Proceedings of the United States Livestock Sanitary Association Fifty-Sixth Annual Meeting
Proceedings
FIFTY-SIXTH
ANNUAL MEETING
of the
UNITED STATES LIVESTOCK
SANITARY ASSOCIATION

HOTEL SEELBACK
Louisville, Kentucky
October 29-30-31, 1952
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United States Livestock Sanitary Association

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Mr. E. Robert Shannon, Lafayette, Indiana
Dr. B. T. Simms, Washington, D. C.
Mr. A. M. Smiley, Fowler, Indiana
Mr. F. C. Smith, Groveport, Ohio

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Dr. R. A. Hendershott, N. J.
Dr. R. W. Smith, N. H.

Alternates
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Dr. J. Hay, Columbus, O.
Dr. H. F. Wilkins, Helena, Mont.

REPRESENTATIVE TO POULTRY BRANCH, P. M. A.
Dr. A. L. Brueckner, College Park, Maryland

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Dr. A. L. Breuckner, College Park, Md.
Dr. T. C. Green, Charleston, W. Va.

Dr. R. L. West, St. Paul, Minn.
Dr. H. F. Wilkins, Helena, Mont.
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<th>SECRETARY</th>
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<tr>
<td>1. Sept. 27-28, 1897‡</td>
<td>Fort Worth, Texas</td>
<td>*Mr. C. P. Johnson, Springfield, Ill.</td>
<td>*Mr. D. O. Lively, Fort Worth, Texas</td>
</tr>
<tr>
<td>2. Oct. 11-12, 1898</td>
<td>Omaha, Nebraska</td>
<td>*Mr. C. P. Johnson, Springfield, Ill.</td>
<td>*Mr. Taylor Riddle, Kansas</td>
</tr>
<tr>
<td>5. Oct. 8-9, 1901</td>
<td>Buffalo, New York</td>
<td>*Dr. E. P. Niles, Virginia</td>
<td>*Dr. F. T. Eisenman, Louisville, Ky.</td>
</tr>
<tr>
<td>11. Sept. 16-17, 1907</td>
<td>Richmond, Va.</td>
<td>Dr. D. F. Luckey, Columbia, Mo.</td>
<td>Dr. C. E. Cotton, St. Paul, Minn.</td>
</tr>
<tr>
<td>15. Dec. 5-6, 1911</td>
<td>Chicago, Ill.</td>
<td>*Dr. John F. Devine, Godshen, N. Y.</td>
<td>*Mr. J. J. Ferguson, Chicago, Ill.</td>
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<tr>
<td>Date</td>
<td>City</td>
<td>Name</td>
<td>City</td>
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<td>26. Dec. 6-7-8, 1922</td>
<td>Chicago, Ill.</td>
<td>*Dr. T. E. Munce, Harrisburg, Pa.</td>
<td>*Dr. Theo. A. Burnett, Columbus, Ohio</td>
</tr>
<tr>
<td>27. Dec. 5-6-7, 1923</td>
<td>Chicago, Ill.</td>
<td>*Dr. W. J. Butler, Helena, Montana</td>
<td>*Dr. O. E. Dyson, Kansas City, Mo.</td>
</tr>
<tr>
<td>31. Nov. 30-Dec. 1-2, 1927</td>
<td>Chicago, Ill.</td>
<td>Dr. L. Van Es, Lincoln, Nebraska</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
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<tr>
<td>32. Dec. 5-6-7, 1928</td>
<td>Chicago, Ill.</td>
<td>*Dr. C. A. Cary, Auburn, Alabama</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
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<tr>
<td>33. Dec. 4-5-6, 1929</td>
<td>Chicago, Ill.</td>
<td>*Dr. Chas. G. Lamb, Denver, Colo.</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
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<tr>
<td>34. Dec. 3-4-5, 1930</td>
<td>Chicago, Ill.</td>
<td>Dr. A. E. Wight, Washington, D. C.</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
</tr>
<tr>
<td>36. Nov. 30-Dec. 1-2, 1932</td>
<td>Chicago, Ill.</td>
<td>*Dr. Peter Malcolm, Des Moines, Iowa</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
</tr>
<tr>
<td>37. Dec. 6-7-8, 1933</td>
<td>Chicago, Ill.</td>
<td>*Dr. E. T. Faulder, Albany, N. Y.</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
</tr>
<tr>
<td>38. Dec. 5-6-7, 1934</td>
<td>Chicago, Ill.</td>
<td>*Dr. T. E. Robinson, Providence, R. I.</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
</tr>
<tr>
<td>39. Dec. 4-5-6, 1935</td>
<td>Chicago, Ill.</td>
<td>Dr. Edward Records, Reno, Nevada</td>
<td>*Dr. O. E. Dyson, Wichita, Kansas</td>
</tr>
<tr>
<td>43. Dec. 6-7-8, 1939</td>
<td>Chicago, Ill.</td>
<td>Dr. J. L. Axby, Indianapolis, Ind.</td>
<td>*Dr. L. Enos Day, Chicago, Ill.</td>
</tr>
<tr>
<td>44. Dec. 4-5-6, 1940</td>
<td>Chicago, Ill.</td>
<td>*Dr. H. D. Port, Cheyenne, Wyoming</td>
<td>*Dr. L. A. Merillat, Chicago, Ill.</td>
</tr>
<tr>
<td>45. Dec. 3-4-5, 1941</td>
<td>Chicago, Ill.</td>
<td>*Dr. E. A. Crossman, Boston, Mass.</td>
<td>Dr. Mark Welsh, College Park, Md.</td>
</tr>
<tr>
<td>46. Dec. 2-3-4, 1942</td>
<td>Chicago, Ill.</td>
<td>*Dr. I. S. McAdory, Auburn, Alabama</td>
<td>Dr. Mark Welsh, College Park, Md.</td>
</tr>
<tr>
<td>47. Dec. 1-2-3, 1943</td>
<td>Chicago, Ill.</td>
<td>Dr. W. H. Hendricks, Salt Lake City, Utah</td>
<td>Dr. Mark Walsh, College Park, Md.</td>
</tr>
<tr>
<td>48. Dec. 6-7-8, 1944</td>
<td>Chicago, Ill.</td>
<td>Dr. J. M. Sutton, Atlanta, Ga.</td>
<td>Dr. R. A. Hendershott, Trenton, N. J.</td>
</tr>
<tr>
<td>49. Dec. 5-6-7, 1945</td>
<td>Chicago, Ill.</td>
<td>Dr. C. U. Duckworth, Sacramento, Calif.</td>
<td>Dr. R. A. Hendershott, Trenton, N. J.</td>
</tr>
<tr>
<td>50. Dec. 4-5-6, 1946</td>
<td>Chicago, Ill.</td>
<td>Dr. William Moore, Raleigh, N. Car.</td>
<td>Dr. R. A. Hendershott, Trenton, N. J.</td>
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### Historical

