatched from his own eggs. When last tested in 1939-40, the flock had only one reactor out of 363 birds (0.2%). The eggs for both lots were laid after the last test.
A third flock consisted of 324 turkeys of two age groups with a total of 27 reactors (8.3%). Both of these groups were hatched from pooled eggs containing a few secured from three flocks which had been tested from two to three times, and which on the last test, showed less than 1% reactors. This entire flock was sold, and the owner is not keeping any turkey breeders for the association this year. This, and the previous case are examples of the fallacy of considering a flock safe until at least one negative agglutination test is obtained.

A fourth flock consisting of 294 birds had 6 reactors on first test. This man had purchased 40 eggs from an outside grower on the verbal assurance that his birds were free from pullorum disease. The laboratory testing records showed that this flock had not had a negative report.

Another flock of 599 turkeys had 12 reactors on the first test. This man has always used November and December eggs. Since in 1939-40 all flocks were not free at that time, and since he insisted on using pooled eggs, it is not surprising that his flock was infected. His was a particularly difficult problem since some birds were laying before testing began this season. Sanitation on his place was also poor. His flock when finally free consisted of 231 birds. Sixty-three reactors had been removed and heavily infected pens sold.

Another grower bought outside eggs and had them hatched in a hatchery which accepts all grades of chicken and turkey eggs. On first test he had 49 reactors out of 310 birds. At that time we advised him to sell his flock. He made one more test, however, at which time he had 90 reactors out of 304 turkeys, so sold his entire flock. A few birds were laying at the time of the first test, and this grower was away all day and could not prevent egg eating. Other sanitary conditions were only fair.

The remaining five flocks are definite examples of incubator transmission.

**Incidence of Male and Female Reactors**

Data on the distribution of male and female reactors in a group of 49,890 tests made in 1939-40 is given in Table IV. There were 4,131 males with 73 (1.77%) reactors and 45,759 females with 1,938 (4.23%) reactors in the 8 tests made. These data indicate that the problem of eradicating the disease in males is not as great as in females. The number of males is, however, small in comparison to females, but in most instances they were (after the first test) in the same pens and equally exposed to infection. The first tests include some made on the flocks found to be free on first test and this accounts for the drop in numbers between the first and second test, and also partly accounts for the increase in percentage of reaction between these two tests. In a few cases, males from pens free on first test were added to pens of females infected on first test, and after a month a few of these males reacted as a result of this exposure. One reason for the lowered incidence in males on retest is the fact that few males become egg eaters, a common means of infection in adult females.
Discussion

When the cooperative arrangement was made with the Ramona Turkey Growers' Association it was recognized that the educational phase of the program would be very important. Previous to 1937 no losses from the disease had been experienced; and with the exception of a limited use of the stained antigen whole blood method in 1938-39, the growers had had no experience with a testing program. When it was realized in 1939-40 that half of the flocks were infected and that several tests on these flocks would have to be made, we had the problem of convincing the owners of these flocks that eradication necessitated retesting until no reactors were found.

All of the difficulties met with in an eradication project for chickens have been encountered in this program. Clearing flocks of turkeys by a retesting program alone is in general more difficult to accomplish than in the case of infected flocks of chickens. Several factors contribute to the difficulty of obtaining free flocks by retest, but two of the most important are transmission by eating infected eggs and by contamination of food and water by intestinal shedders. The spread of the disease by egg eating is apparently common in turkeys. The birds are usually reared under range conditions where many yard eggs are laid, and females often, and males less often, become habitual egg eaters. This habit is usually started early in the season before nests are provided. Some turkeys also become habitual yard layers and never use the nests, and thereby increase the dangers of spread by this means.

The results of retests, and autopsy studies on reactors to these retests in flocks that were laying, indicate that sub-acute outbreaks often follow the eating of infected eggs. In a group of 36 such reactors, 11% of them yielded Salmonella pullorum from the intestines and 38% of them yielded the organism from the liver. An example is an outbreak where there were 10.7% reactors in 186 turkeys on first test, and a month later, there were 67 reactors in the 161 remaining birds (41.6%). These reactors were definitely sub-normal, and when dressed out at the killing plant, a large number showed ascites which is a common finding in such outbreaks. This group of birds was in heavy production at the time of the first test. Incidentally, on the fifth test the flock was free, but there were only 71 birds left in it.

This continued spread of infection resulting in new outbreaks is the true explanation for the increase in percentage of reactors after flocks start to lay. Many individuals have the false impression that some infected birds do not start to react until they are in production. The data collected in this program have shown that such opinions are without foundation. It is obvious that it is advisable to start testing the flock at an early age so that retesting, if necessary, may be finished before the birds start to lay. We suggest 4 months as a satisfactory age to make the first test. Flocks found to be negative at this age and retested when laying have consistently continued to be negative to the test.

The same principles which govern the successful eradication of the disease from chickens apply also to turkeys and one cannot predict by the
results of the first test the correct procedure to follow. Every ranch has
to be considered an individual problem, when mapping out a program.
Factors to be considered when deciding on the method include, (1) type
of manager, (2) plan of ranch, (3) type of available equipment,
(4) size of yards, (5) drainage and (6) history of flock.

On some ranches one would advise selling all infected pens and retesting
the non-reactor pens. On others one would advise retesting all of
the infected pens at least once, and from the results obtained, decide on
the subsequent procedure. If the owner is not a good manager, if the
yards and equipment are in poor condition, and the birds in crowded
quarters one might advise selling the entire flock. The average percentage
of reactors is not in itself sufficient to enable one to evaluate subsequent
procedure.

One of the greatest dangers, and one which is hardest to overcome, is
the acceptance of a tolerance of percentage of reactors by so many indi-
viduals, including growers, hatcherymen, laboratorians, and various serv-
ice men. The results of our testing program have definitely proven that
any tolerance above zero per cent is a dangerous procedure to follow if
pullorum disease is to be eradicated from turkey flocks. The results ob-
tained with one flock is typical of several examples that could be cited.
This grower had 8.75% reactors at the first test on 400 turkeys. At the
second test the laboratory, through a misunderstanding, called the flock
negative on the basis of not isolating S. pullorum from the one-low titer
reactor. Eggs from the flock were used for replacements and these were
hatched by the owner in his own incubator. Only slight losses were experi-
cenced in the pouls, but when 464 of the progeny were tested this year
there were 14 reactors (3.1%). It took 5 tests to clear the flock and a
total of 35 reactors were removed in the first 4 tests. This example also
shows the fallacy of giving a flock a negative report, by autopsy of a
single reactor to a retest, when infection has been proven to be present in
the flock by previous tests.

In any organized eradication program it is necessary to have correlation
of the laboratory and field work. This implies a knowledge of the com-
plete history of the flock including source of eggs, hatching record, mor-
tality record, purchase of adult birds and segregation of the groups
within the flock. If, on first test, the laboratory should find a few low
titer or atypical reactors to the agglutination test in a flock which has no
evidence of ever having had the disease, we do not recommend that the
grower be given a positive report unless further study justifies it. In some
cases we recommend that the questionable reactors be retested, and if they
are negative, that the flock be cleared. In other cases such suspicious birds
are autopsied and if S. pullorum is not found the flocks are cleared. We
have ample evidence in the form of results of tests on progeny of flocks
certified by such methods to warrant this procedure.

The finding of questionable reactors in flocks having had no outbreak
of pullorum disease is not a reflection on the efficiency of the test. The
same results are often met with when testing chickens, and if laboratorians
will recognize the fact that a few non-specific reactions may occur and
will hold up reports until a correct interpretation is made, the test may be considered as efficient as any agglutination test used for diagnosing disease. The statement made by some persons that the tube agglutination test for detecting carriers of pullorum disease in turkeys is still in the experimental stage is without foundation. The results obtained in this project show it to be a very efficient test for use in an eradication program.

Data on bacteriological examination of reactors to be published as a separate paper show that it is necessary to use a 1-25 dilution test made according to the National Poultry Improvement Plan recommendations (7) as a detection dilution. Approximately 30% of the reactors yielding S. pullorum in this study had a maximum titer of only 1-25. However, it is rare that higher titers are not also found along with these low titers in infected flocks. It is also seldom that one finds a titer of over 1-25 in the questionable or atypical cases referred to above. For this reason we recommend for the original test the procedure suggested for chickens in the National Poultry Improvement Plan (7) i.e., that 1-25 be used as a finding dilution only, and that in flocks where none of the reactors have a titer above 1-25 that final diagnosis be made on the basis of retests on, or, by autopsy of the questionable reactors. Under no consideration do we recommend giving a flock a negative report on the basis of finding reactors showing only a titer of 1-25 in retested flocks. Nor do we recommend clearing such retested flocks because of failure to isolate S. pullorum from such reactors. It is only on the first test in a flock that we recommend such a procedure.

Misinterpretation of this recommendation has caused considerable trouble and is illustrated by the following example. During the 1939-40 season two low titer reactors out of 157 birds were found on second test. These birds were autopsied and S. pullorum was not isolated. The flock was, however, considered free by the owner because of a misinterpretation of the laboratory report. Eggs were used from the flock as part of a pooled group for two hatches and both hatches of poults had pullorum disease. The eggs from this particular flock made up only a small percentage of the total eggs set and were the only ones from an infected source. The flock was retested 4 months later and was found to have 28.4% reactors.

Various reasons for non-specific reactions in the 1-25 dilution test have been suggested. Johnson and Pollard (8) have reported that turkeys infected with a gram-positive organism belonging to the Lactobacilli may cause non-specific reactions in 1-25 dilutions. Hurt and McCulloch (9) found that a gram-positive coccus in chickens was responsible for non-specific reactions in the serum plate test, and Holm, Williams, Callahan and Halversen (10) observed similar reactions in whole blood tests on chickens infected with coccus types. They also found Alcaligenes fecalis and Al. marshalli in a few chickens giving such reactions. Hinshaw and Dunlap (11) reported that a small gram-positive coccus, contaminating blood samples and growing in the serum-antigen mixtures, gave false reactions due to the rough colonial growth in the tubes. We have, in the present studies, found that about 60% of the questionable reactors in flocks that
had no history of an outbreak of pullorum disease, were negative when re-tested within a week or 10 days. The remaining birds continued to react but in very low dilutions. These reactions have been associated in our experience to (1) bacterial contamination such as described by Hinshaw and Dunlap, (2) traumatic injuries in the bird, (3) coccus infection, and (4) Salmonella typhimurium infections. We have not yet isolated the organism described by Johnson and Pollard from such cases. In practically every instance where a reaction occurs that is not due to contamination we have observed some pathological change upon autopsy. Traumatic injuries have included adventitious cysts in the gizzard, and external injuries caused by fighting. In the coccus infections, necrotic abscesses in the liver have been common. In one instance, the only suspicious reactor was in the advanced stages of blackhead. Three diagnoses of S. typhimurium infection have been made by isolation of this organism from turkeys giving a low titer reaction to S. pullorum antigen.