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<th>President</th>
<th>Secretary</th>
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<tr>
<td>Dec. 3-4-5, 1947</td>
<td>Chicago, Ill.</td>
<td>Mr. Will J. Miller, Topeka, Kansas</td>
<td>Dr. R. A. Hendershott, Trenton, N.J.</td>
</tr>
<tr>
<td>Oct. 12-13-14, 1949</td>
<td>Columbus, Ohio</td>
<td>Dr. T. O. Brandenburg, Bismarck, N. D.</td>
<td>Dr. R. A. Hendershott, Trenton, N.J.</td>
</tr>
<tr>
<td>Sept. 23-24-25, 1953</td>
<td>Louisville, Ky.</td>
<td>Dr. Ralph L. West, St. Paul, Minn.</td>
<td>Dr. R. A. Hendershott, Trenton, N.J.</td>
</tr>
<tr>
<td></td>
<td>Atlantic City, N. J.</td>
<td>Dr. T. Childs, Ottawa, Canada</td>
<td>Dr. R. A. Hendershott, Trenton, N.J.</td>
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* Deceased
† This was the last meeting of the Interstate Association of Live Stock Sanitary Boards
‡ Reprinted in 54th Annual Report
HISTORY OF THE CONSTITUTION AND BY-LAWS

R. A. HENDERSHOTT

Trenton, New Jersey

After some research, we have been successful in piecing together some of the early history of the United States Livestock Sanitary Association with respect to the men who served as officers and also the place and dates of the annual meetings.