The results obtained in our program this year have shown that it is possible to eradicate pullorum disease from turkey flocks but that certain fundamental principles have to be observed if such a program is to be successful. These are (1) to make the initial test at 4 months of age; (2) to divide the flock into small groups on clean ground two weeks before testing; (3) to remove the reactors promptly and sell them to the market immediately; (4) to thoroughly clean and disinfect all feeding and watering equipment; (5) to remove all infected pens to clean ground; (6) to retest infected pens at monthly intervals, or to dispose of them by selling for market purposes; (7) after all groups are free by the pen method of testing to retest the entire flock; (8) to use eggs for poults from free on first test flocks for all replacements; and (9) to practice a rigid sanitary program. As stated above, the exact procedure will vary with the individual ranch set-up.

It is often necessary to keep untested birds on the premises until they are ready for market. If complete segregation of such groups from the tested groups can be maintained, it is a safe procedure to follow. Again the individual ranch set-up will influence the recommendations to be made.

The most important feature of the program has been the use of replacements from free flocks for the infected ranches. If all of the growers had cooperated in this plan, and all the hatcheries likewise had cooperated by accepting eggs only from free flocks it would have been possible to have had 100% instead of 80% of the flocks free on first test this year.

It cannot be emphasized too often that the hatchery itself is the keynote of the whole eradication program. A single non-cooperating hatchery can destroy the results of the entire program, by accepting eggs from flocks of either chickens or turkeys that are not of equal status to those cooperating in the program. The most important contributing factor to the success of our 1940-41 program was the fact that with a few exceptions we were able to convince the growers to have free eggs hatched in the hatcheries.
which accept only eggs of like status. In no instance have we had an outbreak of pullorum disease in a flock which came from eggs laid by a negative flock (either on first test or by retest) and hatched by a hatchery accepting eggs of like status.

Summary

This is a progress report on a cooperative pullorum disease eradication demonstration project which the University of California entered into with the Ramona Turkey Growers Association in July, 1939. The project includes testing all flocks by means of the tube agglutination method (1-25 dilution) at monthly intervals until one negative test is obtained; field supervision of flocks; inspection of hatcheries; and frequent educational conferences.

When the 80 flocks (28,810 birds) were tested in the 1939-40 season, 40 of them (8,718 birds) were free on first test and by the end of the season, a total of 64 were free (80% of the flocks and 68% of the turkeys). The remaining 16 infected flocks were tested at monthly intervals until the end of the hatching season.

This year, 81% of the flocks and 81% of the turkeys (17,181 birds) were free on first test. This is in contrast to 50% of the flocks and 30% of the turkeys free on first test last year. The infected flocks of this season have either been sold or cleared by retest; so that all flocks now supplying eggs have the equivalent, but unofficial status of the U. S. Pullorum Passed Grade. A total of 600,000 eggs were sold to mid-western and eastern hatcherymen in 1939-40 without a single complaint of losses from pullorum disease.

Data on 49,890 tests made during 1939-40 showed that 1.77% of the males and 4.23% of the females were reactors.

Attempts to rid flocks of the disease have involved the same difficulties met with in similar programs with chickens. The two most important problems were reinfection of flocks by birds eating infected eggs, and the spread by contamination of food and water by intestinal shedders.

In no instance in 1940 was there an outbreak of pullorum disease in a flock which came from eggs laid by a negative flock (either on first test or by retest) and hatched by a hatchery accepting only eggs of like status.

Lack of cooperation on someone's part accounted for each outbreak of pullorum disease encountered this year. Purchase of eggs of unknown status, hatching pullorum-free eggs in hatcheries which accepted eggs from reacting flocks, and the use of eggs from a flock before a negative test had been obtained were the principal reasons for failure.

ACKNOWLEDGMENTS

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data; Mr. A. E. Matlack, Manager of Ramona Turkey Growers’ Association for extending the use of the facilities of the association to us; and Mr. T. J. Taylor for his assistance in the bacteriological examination of reactors.

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1. Hewitt, E. A.

2. Brunett, E. L.

3. Hinshaw, W. R.


5. Hinshaw, W. R.

6. Hinshaw, W. R.

7. The National Poultry Improvement Plan.


### TABLE I

Status of Flocks at Beginning and End of the 1939-40 Testing Season

<table>
<thead>
<tr>
<th>Range of Infection</th>
<th>Number of Flocks</th>
<th>Number of Turkeys</th>
<th>Number of Reactors</th>
<th>Average Per Cent Reactors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BEGINNING OF SEASON</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative on First Test</td>
<td>40</td>
<td>8,718</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Infected Under 2 Per Cent</td>
<td>9</td>
<td>4,995</td>
<td>59</td>
<td>1.2</td>
</tr>
<tr>
<td>Infected Over 2 Per Cent</td>
<td>31</td>
<td>15,097</td>
<td>791</td>
<td>5.2</td>
</tr>
<tr>
<td><strong>Totals and Averages</strong></td>
<td>80</td>
<td>28,810</td>
<td>850</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>END OF SEASON</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative on First Test</td>
<td>40</td>
<td>8,718</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Negative by Retest, Culling, etc.</td>
<td>24</td>
<td>7,305</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Infected Under 2 Per Cent</td>
<td>8</td>
<td>4,852</td>
<td>35</td>
<td>0.7</td>
</tr>
<tr>
<td>Infected Over 2 Per Cent</td>
<td>8</td>
<td>2,378</td>
<td>112</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Totals and Averages</strong></td>
<td>80</td>
<td>24,354</td>
<td>147</td>
<td>0.6</td>
</tr>
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</table>

### TABLE II

Comparison of Status of Flocks of 1939-40 with that of 1940-41

<table>
<thead>
<tr>
<th>Flock Status</th>
<th>Flocks</th>
<th>Turkeys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Per cent of total</td>
</tr>
<tr>
<td></td>
<td>1939</td>
<td>1940</td>
</tr>
<tr>
<td><strong>Free on first test</strong></td>
<td>40</td>
<td>47</td>
</tr>
<tr>
<td><strong>Infected on first test</strong></td>
<td>40</td>
<td>11</td>
</tr>
<tr>
<td><strong>Free at end of season</strong></td>
<td>64</td>
<td>0</td>
</tr>
<tr>
<td><strong>Infected at end of season</strong></td>
<td>16</td>
<td>0</td>
</tr>
</tbody>
</table>

* Three infected flocks were sold after the first test.

### TABLE III

Range of Percentage of Reactors to the First Test in 1939-40

<table>
<thead>
<tr>
<th>Range of Percentage Reactors</th>
<th>Number of Groups</th>
<th>Per Cent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 2 per cent</td>
<td>11</td>
<td>17.2</td>
</tr>
<tr>
<td>2.1 to 5 per cent</td>
<td>14</td>
<td>17.2</td>
</tr>
<tr>
<td>3.1 to 5 per cent</td>
<td>14</td>
<td>21.9</td>
</tr>
<tr>
<td>5.1 to 10 per cent</td>
<td>14</td>
<td>21.9</td>
</tr>
<tr>
<td>10.1 to 16 per cent</td>
<td>8</td>
<td>12.5</td>
</tr>
<tr>
<td>Over 15 per cent</td>
<td>6</td>
<td>5.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>64</td>
<td>99.6</td>
</tr>
</tbody>
</table>

### TABLE IV

Comparison of Incidence of Male and Female Reactors in Infected Turkey Flocks

<table>
<thead>
<tr>
<th>Test*</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Number</td>
<td>Number Reactors</td>
</tr>
<tr>
<td>1</td>
<td>2,063</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>947</td>
<td>28</td>
</tr>
<tr>
<td>3</td>
<td>499</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>228</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>150</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>103</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>88</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>64</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4,131</td>
<td>73</td>
</tr>
</tbody>
</table>

* Tests made at intervals of 1 to 2 months during the season or until one negative test was obtained.
REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY

CLIFF CARPENTER, Chairman, Ft. Wayne, Indiana
A. J. DURANT, Columbia, Missouri
L. D. FREDERICK, Chicago, Illinois
H. J. STAFSETH, East Lansing, Michigan
ERWIN JUNGHERR, Storrs, Connecticut
J. S. ANDERSON, Lincoln, Nebraska

The activities of the Committee on Transmissible Diseases of Poultry for the year 1940 have centered around preparing a round-table discussion of the present-day knowledge of poultry disease control for the annual meeting. This program precludes the reading of technical papers on poultry subject matter and constitutes a review of infectious, parasitic and nutritional diseases under the topic heading of "Poultry Information Please."

The board is composed of the following authorities:

Dr. J. Holmes Martin, Purdue University—Genetics and Husbandry
Dr. R. M. Bethke, Ohio Agr. Exp't Station—Nutritional Diseases
Dr. W. R. Hinshaw, University of California—Turkey Diseases
Dr. F. R. Beaudette, New Jersey Agr. Exp't Station—Virus Diseases
Dr. H. J. Stafseth, Michigan State College—Bacterial Diseases
Dr. Erwin Jungherr, Storrs Agr. Exp't Station—Pathology.

It is intended that the answers by the board, to the questions asked by the chairman, and from the floor, will provide an acceptable reference to what is known today about the diseases of chickens and turkeys. Later in this report, there appears a recommendation concerning the future use of this material.

The committee held a meeting at Washington, D. C., August 30, 1940, to discuss program material, and certain recommendations, including some made by the Poultry Committee of the American Veterinary Medical Association, as presented at the 1940 Washington meeting.

Phenothiazine

The U. S. Department of Agriculture has released information that phenothiazine is a valuable anthelmintic for the removal of cecal worms in chickens. Since this parasite is the chief vector of Histomonas meleagridis, causative agent of blackhead, this drug now becomes an important veterinary aid. Veterinarians are urged not to depend upon this drug as a substitute for, but only as an adjunct to, the sanitary measures which have proved so valuable in preventing this disastrous disease of turkeys.

Pullorum in Turkeys

Further progress is reported in the control of pullorum disease in turkey flocks. Veterinarians are urged to keep abreast of the latest scientific findings in this field, particularly as they apply to improved methods of blood testing.
Swine Erysipelas in Turkeys

Both regulatory and practicing veterinarians are urged to be aware of the occurrence of swine erysipelas in turkeys. This disease, also infectious to man, has been reported from New Jersey, Massachusetts, Oregon, and other states. Severe losses may occur, particularly at or near marketing time. The soil is believed to be a possible source of infection.

Pullet Disease or Blue Comb

This disease, which is quite common in the Northeastern states, is often confused clinically with fowl cholera and pullorum disease. Jungherr and Levine report that pullet disease appears to be non-infectious, but due to a sudden upset of the chemistry of the body—somewhat like milk fever in cattle. Little is known of preventive or corrective measures.

Nutritional Diseases

Continued progress is reported by research workers in the field of biochemistry. For each of several years past, one or more new vitamin factors have been isolated and their absence from a ration shown to be detrimental to chickens and turkeys.

Recently Hogan and Patrick, of the Missouri Experiment Station, reported the discovery of a nutritional factor other than manganese, as being responsible, at least in part, for the prevention of perosis. This factor is contained in the “B Complex” and is named tentatively by them, vitamin Bp.

This committee acknowledges the fine investigational work now being carried out by state veterinary colleges and experiment stations, and desires to point out that further knowledge is necessary in several fields of research, before regulatory and practicing veterinarians can give accurate and practical recommendations for the control of the following poultry diseases:

1) Coryza
2) Fowl cholera
3) Fowl typhoid
4) Mycosis
5) Hexamitiasis
6) Trichomoniasis
7) Infectious (chick) bronchitis.

Infectious Bronchitis

Infectious bronchitis (chick bronchitis) continues to constitute a serious menace to both hatcherymen and chick raisers.

The short incubation period; the fact that the disease may cause death by suffocation or starvation (if chicks become affected before having learned how to eat); the recovered carrier problem; the spreading of the virus by mechanical means on the poultry farm—all tend to make infectious bronchitis a serious economic problem.

Your committee recommends that a study be made of the factors which promote the widespread dissemination of this virus, and steps be taken to formulate plans to prevent the further spread of this disease.
This committee has reviewed recommendations numbered 10 to 13 inclusive, of the 1939-1940 Poultry Committee of the American Veterinary Medical Association, and recommends that this association go on record as approving said recommendations. The recommendations as presented are as follows:

1. That veterinary colleges and veterinary departments, in each of the 48 states, assisted by state and district veterinary associations, conduct a detailed survey to determine:
   
a. The amount of poultry practice being done by each licensed veterinarian.

b. The number of veterinarians who would enroll in regularly scheduled extension classes for veterinarians only, if conducted by their state college or university; and any other information germane to the issues involved.

2. That, when these figures are available, adequate arrangements be made by state institutions to offer extension instruction in poultry disease control to graduate veterinarians only.

3. That such instruction include anatomy, physiology, gross and microscopic pathology, parasitology, therapeutics, and particularly, nutrition, sanitation, management, and breeding.

4. That all state and district veterinary programs feature poultry papers, demonstrations and clinics of practical value.

Pullorum

Control measures for pullorum disease, by blood testing and eradicating carriers, continue to expand, under the leadership of the National Poultry Improvement Plan. The latest available figures released by the U. S. Department of Agriculture show that 44 states now operate under this plan, comprising nearly 2,200 hatcheries with more than 90,000,000 egg capacity. Eighty-four per cent of the 11,000,000 breeding chickens under the plan are now being blood tested for pullorum disease by one of the accepted diagnostic methods.

The 1939-1940 Poultry Committee of the American Veterinary Medical Association, at its annual meeting in August, 1940, recommended that the present tolerance of 10% reactors in the U. S. Pullorum-Tested Class, be lowered to:

- 8% for 1941
- 7% for 1942
- 6% for 1943
- 5% for 1944

They further recommended that: "Since pullorum disease control and eradication represent an important phase of the National Poultry Improvement Plan, a graduate veterinarian, well qualified in poultry, be added to the staff of coordinators at the earliest opportunity."
This committee heartily endorses both of these points, and recommends that this association transmit its approval to the U. S. Department of Agriculture.

We recommend that the questions and answers presented at the Poultry Section be printed in a separate issue and made available for distribution to veterinarians, institutions, and other interested individuals, at a minimum price to cover costs.

REPORT OF COMMITTEE ON LEGISLATION

J. L. AXBY, Chairman, Indianapolis, Indiana
E. T. FAULDER, Albany, New York
J. M. SUTTON, Atlanta, Georgia
T. O. BRANDENBURG, Bismarck, North Dakota
J. P. STOUT, Springfield, Illinois

Your Committee on Legislation begs leave to make the following report:

1. We recommend that the United States Department of Agriculture adopt and promulgate a regulation governing the interstate movement of dairy and breeding live stock certifying their freedom from Brucellosis.

2. We recommend all states be urged to provide laws for the better regulation and supervision of all sale barns and auction community sales of live stock, and all stock yards, not under federal supervision.

3. We recommend that all states be urged to appropriate funds for the control and eventual eradication of Brucellosis in live stock.

4. We recommend that all states adopt legislation restricting the use of Abortion Vaccine to licensed authorized veterinarians only, and that all of such sales of Abortion Vaccine be reported to the chief sanitary official of the state of destination, by the person, firm, or corporation, shipping such vaccine.

5. We recommend that all states continue to appropriate funds for the eradication of tuberculosis in all its aspects, pertaining to live stock and poultry.

President Port: We will stand adjourned at this time until 1:15. The meeting adjourned at 12:20 o'clock.

FRIDAY AFTERNOON SESSION,
DECEMBER 6, 1940

The meeting convened at 1:25 o'clock, President H. D. Port, presiding.

Army Inspection of Food Products of Animal Origin

By Lt.-Col. W. C. Griffin, Veterinary Corps, U. S. Army

Few of our citizens are aware of the quality of the food fed our Army, and I wish to state that it is seldom one will find in the average neigh-
borhood grocery or meat market food products which will equal the quality and grade of those purchased for the Army.

The problem of feeding the Army is an extensive study, especially considering food products of animal origin and the vast quantities that will be required. Packinghouses and meat canning firms will be taxed to the limit of their production capacity during mobilization or in time of war.

It is amazing to most people the poundage of food products of animal origin that is required to feed an army. As an example, the following list shows the amount of food of animal origin required to feed an army of 1,200,000 for one day:

FOOD CONSUMED DAILY AND ANNUALLY

<table>
<thead>
<tr>
<th>FOOD</th>
<th>DAILY CONSUMPTION</th>
<th>ANNUAL CONSUMPTION</th>
</tr>
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<tbody>
<tr>
<td>BEEF</td>
<td>1,153 carcasses</td>
<td>650 lbs. or 221,376 a year (4 times a week)</td>
</tr>
<tr>
<td>VEAL</td>
<td>140 lb. carcasses</td>
<td>5,357 per day or 257,136 a year (once a week)</td>
</tr>
<tr>
<td>LAMB</td>
<td>40 lb. carcasses</td>
<td>4,687 per day or 212,966 a year (once a week)</td>
</tr>
<tr>
<td>PORK, fresh</td>
<td>200 lb. carcasses</td>
<td>3,410 per day or 153,680 per year (once a week)</td>
</tr>
<tr>
<td>BACON</td>
<td>150,000 lb. daily</td>
<td>13,400,000 lb. a year (3 times a week)</td>
</tr>
<tr>
<td>HAM</td>
<td>225,000 daily or 10,800,000 lb. per year (fed once weekly)</td>
<td></td>
</tr>
<tr>
<td>CHICKEN</td>
<td>30,000—3½ lb. chickens daily or 1,440,000 year (once weekly)</td>
<td></td>
</tr>
<tr>
<td>MILK, fresh</td>
<td>150,000 gallons daily</td>
<td>54,100,000 year. (fed 7 times a week)</td>
</tr>
<tr>
<td>BUTTER</td>
<td>150,000 lbs. daily</td>
<td>9,000,000 yearly (fed 4 days a week)</td>
</tr>
<tr>
<td>CANNED MEATS</td>
<td>750,000 lb. daily</td>
<td>if troops were placed on same in field, it would require 22,500,00 1-lb. cans per month.</td>
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SECTION I

1—All food products consumed by the Army are purchased by contract on a competitive bidding basis. The contracts are awarded to the lowest bidder provided the lowest bidder can show his firm has all facilities for fulfillment of the contract and is classed as being thoroughly reliable and can meet with all the requirements as specified in regulations.

2—Contracts for purchase of all foods are directly under and are awarded by the Quartermaster Corps. The requirements for the food items by various stations are submitted on requisition forms to the Purchasing Quartermaster who compiles the amounts and then makes up the bid proposals which are known as Invitations for Bids. These bid proposals are mailed to all firms dealing in the articles called for; provided the bidder has had his firm placed on the mailing list of the Quartermaster. The Invitation for Bids shows the Federal Specification Number, names of the items called for, their amounts, the grade or quality and size or weight desired. It also contains instructions as to time and the place of delivery and the date the bids are
to be opened. On the date of opening of sealed bids, the bidders or their representatives are present and bids are opened in their presence, the lowest bidder being awarded the contract.

3—Upon award of the contract, the successful bidder receives a purchase order and on this order it is stated, the contractor will notify the Quartermaster as to date he will start fulfilling contract and the time and date the presence of the veterinary inspector will be required. No government meat contract can start without a veterinary officer present. The veterinary officer is given a copy of the purchase order and reads carefully the Grade, Type, and Class of the article called for, and the number of the Federal Specification governing the purchase of that certain item.

4—Army regulations provide that all meat and meat food products, purchased for the Army, must originate in a plant which is under supervision of the U. S. Bureau of Animal Industry and that all meat used must have been slaughtered under supervision of that agency. All carcasses, and wholesale cuts therefrom, must bear the official U. S. BAI stamp. No meat or meat food product from countries other than the United States is acceptable. Inspectors must verify that they have observed the BAI stamp on the meat to see that it originated in the United States.

5—Meat packing firms under supervision of state, county, or city inspection agencies may supply their products to the CCC, provided the Army has first made an inspection and investigation of these plants and that same have met with all sanitary requirements of the War Department, who must approve of the inspection agency before they are placed on accepted list. For numerous reasons there are very few of these agencies which meet the requirements of the War Department. In some cases, the inspectors are not qualified veterinarians, or their salaries are paid by the owners of the packing houses where they conduct the inspection. A great many of those packing houses do not possess the necessary sanitary requirements.

6—The inspection of food products of animal origin for use by the Army is conducted by the Veterinary Corps under authority contained in Army regulations. The Veterinary Corps is responsible that all food products of animal origin used by the Army meet with the requirements of federal specifications and regulations of the War Department governing their soundness, grade, and class as well as the type.