This searching also brought to light some interesting facts with respect to our Constitution and By-laws, and as well, many other items of interest which time permitting, we shall try to present in subsequent annual reports.

During the early years from 1897 to 1910, this Association was known as the “Inter State Association of Livestock Sanitary Boards”, and was in fact just that. Its meetings were attended almost exclusively by official state representatives who met annually to discuss common problems, with respect to their official duties in their respective states, as livestock disease control officials. Prior to 1897 they carried on their cooperative effort with other representatives principally through correspondence. The fact that they did meet on occasions and discuss common problems is born out by the printed report of the Board of Livestock Commissioners of Illinois for 1892 pages D 102 and D 103, on which is recorded: “Resolutions adopted by the Inter-State Meeting of Livestock Boards and State Veterinarians”. See page 5 of the Proceedings of the 55th Annual Meeting of the United States Livestock Sanitary Association.

At the 1897 meeting in Fort Worth, Texas, Mr. C. P. Johnson of Illinois was elected President; Mr. R. J. Kleberg of Texas, Vice-President; and Mr. Taylor Riddle of Kansas, Secretary. Apparently there was neither any concern nor need for the election of a treasurer. President Johnson printed the report of this meeting as an addendum to the Twelfth Annual Report of the State Board of Livestock Commissioners for the State of Illinois. Pages 204–223. (Reprinted in the 54th Annual Report of the United States Livestock Sanitary Association for 1950, Pages 337–360). At the 1897 meeting, Mr. J. P. Lott of the Illinois State Board moved that the chair appoint a committee of three to draw up a Constitution and By-laws. The motion was duly seconded and passed and President Johnson appointed Messrs. J. P. Lott of Illionois; Mr. W. N. Babcock of Nebraska and Mr. W. B. Tullis of Texas as members of this committee.

Unfortunately, since we have been unable to find any printed record of the second annual meeting held in Omaha, Nebraska, October 11–12, 1898, it is not known whether or not the committee on Constitution and By-laws ever completed its task. We do know that the record of the third annual meeting in 1899 reveals that the officers at that time were president, vice-president, secretary and treasurer. Mr. W. B. Tullis of Quanah, Texas being treasurer and Dr. Mortimer Levering of Lafayette, Indiana serving as secretary. This could mean that the committee on Constitution and By-laws appointed in 1897 did make a report at the 1898 meeting and made provisions for the office of treasurer.
President C. P. Johnson at the third annual meeting in 1899 remarked, "When this Association was organized at Fort Worth, no provision was made for ways and means. The Illinois Board published the minutes of the first meeting in its annual report and copies were sent to all members; but at its second meeting in Omaha in 1898, it was thought wise to create a fund so the minutes might be printed independently and sent to all boards interested in receiving them."

Secretary Mortimer Levering announced he was ready to receive contributions to the fund to print the minutes of the meeting. Representatives of the following states each contributed $5.00: Arizona, Colorado, Illinois, Indiana, Kansas, Kentucky, Massachusetts, Minnesota, Missouri, Pennsylvania, Tennessee and Texas. A sum of $60.00 was realized. Other states represented were Michigan, Virginia and Wisconsin; the United States Bureau of Animal Industry also was represented.

Mr. Taylor Riddle of Kansas moved that 500 copies of the transcript of the meeting be printed; the motion duly seconded was passed.

The office of secretary and that of treasurer were combined at the sixth annual meeting in 1902 and Mr. William P. Smith of Monticello, Illinois elected to fill the office.

The office of treasurer was filled in 1899 by Mr. W. B. Tullis, in 1900 by Dr. H. P. Clute of Marinette, Wisconsin; in 1901 by Dr. H. P. Clute of Wisconsin. Since 1902, the office of treasurer and secretary have been combined. (1)

No reference is made to a Constitution and By-laws until 1908 when President Charles G. Lamb (1) of Colorado said, "It has been said that this Association was sired by Texas fever tick and its dam was necessity. We have been working all this year without any Constitution or By-laws, whatever, that I have ever seen. As far as I know there are no Constitution and By-laws for this Association, the conduct of its business or the limitation of its membership, and would it not be advisable at this meeting to make some arrangement towards a compilation of a set of By-laws or a Constitution?" (1)

Dr. Reynolds (2), "While the balloting is going on, I would move that the incoming President appoint a committee to draft a Constitution and By-laws to be presented at the next meeting for consideration of this Association." The motion was duly seconded and passed.