7—The placing of this responsibility in the hands of the Veterinary Corps was a most wise move. There is no branch of the service which is better qualified to handle this important work than the Veterinary Corps. The Veterinarian's knowledge of anatomy, histology, pathology, bacteriology, his ability to differentiate the various kinds of tissues, his training in sanitation, in fact his entire veterinary education better qualifies him for this work than other officers of the many branches of the Army. It does not require a very long period to train a veterinarian to become an efficient inspector and grader of meat items. To train a layman, requires several months and even years of practical experience before he will be classed as proficient.

8—Veterinary officers detailed to conduct inspection of meat and dairy products are given a special course of instruction at the Army Veterinary School, Washington, D. C., and lately at a school which has been established at the Chicago Quartermaster Depot, Chicago, Illinois. This school was organized for the purpose of training Veterinary Reserve Officers who have entered the service during the past year. The
large packing houses located in Chicago are cooperating with the Army and offering every facility of their plants to assist in making this school a practical one where the students can receive a wonderful training.

9—There is a separate federal specification for every food product of animal origin purchased by the Army. These specifications list in detail all of the specific requirements for article being purchased, such as the type, class or grade, desired and the minimum and maximum weights of the different products. Under type it states whether or not fresh, chilled, or frozen products are authorized, or whether carcass or wholesale cuts therefrom can be purchased. The officer conducting the inspection must be familiar with all these specifications and consult them when inspecting products. He is not authorized to divert from any requirement contained therein, unless he obtains authority from the purchasing officer who awarded the contract.

10—The federal specification for the purchase of beef, directs that only steer carcasses will be accepted. Wholesale cuts of beef must also be from steer carcasses. The grade purchased by the Army is known as Grade B Medium Beef, and is comparable to the Bureau Market Service's Low Good or Top-Medium. This grade of beef generally comes from cattle that have been on feed for some time and is derived from steers of good conformation, possessing a covering of fat over the carcass which is not to be excessive. The fat must be firm and ranging from a creamy-white color to a fat with a slight yellowish tinge. The lean meat must be firm, free from excessive moisture and flabbiness. The grain of the meat should be smooth, with muscle fibers which are short and not coarse and stringy. The color of the lean meat should be from a medium cherry to a dark cherry. The presence of small deposits of fat between the muscle fibers known as marbling is specified. The chine bones or split vertebrae should be of a red to a reddish-pink color and the texture of the bone soft. The softness and the red color of the bone is an important factor to determine the meat is from a young carcass. On top of the chine bones are small white cartilages which become hard and turn into bone as the animal becomes older; these are known to the meat-trade as “the buttons.” In selecting beef which is tender, it is important to note the softness of and development of these cartilages or buttons.

11—The weights of dressed carcasses for the Army average from 600 to 900 pounds. Carcasses weighing from 650 to 750 pounds are the most desirable for Army use.

If the government purchases frozen beef, it must be inspected prior to freezing. The Army is now using a considerable amount of frozen beef which has had all bones removed and is known as Frozen Boneless Beef. It is generally purchased as boneless frozen cuts put up in three separate packages as stew or boiling meat, steaks and roasts, and ground meat or hamburger. All of this boneless frozen beef is inspected by the Army prior to freezing and boning.

Frozen boneless beef saves much space in transporting in boats, does away with waste, and is easy to handle by cooks. It remains in a frozen condition after leaving cold storage for a period from 18 to 36 hrs. While it is about 12 per cent more costly than fresh chilled carcasses with bone left in, yet when issued the amount issued per soldier is reduced from 2¼ to 1 oz. and there is no waste and savings made in space involved in transporting, about balances it with cost of the fresh chilled meat with bone in.
SECTION II

VEAL

12—Veal is purchased by the Army either in carcass form or the commercial wholesale cuts. Two grades are authorized in federal specifications: Choice or Grade A-1 and Good or Grade A, and in addition to the grades, two classes known as the Light Weight Veal and the Heavy Weight Veal. Federal specifications set forth the weights of each of these classes. Light Weight Veal are dressed carcasses weighing not less than 75 pounds and not more than 120 pounds. Heavy Weight Veal is the dressed carcass weighing not less than 121 pounds and not more than 190 pounds. Veal in the grades called for must be carcasses or wholesale cuts from carcasses that are blocky, compact with a light covering of fat over regions of the hips, back and shoulder in the light weight class, and in the heavy weight class, a good covering of firm white fat over hips, back and shoulder. The kidneys must be well covered with fat. One point in grading veal which will meet the requirements of grades specified is that the kidney be well covered with fat and one will seldom find either in veal or in lamb, a carcass which is deficient in fat covering the kidneys, that will meet the requirements of a Grade A-1 or Grade A veal. The color of the flesh or lean meat is important and in the light weight class the color should be a pinkish-brown while in the heavy weight class the color varies from pinkish-brown to a light red. The ideal weight of carcasses for Army consumption range from 130 to 150 pounds. Sex is not a consideration in purchase of veal.

SECTION III

LAMB

13—Lamb for Army consumption is purchased according to the federal specifications which authorize the purchase of either carcasses or wholesale cuts. Two grades are authorized—Grade A or Choice, and Grade B or Good. Sometimes when these two grades cannot be obtained in sufficient amounts to meet the Army requirements, then the Common or Grade C is purchased. This is seldom, however. Lamb is generally graded according to weight, conformation, quality and finish, these being the common grading factors of all carcass meats and wholesale cuts. To meet the requirements of the grades as called for or authorized by federal specifications, lambs must possess a good, blocky conformation; carcasses of choice grade must have a heavy covering of white firm fat over the hips, loins and shoulders; in the Good or Grade B lamb, this heavy covering of fat is not required. The flesh must be of a pinkish color in the light weight lambs (30 to 40 pounds) and it may be of a darker color in the 40 to 50 pounds weight of Grade B lamb. In grading lamb, the long bones such as leg bones and the ribs should possess a good red color. The knee joint, known as the break joint, should show 4 red, soft, smooth, well-developed ridges. As the lambs start reaching the mutton stage, these ridges become hard and rough and gradually disappear; as lamb is reaching maturity, and enters the mutton type, the 4 ridges have disappeared and leave two large distinct joint surfaces.

14—One important factor in grading the lamb for grades meeting requirements of federal specifications is that the kidneys will be heavily covered with a firm white or pinkish-white fat. One will seldom find a lamb whose kidneys are not heavily covered with fat, that will grade up to standards required by the Army.
15—During the spring, there is always a shortage of light lambs (those weighing from 30 to 40 pounds) and it then becomes necessary to waive these light weights and accept lambs weighing from 40 to 50 pounds.

Very little mutton is purchased for the Army. Mutton never was a popular dish in the Army.

SECTION IV

PORK

16—Pork is seldom purchased by carcass. Ninety-five per cent of the fresh pork consumed by the Army is wholesale cuts (shoulders, hams, loins and spareribs.) The maximum and minimum weights are specified in the bid proposals.

17—The Army generally purchases Grade 2 pork. No soft or oily pork or pork from old sows, stags or boars, or cuts showing thick, coarse skin or coarse-grained and dark-colored meat is accepted.

Ham and bacon, smoked, are purchased according to the type or cure and by Grade. Grades No. 1 and No. 2 are acceptable. About 70 per cent of the ham consumed is the sweet-pickle, smoked. A special smoked ham is purchased for troops in Hawaii, Panama, and the Philippines. This ham is given a long smoke, either a 48-hour smoke at 115 degrees F. or another type which is given a 7-day smoke at a temperature ranging from 110 degrees F. for the first 24 hours and then gradually bringing the temperature up to 135 degrees F. and maintaining this temperature for 48 hours and gradually lowering it to 110 degrees for the remainder of the 7-day period. This method produces a dry product with excellent flavor, having good keeping quality and not likely to mold as the ordinary commercial smoked ham would in tropical climate. The weights of hams for the Army are from 10 to 12 pounds and from 12 to 14 pounds.

18—Bacon is purchased according to type and cure desired and the grade: Grade 1 and Grade 2. It is purchased in slabs weighing from 6 to 8 pounds or 8 to 10 pounds for the Grade 1, and in the Grade 2, weights may be from 8 to 10 pounds or 10 to 12 pounds, as may be specified in bids. Bacon in slabs, purchased for our foreign possessions, is smoked for 48 hours at a temperature of 125 degrees F.

19—A dry salt cured bacon is purchased for use in the tropics and this bacon is placed in cans weighing 12 pounds net each. This bacon is given a 7-day smoke at a temperature not lower than 110 degrees F. It has wonderful keeping qualities and naturally will not mold. The cans are filled under vacuum. It is made from selected bellies of uniform thickness and breadth. Millions of pounds of this type of bacon are required in time of war.

20—When contracts are awarded for large amounts of ham and bacon, the product is prepared under Veterinary Corps supervision. A veterinary officer first selects and grades the green bellies, then supervises the curing and the over-hauling. Veterinary inspection is constantly maintained during the drying, smoking and hanging. It is necessary to keep a constant check on the temperatures of the smokehouses during the smoking period to see that the proper temperatures are maintained.

21—The Army purchases large amounts of sausage fresh and smoked and also canned. When sausage contracts are awarded, the Veterinary Corps selects and grades
the meats used, the percentage of each mixture and maintains inspection up to time product is placed in trucks or cars for shipment to destination. Only one grade of sausage purchased; the best grade or Grade No. 1. The sausage prepared under Army supervision cannot be excelled.

SECTION V
CANNED MEATS

1—Several hundred thousand pounds of canned meats are consumed by the Army each year. During the coming year this figure will run into several million pounds. In the event of war, canned meat would be used extensively. Modern warfare with highly mobile, fast-moving troops, improved aerial observation, long range guns, which would prevent the use of fires for cooking within many miles of the front lines. Little time can be taken for cooking and preparation of fresh or frozen meats. Cold storage and refrigeration facilities will be lacking, if not entirely absent. Conservation of space in transporting is another important factor.

2—Canned meats being already prepared for use have indefinite keeping qualities and are always properly cooked and compounded, being protected from contamination of all sorts and from any poisonous gas, make these products ideal for use by the Army. The Army has adopted the following and with these varieties it will provide much variation in the ration.

Corned beef canned; hash, corned beef, canned; Vienna sausage, canned; sausage, pork, canned, and the new Type C Field Ration, consisting of three different canned meat products.

No. 1—A Meat and Vegetable Stew.
No. 2—Meat and Beans.
No. 3—A Vegetable-Meat Hash.

With these three canned meat products, another can containing soluble coffee, sugar and a semi-hard biscuit is included. These four cans constitute a one-day ration for the soldier in case of an emergency. In addition to the above is the Dry Salt-Cured Bacon in 12-lb. cans, which I have described in this paper.

3—All canned meats are prepared in the United States and are prepared under direct supervision of the Veterinary Corps. Ninety per cent of canned meats for Army use are prepared in Chicago. The canned meats prepared under Veterinary Corps supervision are excellent products and are far superior in quality and taste and in all respects to the commercial canned meats.

Federal specifications require that canned meats be prepared according to the formulas given in them and quote the percentages of the different kinds of meat or ingredients used. The requirements also state as to the cure that must be given; the cuts of meat which are not acceptable, such as flank meat, shanks, skirts, naval ends, cheek or head meats.

4—A veterinary officer is present when contractor starts contract. This officer selects and grades all the green meat before it is placed in cure or even chopped into small pieces. He sees to it that only U. S. Inspected and Passed Meats are used and that meat originated within the United States.
All sanitary precautions are taken to see meat is properly handled and kept in good condition at all times.

The curing vats are first thoroughly cleaned by steam and water before being used on an Army contract. The pickle or cure is inspected to assure its freshness, cleanliness and freedom from any objectionable substances. While meats are in cure, frequent inspections by Veterinary Corps are conducted to see that meat is being properly cured.

After meat has been thoroughly cured, it is sent to the cutting and trimming benches, where it is under constant supervision of a highly trained enlisted man of the Veterinary Corps. He closely observes to see all fibrous tissue, ligaments, tendons, and pieces showing any signs of contamination, blood clots, undercured pieces, and excess fat is removed.

The mixing is under his close observation to see that each batch is properly mixed and percentage of ingredients as are required are placed in grinder and mixer. One enlisted man checks the weights of the cans being filled and observes them while in vacuum machine. Cans are inspected after taken from this machine and then are placed in large retorts and cooked under steam pressure at 240 degrees F. for given time, and this time varies according to size of cans and product being prepared. After cans leave retort, the Veterinary Corps inspects for defective cans. The cans are then placed on a steam table and held for 72 hours. This is done to see if any leakers or swellers will develop due to defective cans or improperly processed cans.

The inspection of food products of animal origin is of great importance to the Army. The consumption of unsound meat, meat food products, and dairy products by armies during war and even on the march and maneuvers has produced many cases of severe illnesses among the soldiers. The embalmed beef scandal of the Spanish-American War was a costly example of using poorly-prepared and uninspected meats.

The wonderful record of efficient inspection service of meat and dairy products rendered during World War I both for our Army and that of the Allies, has established a record for the U. S. Army Veterinary Corps, which was praised by our Allies who after the war stated that the meat inspection service of the U. S. Army was the best in the world. No cause of illness due to meat or meat products were reported from overseas or at home. The Army today has even a more perfected meat and dairy inspection service than during World War I and it is well prepared to handle any volume of inspection that may be required. Our Army will be assured of high quality, sound and safe meat and dairy products, and the government will profit in every manner by maintaining perfect veterinary inspection as exists in our Army of today.

DISCUSSION

DR. A. W. MILLER (Washington, D. C.) : I would like to ask why there is a discrimination against heifers. I noticed the requirements of fresh meat were all-steer meat. I wonder why 800 or 900-pound heifers might not qualify very satisfactorily.
COLONEL GRIFFITH: In the past, of course, a great many of our heifers of the grade called for are wasted. But I may tell you what we are doing now. Consideration of the acceptance of heifers is underway, but we won't go over the 900 pounds. In carcass weights it won't exceed probably 600 pounds. I believe there is a Commission coming to Chicago this week, from Washington, and I presume that will be one of the many things they will discuss.

As far as these weights that I have given you today are concerned, we are going to run up against a very difficult proposition in obtaining enough beef of Grade B Medium, or, as we say, an American Meat Institute Packers Grade 4. We use the institute grading in the Army. I believe we are going to have to come down even in weights of carcasses. We may have to do as they did during the World War. In those days they got down to where they were accepting carcasses at 450 pounds. We will probably have to do that before this thing is over.

It may be possible, too, they may raise that grade of carcasses in meats for canning. The packers contend that it is very difficult to obtain enough cattle right now to fill many of these contracts. There was a contract awarded here a short time ago—I think it called for 210,000 cans. That is just a small amount when you consider what will be required. On the days that canned ration will be fed, there will be about 750,000 1-pound cans consumed, or one million cans a month. So in my judgment we will be using the heifers.

DR. WALTER WISNICKY (Madison, Wisconsin): What is the daily cheese consumption of the Army?

COLONEL GRIFFITH: I was rather surprised when I saw the figures on that a few days ago. I believe the figure on daily cheese consumption was 104,000 pounds, and I really believe that is one thing that should be increased. No doubt the Quartermaster will do that. They are considering many things now; they have a most efficient Quartermaster service at the present time, and they are taking that into consideration.

DR. A. F. SCHALK (Columbus, Ohio): I am wondering if Colonel Griffith has milk under his inspection and, if so, could you, in a couple of minutes, give a brief résumé of that?

COLONEL GRIFFITH: Yes, sir, I could, Doctor. The Army purchases both fresh milk and evaporated milk. Each soldier is allowed one-half pint of fresh milk per day. Our milk is purchased in two grades: We use Grade A pasteurized milk and a Grade A milk. The bacteria count cannot exceed 50,000 in the finished product within 24 hours after pasteurization. We make inspections, and we will recognize city, state or county inspection after the initial inspection is made. In other words, to be sure that whatever system is being used is up to the standards of the United States Public Health Service. We find especially in some of the states that the milk inspection service is worse than nothing. They have men out inspecting the milk who are not qualified, who know nothing about milk inspection. In one state adjoining Illinois, we had a retired section man. They wanted to give him a political job, so they put him on milk inspection.

After we inspect these systems to be sure they have qualified men, then we approve of them, and their milk is accepted.
I don't know whether Dr. Schalk had any reference to the tests that we have been using. We have been using two tests lately which have proved to be of great value. One of them is the field test for the proper pasteurization. In this test they may determine the milk that has been properly pasteurized or has even one-tenth of one degree under the proper pasteurization temperature; that milk will show it on this test. It is conducted in about fifteen minutes, so the inspector can conduct it before he leaves the farm. One thing: If you have properly pasteurized milk you have a safe milk.

They have been using the second test for the determination of bacteria. It does not work so well on pasteurized milk, but works better on raw milk. In the absence of anything better, this second test is pretty good. We send out milk samples into the laboratories for the tests. The inspector sends them in once a month. It is rather difficult to get the samples.

Does that answer your question?

DR. SCHALK: Yes, thank you.

REPORT OF THE COMMITTEE ON MEAT AND MILK HYGIENE

A. F. SCHALK, Chairman, Columbus, Ohio
J. S. KOEN, Storm Lake, Iowa
T. O. BOOTH, Ft. Worth, Tex.
E. S. BRASHIER, Jackson, Miss.
R. A. CULBERT, St. Louis, Missouri

Meat Inspection:—Your committee is pleased to report progress in the extension of state and municipal systems of meat inspection in all states and cities where such service has been established. Several states will attempt new legislation this winter to provide for state-wide meat inspection.

Prospects for success of such effort in these states are reported as favorable. Several cities have reported the strengthening and extension of their local meat inspection work. The inspection of poultry at time of slaughter has made very considerable increase in the volume of birds inspected.

The volume of meat and meat products that will be brought under Military Meat Inspection will be enormously increased next year. The splendid presentation of this phase of meat inspection to this convention by Lt. Col. W. C. Griffith, Veterinary Corps, United States Army, brings real encouragement to all who are interested in better meat and food.

Our committee takes this opportunity to extend our thanks and appreciation to Lt. Col. W. C. Griffith for this interesting contribution to our program.

Meat inspection by the United States Bureau of Animal Industry has been continued on the very high plane of efficiency that has always established it as the best meat inspection service in existence.

Milk inspection has not made the progress that is necessary to insure a safe and wholesome supply of milk and dairy products.
One of the greatest obstacles to progress in this type of public service is the deplorable low renumeration offered to veterinarians to engage in milk inspection. The very nature of such service demands ability of unusual degree, yet the salaries offered or paid for it discourages competent and ambitious professional men from ever giving it consideration.

Every effort should be exerted to correct this serious condition. Your committee desires to re-state and to emphasize the position it has always maintained—that the physical examination of all milch cows on the farm by competent veterinarians and the removal of diseased cows from the milk line is the first requirement for adequate milk inspection.

The progress in Bang's disease work is assisting in bringing to the attention of consumers of milk the necessity for physical examination of milch cows.

REPORT OF COMMITTEE ON POLICY

R. W. SMITH, Chairman, Concord, New Hampshire
JOHN R. MOHLER, Washington, D. C.
L. A. MERILLAT, Chicago, Illinois
EDWARD RECORDS, Reno, Nev.
R. R. DYKSTRA, Manhattan, Kansas

Your Committee on Policy has attended to their duties and wishes to make the following recommendations for your consideration:

First: We recommend that special efforts be made by the officers and active members of the United States Live Stock Sanitary Association to procure a more definite and stable membership and that every effort be made to collect yearly dues from all members.

Second: That some method of publicity be adopted whereby members of the veterinary profession in good standing and other interested persons may be informed that they are eligible for membership in this association even though they are not actively engaged in live stock sanitary or regulatory work.

Third: Your committee approves and recommends that the policy of requiring a registration fee of $1.00 per person for admittance to meeting of this association be continued.

Fourth: Your committee recommends that a policy of procuring proper paid advertisements to be run in our annual report be adopted if and when such a policy would prove to be of sufficient benefit to warrant the effort.

Fifth: Your committee recommends that a fee of $2.00 be charged for all single copies of the annual report of the United States Live Stock Sanitary Association when sold to non-members of the association, plus $1.00 for all additional copies except to libraries where the charge will be at cost.

Sixth: It is further recommended that the Committee on Policy be appointed by the president of this association in the following manner:

(a) The committee shall consist of five members.
(b) The members shall be selected from different geographical sections of the United States.

(c) One member shall be selected from the ranks of the Bureau of Animal Industry. One member shall be a layman, and three members shall be selected from the ranks of the Regulatory Live Stock Officials of the respective states.

(d) The duties of the Committee on Policy shall be to study, prepare and present for the consideration of the executive committee all policies of a general nature of this association.