President Dalrymple. I will appoint the following committee to draft a Constitution and By-laws: Dr. Tait Butler, North Carolina; Dr. D. F. Luckey of Missouri and Dr. S. B. Nelson of Washington.

Dr. Dalrymple (3) called for a report of the committee on Constitution and By-laws. Dr. Tait Butler, chairman was not present; but a report was presented that no work had been done by the committee and a motion was carried that President Dalrymple appoint a new chairman and instruct the committee to bring in a report during the meeting. Dr. R. A. Archibald, City Veterinarian for Oakland, California, was named to replace Dr. T. Butler as chairman.

Later on a discussion took place relative to the adoption of a Constitution and By-laws and methods of raising funds to meet the expenses of the Association (4). The discussion terminated in a motion which was duly seconded and passed that the committee on Constitution and By-laws incorporate in their report an article
providing for the copyrighting of the minutes of the meetings and fixing a price at which the published copies of the proceedings of the meetings should be sold.

ADOPTION OF CONSTITUTION AND BY-LAWS SEPTEMBER 14, 1909

CONSTITUTION

Section 1. This Association shall be known as the "United States Livestock Sanitary Association".

Section 2. The purposes of this Association shall be the study of sanitary science, and the dissemination of information and methods pertaining to the control and eradication of infectious diseases among livestock.

Section 3. The officers of this Association shall be a President, five Vice-Presidents and a Secretary-treasurer.

Section 4. The elective officers of the Association shall constitute the Executive Committee.

BY-LAWS

Section 1. The duties of the several elective officers shall be those generally performed by such officers in similar organizations.

Section 2. The Executive Committee shall select the place for the meeting of the Association and execute such other duties as the Association shall direct.

Section 3. The several officers of the Association shall be elected by ballot at each annual meeting, and a majority of all votes cast shall be necessary to a choice.

Section 4. The standing committees of the Association, in addition to the Executive Committee, shall be a committee on publication, legislation, finance, credentials and resolutions. They shall each consist of three members who shall be appointed by the president at each annual meeting or as soon thereafter as may be practical.

Section 5. Any person engaged in livestock sanitary work for Federal, State, Territorial, County or Municipal governments shall be eligible to membership in this Association, and any other person interested in livestock sanitation may be elected to active membership upon the recommendation of the Executive Committee and a two-thirds vote of the members present.

Section 6. Each application for membership shall be submitted in writing and shall be referred to the Executive Committee for consideration and recommendation to the Association.

Section 7. The revenue of this Association shall be derived as follows: Each member shall pay an annual due of one dollar, payable in advance. By the sale of the annual reports of the Association at a price to be annually fixed by the committee on publication, said annual reports to be copyrighted.

Section 8. Order of Business

Roll Call
Reading of minutes
Unfinished business
President's address

Report of Secretary-Treasurer
Reading of papers, discussions, Etc.
New business
Election of officers
Report of Executive Committee
Reports of Standing Committees
Reports of Special Committees

Section 9. The meetings of this Association shall be held annually at such time and place as may be designated by the Executive Committee.

Section 10. A suspension of the By-laws may be made by a two-thirds majority for the purpose of changing the order of business to facilitate important business.

Section 11. All proposals for the alteration of the Constitution and By-laws shall be submitted in writing, and no alteration shall be acted upon until it has been referred to the Executive Committee and presented anew by them at the next meeting of the Association.

President Cotton in 1910 (5) stated "When our Constitution and By-laws were adopted last year, it was done rather hurriedly; as a consequence we have an Executive Committee to pass on candidates for membership in the Association, to be later endorsed by two-thirds vote of the Association. We also have a Credential Committee, and I don't understand what this Committee is for, because the recommendations are taken up by the Executive Committee under the Constitution.