REPORT OF COMMITTEE ON RESOLUTIONS

W. J. MILLER, Chairman, Topeka, Kansas
R. M. GOW, Denver, Colorado
D. M. CAMPBELL, Chicago, Illinois
J. V. KNAPP, Tallahassee, Florida
R. S. ROBINSON, Pierre, South Dakota

WHEREAS: After more than 30 years' effort and the expenditure of millions of dollars of public funds, the Texas fever tick has been eliminated from its natural habitat in the United States, excepting a small area in Florida and the area along the Rio Grande in Texas; and

WHEREAS: The live stock in the eastern part of the Republic of Mexico are infested with the Texas fever tick; and

WHEREAS: It is possible for live stock to walk across the Rio Grande River from Mexico into the United States during many months of the year, thereby reinfecting the live stock with which they may come in contact in the United States; and

WHEREAS: Smuggling of live stock across the Rio Grande from Mexico into the United States is of frequent occurrence, thereby not only avoiding the payment of the duty, but also reinfecting areas in the United States with the Texas fever tick; and

WHEREAS: Other diseases of live stock, common to Mexico, are brought into the United States by these straying and smuggled live stock, thereby endangering the health of the native live stock of the United States; and

WHEREAS: The section of the Rio Grande over which live stock may cross or be driven is approximately 500 miles long, creating a situation which is very expensive to handle and which, at best, cannot be 100% effective; therefore be it

RESOLVED: That we request the International Boundary Commission to erect and maintain a live stock proof fence along the Rio Grande on the United States side, from the Gulf of Mexico to Del Rio, for the purpose of preventing the unauthorized movement of live stock from the Republic of Mexico into the United States and thereby making it possible to eradicate completely the Texas fever tick from the United States, also to lessen the danger of its reintroduction into the United States from Mexico; and to further prevent the introduction of other diseases of live stock from Mexico
into the United States, and to eliminate the necessity of maintaining a large force of inspectors along this border, thus materially reducing the expenditure of public funds for this purpose.

WHEREAS: Through the highly efficient efforts of the Bureau of Animal Industry and of the sanitary officials from the various states, working in close cooperation with live stock producers, our country has been placed in a most enviable position with regard to the health and condition of our live stock herds and flocks; and

WHEREAS: This condition has been made possible only at great sacrifice to live stock producers and at great cost to both state and federal government; and

WHEREAS: The greatest contribution that the live stock industry of this country can make to an adequate defense program is to insure a continuing, ample supply of meat, meat products and dairy products, the basis of the Army and Navy ration and of the diet of all the citizens; and

WHEREAS: Any step lessening the safeguards at present applying to imports of live animals or dressed meats from the countries where foot-and-mouth disease exists would constitute a hazard to our live stock industry and to our present and future food supply; therefore be it

RESOLVED: That we again register our opposition to any change in the embargo provisions of the present law.

WHEREAS: A large part of the interstate transportation of live stock is now accomplished in motor trucks; and

WHEREAS: The transportation of live stock over long distances without unloading for water, feed and rest is not only inhumane and uneconomical, but also contributes to the spread of disease by rendering such starved and exhausted animals unduly susceptible to infection to which they may be exposed en route or at the end of their journey; therefore be it

RESOLVED: That the Legislative Committee of this association be and hereby is instructed to use its best efforts and all proper means to the end that the Congress amend the "28-hour law" regulating the interstate transportation of live stock by rail to apply also to the interstate transportation of live stock by motor truck; and that the Secretary, U. S. Department of Agriculture, be authorized to issue necessary regulations for carrying this amendment into effect.

RESOLVED: That the Legislative Committee be and hereby is directed to use its best efforts to secure the enactment by the Congress of an amendment to the present law providing for the licensing of manufacturers of veterinary biological products destined for interstate distribution, authorizing and directing the Secretary of Agriculture to prohibit the shipment of virus, bacteria, vaccines, antigens or other products capable of exciting reaction to or causing any infectious or communicable disease of animals from licensed manufacturers into any state in violation of the laws or live stock sanitary regulations of that state.
WHEREAS: Glanders in horses has been reduced in this country to a point of practical eradication; and

WHEREAS: The requirement that horses entering a given state must have given a negative reaction to the test for glanders is a hindrance to interstate trade and, in the main, an unjustified expense upon the shipper; therefore be it

RESOLVED: That the mallein tests as a prerequisite to the shipment of horses in interstate traffic be no longer required except for horses from regions which the live stock authority of the state of destination has reason to suspect harbor infection.

RESOLVED: That this association and the members thereof as individuals, commend the Bureau of Animal Industry for the development of brucellosis vaccine from “Strain 19” and for standardization of brucella antigen; both achievements having, in our opinion, contributed largely to the control of brucellosis in cattle.

RESOLVED: That we extend to the manager and other employees of the Hotel Morrison our appreciation and thanks for the satisfactory manner in which they have provided for this convention and for the uniform courtesy and efficiency with which they have accommodated our members and visitors during the period of our meeting.

RESOLVED: That the president and secretary-treasurer of this association be and hereby are authorized to supply copies of the foregoing resolutions to the appropriate persons and by letter direct their attention to these resolutions.

REPORT OF COMMITTEE ON REVISION OF CONSTITUTION AND BY-LAWS

H. E. CURRY, Chairman, Jefferson City, Missouri
WM. MOORE, Raleigh, North Carolina
C. D. STUBBS, Little Rock, Arkansas
F. L. SCHNEIDER, Albuquerque, New Mexico
MARK WELSH, College Park, Maryland

A special auditing committee appointed by President Axby last year submitted the following recommendation: “We therefore recommend that the Secretary-Treasurer be empowered to employ such assistance as may be deemed necessary for the purpose of incorporating this association as a non-profit organization.”

The committee’s report was submitted to the Executive Committee, and was approved and adopted. I am informed by Secretary Welsh that the association is now incorporated under the laws of the state of Delaware; therefore, your Committee on Revision of the Constitution and By-Laws offers the following proposed amendment to the Constitution and By-Laws of the United States Live Stock Sanitary Association:
Article 1—Name

This association shall be incorporated in the state of Delaware under the name of the U. S. Live Stock Sanitary Association. Its corporate officers hereinafter described shall comply with the laws of the United States governing corporations and of the state in which the association is incorporated. It shall forever remain a non-profit organization in fact.

Article 3

That the third paragraph of Article 3 be amended by inserting the clause between the words “person” and “interested,” “association or organization represented by a designated individual.”

PRESIDENT PORT: The Secretary-Treasurer has an announcement to make.

SECRETARY WELSH: This is in the manner of both an announcement and an explanation:

At a meeting before the Assembly of Chief Live Stock Sanitary Officials on Tuesday, a report was read by Dr. D. I. Skidmore, Chief of the Division of Serum Virus Control, United States Bureau of Agriculture, entitled, “Wherein Is the Serum Virus Toxin Law Inadequate For the Proper Control of Biologics?”

The paper was read before this group, and created a great deal of interest. It seemed desirable that it have, perhaps, more detailed study than was possible for us to give it from listening to the very excellent address that Dr. Skidmore made. It was a resolution of the Executive Committee that this paper be read by title, and be carried in the proceedings of this Association.

One other paper that was presented at the same time before the same group, was one by Dr. Laitner, on a method of rabies control, which it seemed desirable to be given further study, and for that purpose it was requested that it, too, be carried in the Journal of this Association.

WHEREIN IS THE VIRUS-SERUM-TOXIN LAW INADEQUATE FOR THE PROPER CONTROL OF VETERINARY BIOLOGICS?

By DON I. SKIDMORE, Chief, Division, Virus-Serum Control

Correspondence with Dr. R. A. Hendershott, Secretary, Association of Live Stock Sanitarians (or National Assembly Chief Live Stock Officials), and with Dr. Charles E. Cotton, secretary and executive officer, Minnesota Live Stock Sanitary Board, and others, seems to focus attention on the particular matter which prompted Dr. Hendershott to invite me to discuss with you the situation with reference to the distribution and use of veterinary biologics.
On November 8 Dr. Cotton transmitted to Dr. Mohler copy of resolutions adopted by the Minnesota Live Stock Breeders' Association, September 18, 1940. These resolutions, which are similar to others received, read as follows:

1. "Be it resolved that the plan and program of area control and testing for Bang's disease control be continued, and that the Live Stock Sanitary Board be asked to continue the program with Federal assistance and sufficient state appropriations to do the work, adopting such changes as are proposed by the federal government.

We further recognize that a considerable amount of work has been done in experiment and research in vaccination for Bang's disease and we further emphasize that the use of vaccines within the state be under the control of and regulated by the Live Stock Sanitary Board, that pending more definite specific results from the vaccination we continue to endorse and support the present program. That we endorse the tabulation read by Dr. Cotton at this meeting, and the report of the Bang's Disease Committee of the American Veterinary Medical Association, adopted by the Association August 29th, 1940.

2. Be it resolved that we request our members of Congress to introduce the proper legislation by amending the present law governing the proper manufacture and licensing for interstate movement of all biological products manufactured for use in the diagnosis and the preventive or therapeutic treatment of communicable diseases of live stock and poultry, or if this is found impracticable to introduce an Act providing that all biological products including serums, vaccines, bacterins, viruses or preparations made from or through the agencies of the micro-organisms or the virus of communicable diseases of live stock and poultry, shall be manufactured under the supervision of the Bureau of Animal Industry, U. S. Department of Agriculture, and shall be required to comply with the legal requirements governing the sale, distribution and use of such products, of the states of destination to which such products are shipped interstate by express, through the United States mail or otherwise."

In response to my request of Dr. Hendershott for his views as to what the association had in mind, he supplied the following:

That the Association of Live Stock Sanitarians is keenly interested in the distribution of hog-cholera virus, abortus vaccine, and abortus antigen, as well as rabies vaccine perhaps in some states.

That veterinarians and farmers can circumvent state laws by purchasing these products through the mail and by having them delivered to their door in contradiction of state regulations at destination.

That the problem has become acute, particularly with reference to abortus products in many of the states.

The information supplied by Dr. Hendershott and the resolutions adopted by a number of associations appear to express the hopes and aspirations of the Association of Live Stock Sanitarians looking to a more complete control of the distribution and use of viruses, etc. It,
therefore, seems proper to compare the provisions of the Virus-Serum-Toxin Law with the provisions of the second section of the resolutions of the Minnesota Live Stock Breeders' Association. I shall attempt this a little later.

Excerpts from the Virus-Serum-Toxin Law approved March 4, 1913, (37 Stat. 832):

That . . . it shall be unlawful for any person, firm, or corporation . . . to ship or deliver for shipment from one state or territory or the District of Columbia to any other state or territory or the District of Columbia, any worthless, contaminated, dangerous, or harmful virus, serum, toxin, or analogous product intended for use in the treatment of domestic animals, and no person, firm, or corporation shall prepare, sell, barter, exchange, or ship as aforesaid any virus, serum, toxin, or analogous product manufactured within the United States and intended for use in the treatment of domestic animals, unless and until the said virus, . . . shall have been prepared under and in compliance with regulations prescribed by the Secretary of Agriculture, at an establishment holding an unsuspended and unrevoked license issued by the Secretary of Agriculture as hereinafter authorized.

That the Secretary of Agriculture be, and hereby is, authorized to make and promulgate from time to time such rules and regulations as may be necessary to prevent the preparation, sale, barter, exchange, or shipment as aforesaid of any worthless, contaminated, dangerous, or harmful virus, serum, toxin, or analogous product for use in the treatment of domestic animals, and to issue, suspend, and revoke licenses . . . .

That the Secretary of Agriculture may suspend or revoke any . . . license issued under authority of this Act, after opportunity for hearing has been granted the licensee . . . , when the Secretary of Agriculture is satisfied that such license . . . is being used to facilitate or effect the preparation, sale, barter, exchange, or shipment as aforesaid . . . of any worthless, contaminated, dangerous, or harmful virus, serum, toxin, or analogous product for use in the treatment of domestic animals.

The following recommendations are taken from the American Veterinary Medical Association Committee report of 1940 on Bang's disease because of their relationship to the control of Brucella abortus vaccine and antigen:

The Committee believes that with minor exceptions, uniformity is procurable and highly desirable as it relates to the antigen used, the technique employed and the manner of interpretation.

Smooth, fresh cultures of strain 19 supplied by U. S. B. A. I. have shown substantial evidence of being the safest and most effective immunizing agent yet employed extensively against Bang's disease, especially when used on calves, where it yields in most cases a substantial resistance.

Strain 19 is much less virulent for guinea pigs than are the ordinary field strains. (It should be added that it is much less virulent for other animals.)
To continue, and having in mind the points just enumerated (among others in the report), the committee recommended that inasmuch as strain 19 is known to be capable of producing blood reactions in cattle, immediate and vigorous steps should be taken by the federal government and the several states to prevent its use by laymen and to permit the use of vaccine only under official auspices with the requirements for tagging and reporting all vaccinated animals. The committee further indicated that in no other way can we prevent fraudulent use of the vaccine to create reactors eligible for indemnity and its indiscriminate use in mature cattle and clean herds.

That if under our present laws there is no recourse but to license biological houses that sell live Brucella abortus vaccine to laymen, then the committee recommends that the American Veterinary Medical Association Committee on Legislation be instructed to seek modification that will correct the deficiency.

Resolution adopted by the American Veterinary Medical Association at its 1936 annual meeting in Columbus, Ohio, and submitted by Dr. Hoskins to the bureau January 13, 1937, at the direction of the Executive Board of the American Veterinary Medical Association reads as follows:

WHEREAS, Communicable diseases of animals, as well as of man, are caused by living viruses and bacteria, and

WHEREAS, These communicable diseases endanger human health and cause economic loss in animals, and

WHEREAS, The interstate traffic in biological products is in violation of the respective state laws and has become a menace to the health of live stock; therefore, be it

Resolved, That the American Veterinary Medical Association respectfully call upon the Secretary of Agriculture of the United States Government to cooperate fully with the respective states in order that the practice of permitting the interstate traffic in biological products containing pathogenic organisms, including those in the experimental stage, be prohibited unless in accordance with the laws and regulations of the state of destination.

This resolution and other considerations prompted the bureau to seek the opinion of the solicitor of the department on two points, namely:

That viruses, serums, toxins, and analogous products, produced under the Virus-Serum-Toxin Law, approved March 4, 1913 (37 Stat. 832), or regulations promulgated thereunder, and in an establishment holding an unsuspended and unrevoked license from the Secretary of Agriculture, continue to be in the current of interstate commerce to their final destination within a state different than that in which the products are produced, provided they are continuously held in original packages, or immediate or true containers bearing labels like those approved under regulations of the Secretary.

That the Secretary of Agriculture may prohibit, by regulations promulgated under the Virus-Serum-Toxin Act, interstate movement of viruses, serums, toxins, and analogous products prepared in a licensed establishment
and in compliance with his regulations when the state of destination has regulations prohibiting the distribution of a licensed product originating in another state.

After due consideration the conclusion was reached that viruses, serums, toxins, and analogous products produced under the Virus-Serum-Toxin Law, and regulations promulgated thereunder, and in an establishment operating under a license issued by the Secretary of Agriculture, continued to be in the current of interstate commerce to their final destination if in any state different from that in which the products are produced provided they are continuously held in original packages, or immediate or true containers bearing labels like those approved under regulations of the Secretary.

The conclusion was reached also that the Secretary is without authority to prohibit by regulations promulgated under the Virus-Serum-Toxin Act interstate movement of viruses, serums, toxins, and analogous products prepared in licensed establishments and in compliance with his regulations even though the state of destination has regulations prohibiting the distribution of the licensed products which originated in another state.

It seems clear, in the absence of Congressional legislation, that a state by exercising its police power may regulate the administration within its boundaries of commodities that may expose man, animals, or plants to disease, injury or destruction, notwithstanding the fact that such regulations may in fact have a bearing on certain phases of interstate commerce. It seems clear also that if Congress has by affirmative legislation assumed jurisdiction over interstate commerce with respect to any specific commodity, state action in conflict with any phase of interstate commerce in the commodity is illegal and unwarranted.

Through the medium of the Virus-Serum-Toxin Law Congress appears to have taken jurisdiction, while they are in interstate commerce, over those viruses, serums, toxins, and analogous products, prepared for the treatment of domestic animals. On the other hand, there seems to be no delegation of concurrent jurisdiction over these products while they are in interstate commerce to the several states.

It seems to be the clear intent of the Virus-Serum-Toxin Law that after its requirements and regulations promulgated thereunder have been complied with that the biologics described may then be shipped in interstate commerce and are entitled to reach their destination unmolested, provided they are allowed to remain exactly as they were when shipment was made. Obviously, the state concerned may exercise its police powers after a shipment of these products has come to rest within its jurisdiction and under these powers may prevent distribution and use of the products within its borders.

Following is the substance of postal laws and regulations relating to mailing of poisonous drugs and medicines:

It is understood that the postal laws and regulations permit of the mailing of poisonous drugs and medicines only when sent by the manufacturer thereof
or dealer therein to licensed physicians, surgeons, dentists, pharmacists, druggists and veterinarians, when addressed as such. It is further understood that they also permit of the mailing of specimens of diseased tissues, blood, serum, and cultures of pathogenic micro-organisms when addressed to a laboratory which has been authorized to receive such specimens by the Postmaster General.

It has been held that certain vaccines and viruses cannot be considered poisonous in the usual sense of the word because they are not noxious or deadly under proper handling and use. Of course, hog-cholera virus is innocuous to man. If properly packed there would seem to be no danger to those handling packages of strain 19 used in abortus vaccine which is of very low virulence. It is worth noting, however, that even though construed as poisonous these products still could be transported under the postal regulations to pharmacists and druggists, which are but one step removed from the farmer. Delivery by express or other means of transportation still would be available to the manufacturer and dealer.

Extension of the Virus-Serum-Toxin Law as contemplated by the resolutions committee of the Minnesota Live Stock Breeders’ Association, as we understand it, would extend the present law to include,

(a) all veterinary biologics to be used for diagnostic purposes;

(b) those for preventive and therapeutic treatment of “all live stock and poultry” as compared to “domestic animals” under the existing law.

The present Act does not cover diagnostic agents that are not applied to the animal itself, but that are used in treating the blood outside of the animal from which it is derived. Such products are Brucella abortus antigen and pullorum antigen. To control these antigens by law an amendment would be required. It is understood that the resolutions of the Minnesota Live Stock Breeders’ Association as worded would be satisfied if the law were amended accordingly. It is very doubtful, however, that this was the intention.

We are uncertain as to the meaning of the second part of the 2d section and to the need therefor, particularly if the law is amended as proposed in the first part. However, we understand it to propose to amend the Act to include the following provisions only in case the law is not amended to include the provisions of the first part:

That all viruses, . . . prepared in the United States shall be manufactured under the supervision of the U. S. Bureau of Animal Industry and shall conform to any and all “legal requirements” of the particular state in which the products are distributed and used. As already indicated, the legal aspects of such provisions seem insurmountable and the provisions seem definitely to encroach upon the prerogatives of each of the states. However, exploration of the possibilities might lead to a different point of view. In such exploration attempt should be made to foresee some of the many difficulties of enforcement. One of your committees perhaps could very appropriately study the situation.
With the bureau's present plan of testing all abortus vaccine and strict control program covering the production of this vaccine it would seem proper for the states to attempt to develop a system uniform for all for controlling the use of the vaccine within their borders. Such a plan could be made a very powerful force in bringing distributors to a realization of the need for complete cooperation with the states and conformance to their laws. The permit system already used by some states seemingly could be improved and extended to all states and cover all distributors and users within their borders. If it were realized by all users and distributors that the several states were determined to control the situation, I believe that it could be controlled quickly and without amendment to the law aside from those diagnostic agents not covered now. In so doing, however, extreme care should be exercised to see that no regulations are made that would encourage "bootlegging" which might be carried on with little chance of detection. As before indicated, the bureau is now testing every batch of abortus vaccine prepared under license before it is released for sale. Also, subcultures of strain 19 are furnished by the bureau regularly to each licensee with the view of insuring that only satisfactory cultures are used. Those previously used must be excluded from vaccine production upon receipt of the new cultures. Under these conditions the vaccine when prepared should be of highest quality. To avoid attenuation of the product, and thus perhaps render it worthless, it is imperative that the product be held at all times at low temperatures. It is required that labels instruct all concerned to hold the product in the dark at not over 45° F.

I take this opportunity to bring to your attention the importance of revising our thinking in reference to the character and use of Brucella abortus vaccine as prepared from strain 19, which is of low virulence and does not tend to localize itself in the udder. This is in contrast to some of the vaccines furnished in recent years wherein highly virulent and otherwise unsatisfactory cultures were used. So long as Bang's disease is prevalent throughout the nation and the virulent organism is continually being incubated in infected animals to thereby expose susceptible animals through exchange in community yards and by shipment all over the country, we should not too strongly stress the dangers derived from distribution of live cultures of low virulence in bottles, where the vaccine can be controlled quite effectively. Even though misused at times its virulence still is of small consequence compared to other sources of infection. More information is needed with reference to the problems connected with the proper handling and use of this vaccine.