Prior to this year, this has simply been an organization of State Sanitary Boards. Each state was supposed to pay $10.00 dues, and that gave each member of the State Livestock Board membership in this Association. Under the new Constitution we charge $1.00 as dues, and then charge for the annual report. I know that Brother Ferguson has met with some little unpleasantness on the part of some of the members who were not present at the last meeting and did not understand this situation.

We are in better financial condition than heretofore; but there are some little discrepancies in this Constitution which we ought to take up."

The first proposed amendment was presented by Dr. C. M. Haring (6), Chairman of the Executive Committee, February 18, 1915. This proposal would provide for two types of memberships designated active and associate.

"Section 5. The membership of this Association shall consist of Active members and Associate members. Any person engaged in livestock sanitary work for Federal, State, Territorial, County or Municipal governments shall be eligible to Active membership. Upon severing his official connection with Federal, State, Territorial, County or Municipal government, such member shall automatically be transferred to an Associate membership.

Any person interested in livestock sanitation may be elected to Associate membership. All applications for Associate membership must be recommended by the Executive Committee and receive a two-thirds vote of the membership present.

Only active members shall be eligible to the Presidency and Vice-Presidency of this Association.

A majority of all standing committees, including the chairman of such committees shall be active members." No action was taken on this proposal.

On December 4, 1918 (7) an amendment to Section 7 of the By-laws was presented as follows:

Section 7. The revenue of this Association shall be derived as follows: Each member shall pay an annual due of two dollars, payable in advance, and shall be entitled to a copy of the annual report upon such payment.
This is the first *proposed* amendment to the Constitution and By-laws adopted in 1909 which was passed.

*Amendments proposed in 1919 (8)*

Amendment to Section 6 of the By-Laws. For "Executive" in this section substitute "Credentials" making Section 6 read as follows:

Section 6. Each application for membership shall be submitted in writing and shall be referred to the Credentials Committee for consideration and recommendation of the Association.

*Proposed additions to the By-Laws*

Section 18. In matters of a purely regulatory nature, voting in this Association shall be as follows: Each state shall have one vote to be cast by the state's accredited representative of the Livestock Sanitary Control Force of the State. The United States Bureau of Animal Industry shall have ten votes to be cast, one by the Chief of the Bureau of Animal Industry Division, and one by the Chief of each of the following Divisions of the Bureau; Animal Husbandry Division, Biochemic Division, Dairy Division, Field Inspection Division, Quarantine Division, Tick Eradication Division, Tuberculosis Eradication Division, Zoological Division and Division of Hog-Cholera Control. The National Livestock Breed's Associations shall have one vote each to be cast by its accredited representative. No State, Division of the Bureau of Animal Industry or National Livestock Breed's Associations shall be entitled to a vote unless its accredited representative be present when the vote is taken.

*Proposed Amendment to the Constitution*

Section 4. Add to this section: The first vice-president shall be chairman of the Executive Committee.

*Proposed Amendments to the By-Laws*

Section 5. There shall be two classes of membership in the Association, active members and associate members. Any person in charge or representing livestock sanitary control work in any State, the Chief of the Bureau of Animal Industry, and heads of the various divisions within the Bureau of Animal Industry and the President or Secretary of all National Livestock Breeders' Associations shall, ex-officio, be eligible to active membership. Any person interested in livestock sanitation may be elected an associated member upon recommendation of the Credentials Committee and a two-thirds vote of the members present.

Only active members shall be eligible as elected officers of the Association and a majority of all committees shall be active members of the Association.

Section 6. Add the following at the end of this Section: Except as provided in section 5, applicants recommended for membership by the Executive Committee may be elected by a majority vote. This association may, by vote of three-fourths of the members present, direct the Executive Committee to recommend an applicant for membership.

Section 7. To read as follows: "The annual dues shall be $2.00 payable in advance
and shall entitle each member to a copy of the annual report of the Association. No report shall be supplied to any member whose dues are not paid in advance."

Section 8. Instead of at present given, to read as follows: "The Secretary-Treasurer shall, prior to each meeting, publish and send to each member a program for the meeting, showing the order of business and such order shall not be changed except as provided in Section 10."