Should it be the consensus of opinion among experts on biologics and immunology and qualified live stock sanitarians that certain viruses, including Brucella abortus vaccine, infectious laryngotracheitis vaccine, hog cholera virus, and other viruses, are harmful to the American live stock industry, as commonly applied to domestic animals, it would seem possible to declare such biologics harmful under the Virus-Serum-Toxin Law and to deny license to these products. Until some such action is taken, the police powers of any state may be exercised with the view of controlling local conditions. Seizure and condemnation of products within a state should go far to prevent prohibited local distribution and use.
With adequate funds and ample facilities we are sure that the present law could be made to function more efficiently and effectively all along the line. We already have more authority in law covering the production of those veterinary biologics intended for the treatment of domestic animals than can be fully exercised with the limited funds and facilities available. We have heard it stated many times that more money is spent on the control of veterinary biologics than on those intended for use on man. Such a comparison, however, is manifestly unfair to the millions of farmers who are dependent upon certain biologics to protect their live stock investments in order to obtain therefrom a livelihood for themselves and their families.

Report of the Committee on Rabies of the American Hospital Association

EDWIN LAITINEN, U. S. Chairman
Hartford, Conn.

A. R. THEOBALD, D.V.M.  S. W. HAIGLER, B.S., D.V.M.
Cincinnati, Ohio  St. Louis, Mo.

It was with a great deal of pleasure that the Rabies Committee of the American Animal Hospital Association accepted this invitation from your Secretary to present our views and recommendations on the subject of Rabies Control. Particularly is it pleasing that this question, in its present formative state, can have an earnest and sincere review among you men who are the disease control heads in this country. It is our hope that this may be of some value in the laying of a solid and satisfactory foundation upon which to build a sane control plan. By no means do we wish to convey the idea that our views contain anything entirely new or revolutionary, but we have made an attempt to incorporate such measures and practices which in our opinion have merit.

It seems that the greatest initial stumbling block that we have to surmount is public opinion and bringing to the public the seriousness of the disease and the ease with which it can be controlled and eventually eradicated if dog owners and Live Stock Sanitarians can be brought together to mutually understand their common problem. The public must be taught to realize the responsibilities incidental to canine ownership—that dogs have certain limits to which they must be restricted—that owners must appreciate the feelings of their neighbors and respect their personal and property rights. The dissemination of this information can be brought about to some extent by the use of newspapers, periodicals, radio and pamphlets distributed by veterinarians themselves. There will, however, be a great many who will not be in the least interested in reading or listening to anything that might be printed or said and the only thing that will arouse any action will be an outbreak of the disease. This usually leads to a demand from certain groups that the entire canine population be annihilated and at least accomplishes the disposal of great numbers of animals and instills in the minds of a great many people a fear of all dogs. This, of course, is not necessary, but it is at this juncture that adequate control plans and the personnel to carry it out are most necessary.

Now rabies is not a disease that is constantly present but the possibility of its reappearance and its possible spread to human beings is a very real menace. We
do not feel that the difficulty in eradicating the disease lies at all in the lack of knowledge of the disease and its characteristics, neither are the necessary control measures any mystery. The success or failure of the eradication of this disease rests entirely upon the willingness on the part of the dog-owning public to tackle the problem with methods comparable to those that have been successful in the eradication of other infectious diseases in this country. A definite plan must be at hand to cope with any emergency.

It is regrettable, but an actual fact, that in a good many communities in this country disease control is a political issue. We have in some states as many agencies, rules and regulations for the control of rabies as there are political subdivisions. We also have a heterogeneous mixture of agencies that collect tax monies for dog licenses and use the same for almost every conceivable project and absolutely nothing is accrued for the welfare of the dog.

Until such time that animal disease control problems are placed in the hands of veterinary regulatory officials who are qualified by training and experience to cope with these problems, these can be no hope for efficient rabies control. This is primarily a veterinary problem and should be so handled. We feel that each state should accept full responsibility for the application and administration of uniform rules and regulations. Uniform laws pertaining to dogs, together with rules and regulations for rabies control, should be adopted by the various states with such modifications as may seem necessary to best suit existing conditions in the various states.

To arrive at this millennium will require the intelligent cooperation of control officials, veterinarians and dog owners. Since each state has a veterinary disease control organization, the control and eradication of rabies within the borders of each state should be the responsibility of that body. In view of the epidemiology of rabies, it seems unnecessary to have a continuously paid active force in the field for the detection of the disease. Constant vigilance, however, must be maintained to detect primary outbreaks and the organization should have sufficient trained personnel, legal authority and funds to immediately quarantine the area or take such efficient, effective action as the circumstances warrant.

The licensing and controlling of all dogs and the elimination of all strays is the very foundation upon which rests the eradication of rabies. To achieve this end, adequate, uniform dog laws which are practical and capable of enforcement, must be enacted and enforced by the several states through their respective legislatures. We believe that the use of a properly prepared vaccine of high antigenic value may be effectively employed as a supplement to other control measures.

It is not the function of the practitioner to serve in a police capacity, but rather to cooperate with the proper state officials in the enforcement of quarantine and other regulations employed for the control and eradication of disease. It is imperative in the control of rabies that veterinarians, dog-owners, or others, immediately report to the proper state officials all suspicious or known cases of rabies.

In conclusion, we feel that an organized effort should be made to eradicate rabies from the United States. We believe that the work should be undertaken now. That a Committee should be appointed consisting of two representatives from each of the following organizations:
2. The American Veterinary Medical Association.
5. The American Kennel Club.
7. The United States Department of Agriculture.

It is suggested that of the government representatives one be the Chief of the Bureau of Animal Industry. It shall be the function of this Committee to:

(a) Promulgate a basic plan which would be applicable to the conditions prevailing in each state.

(b) To arrange for a revision of the federal statutes whereby the federal government may cooperate with the several states for the control and eradication of rabies.

(c) To provide for a federal appropriation to carry out the work in cooperation with the states and to assist in providing and financing dog laws, both federal and state, capable of enforcement.

In order that the above plan may be put in operation, it is suggested that the secretary of the NATIONAL ASSEMBLY OF CHIEF LIVE STOCK SANITARY OFFICIALS be authorized to invite the above mentioned organization to name their two representatives to attend the meeting which will be called by the Secretary of the NATIONAL ASSEMBLY OF CHIEF LIVE STOCK SANITARY OFFICIALS.

At an early meeting of this Committee, it is suggested that consideration be given to the enactment of laws providing for the designation of quarantine stations at ports of entry. That dogs from disease-free countries be admitted and released after a minimum quarantine. That dogs arriving from countries in which the disease is known to exist be quarantined for a suitable period to be decided upon by the regulatory officials.

In addition, this Committee should encourage the federal government to study the interstate movement of dogs, particularly those from infected to clean areas, and provide suitable regulations governing the same. In conclusion, it is our belief that the prompt organization of this plan will go far in alleviating the present unsatisfactory conditions which now prevail in this country.

REPORT OF NOMINATING COMMITTEE

PRESIDENT PORT: This seems to bring us up to the report of the Nominating Committee. Are they ready to report?

DR. SMITH: Mr. President and members of the convention, your Nominating Committee has met and attended to their duties, and we are pleased to present for your consideration the following list of officers:
1st Vice-President: I. S. McAdory, Auburn, Alabama
2nd Vice-President: W. H. Hendricks, Salt Lake City, Utah
3rd Vice-President: J. M. Sutton, Atlanta, Georgia

PRESIDENT PORT: Gentlemen, you have heard the report. What is your pleasure?

DR. J. V. KNAPP (Tallahassee, Florida): I would like to move, Mr. President, that the nominations be closed.

... The motion was severally seconded, voted upon and carried unanimously. ...

PRESIDENT PORT: There being no objections, I will ask Dr. Knapp and Dr. Smith—

DR. AXBY: Mr. President, the report has not as yet been accepted.

I move you, therefore, that the report of the Nominating Committee be accepted.

DR. D. E. WESTMORLAND (Frankfort, Kentucky): I second the motion.

... The motion was voted on and carried unanimously. ...

DR. WESTMORLAND: Now I would like to move that the Secretary be instructed to cast a unanimous ballot for the nominees.

... The motion was severally seconded, voted upon and carried unanimously. ...

PRESIDENT PORT: I will now ask Dr. Axby, Dr. Smith and Dr. Knapp to bring the newly elected officers to the platform. (Applause)

... The newly elected officers were escorted to the platform. ...

DR. AXBY: Mr. President, as far as humanly possible, your request has been complied with, the escorting to the platform of the newly elected officers, with the exception of Dr. Sutton, who, I am informed, is not present at this time.

PRESIDENT PORT: Thank you, gentlemen. I think the Secretary-Treasurer should also be a part of this group.

Dr. Crossman, you have been inducted to the highest office that any member of this Association can receive. In turning over this important position to you, I give you my most whole-hearted support and assurance of cooperation.

To the Vice-Presidents, I also extend the same cooperation along with my congratulations. (Applause)

Dr. Crossman will take over his duties. In conclusion, I want to say that it has been a pleasure for me to have served in this capacity, and I have enjoyed your cooperation. (Applause)

... President Crossman assumed the Chair. ...

PRESIDENT CROSSMAN: Mr. Retiring President, and what few members of the Association have seen fit to remain, I want to express to you (and this comes from my heart) the appreciation for the confidence you have in me in electing me to what I consider a very high honor.
I know, and I think you all appreciate, that the most important duties of any officer of this Association lies in the hands of the Secretary. However, the President does have certain duties to perform, and I pledge you at this time to give all of those duties my careful consideration, and to work with the officers to make this Association a bigger and better Association.

I hope that a year from now we will be able to report so much progress that you will be proud of the officers you have elected, and we can stand here and say, "We'll be seeing you again." (Applause)

DR. McADORY: Mr. Chairman and members of the Association, I wish to thank you, and I will give my hearty support to the President, and will assist him in every way I can when called upon. Thank you. (Applause)

DR. HENDRICKS: Gentlemen, needless to say I am pleased about this recognition. I have enjoyed my association with the men who are members of this Association over a period of years. I have received a great deal of valuable information through my contacts with you, and what I have been able to glean from the proceedings of this meeting. To me it is invaluable, and I would like to see it carried on.

Certainly I am only too happy to give all the support I can to the furtherance of this Association. Therefore, if at any time I am able to give any help to the officers or Committees, I will be only too glad to do so.

Again I thank you for your confidence in electing me to this position. (Applause)

PRESIDENT CROSSMAN: Mr. Secretary, is there any further business to come before this meeting?

SECRETARY WELSH: There appears to be no further business to come before the Association at this time. Therefore, the Chair will entertain a motion to dissolve.

DR. AXBY: Mr. President, I move that we adjourn.

DR. SMITH: I second the motion.

... The motion was voted upon and carried unanimously, and the meeting adjourned sine die at 2:10 o'clock. ...
45th Annual Meeting
United States Live Stock Sanitary Association
LA SALLE HOTEL, CHICAGO, ILL.
DECEMBER 3-5
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