Section 11. To read as follows: "All proposals for the alteration of the Constitution and By-laws of this Association shall be submitted in writing, and shall be referred to the Executive Committee of the Association. Proposed alterations submitted at any meeting shall not be acted upon by the Association until after publication in the annual report; but in emergencies and at the discretion of the President and Secretary-Treasurer, proposed alterations may be submitted in writing to each member of the Association not less than ten days in advance of any annual meeting and acted upon at the succeeding meeting without previous publication in the annual report.

Note the proposed amendments offered at the 23rd Annual Meeting in 1919 were considered at the 24th Meeting in 1920 (9).

Amendment to Section 4 of the Constitution was adopted, which now reads:

Section 4. The elective officers of the Association shall constitute the Executive Committee. The First Vice-President shall be chairman of the Executive Committee.

Proposed amendment to Section 5 of the By-laws was tabled.

Proposed amendment 6, 7, 8, and 11 passed.

Considerable discussion took place with regard to the possibility of amending any proposed amendments as long as the material presented related to the subject matter contained in the proposed and published amendment. It was decided that this could be done.

Proposed addition of paragraph 12 to the By-laws was tabled.

Next proposed amendment to Section 5 previously tabled was by motion removed from the table for reconsideration.

An amendment to the proposed amendment to Section 5 was moved and seconded. Dr. Cary of Alabama remarked, "That cannot be done without laying the matter over for another year. We tabled this. Unless you take this off the table, your proposed amendment must lay over for a year."

Dr. Cary moved that proposed amendment to Section 5 be taken off the table and reconsidered—this motion was duly seconded and passed 27 to 23.

Dr. Bahnsen, "I now offer a motion to amend Section 5, by striking out the words "Executive Committee" and substituting, in lieu thereof, the words "Credentials Committee."

CONSTITUTION AND BY-LAWS NOVEMBER 30, 1921

CONSTITUTION

Section 1. This Association shall be known as the "United States Livestock Sanitary Association" (1909).

Section 2. The purposes of this Association shall be the study of sanitary science,
and the dissemination of information and methods pertaining to the control and eradication of infectious diseases among livestock. (1909).

Section 3. The officers of this Association shall be a President, five Vice-Presidents and a Secretary-Treasurer. (1909).

Section 4. The elective officers of the Association shall constitute the Executive Committee (1909). The First Vice-President shall be chairman of the Executive Committee (1920-1921).

**BY-LAWS**

Section 1. The duties of the several elective officers shall be those generally performed by such officers in similar organizations. (1909).

Section 2. The Executive Committee shall select the place for the meeting of the Association and execute such other duties as the Association shall direct (1909).

Section 3. The several officers of the Association shall be elected by ballot at each annual meeting, and a majority of all votes cast shall be necessary to a choice (1909).

Section 4. The Standing Committees of the Association, in addition to the Executive Committee, shall be a Committee on Publication, Legislation, Finance, Credentials and Resolutions. They shall each consist of three members who shall be appointed by the President at each annual meeting or as soon thereafter as may be practical (1909).

Section 5. Any person engaged in livestock sanitary work for Federal, State Territorial, County or Municipal governments shall be eligible to membership in the Association and any other person interested in livestock sanitation may be elected to active membership upon the recommendation of the Executive Committee and a two-thirds vote of the members present. (1909).

Section 6. Each application for membership shall be submitted in writing and shall be referred to the Executive Committee for consideration and recommendation to the Association. (1909).

Except as provided in Section 5, applicants recommended for membership by the Executive Committee may be elected by a majority vote. This Association may, by vote of three-fourths of the members present, direct the Executive Committee to recommend an applicant for membership. (1921).

Section 7. The annual dues shall be $2.00 payable in advance and shall entitle each member to a copy of the annual report of the Association. No report shall be supplied to any member whose dues are not paid in advance. (1921).

Section 8. The Secretary-Treasurer shall, prior to each meeting publish and send to each member a program for the meeting, showing the order of business and such order shall not be changed except as provided in Section 10. (1921).

Section 8. Order of Business (1909).

Roll call
Reading of minutes
Unfinished business
President's address
Report of Executive Committee
Reports of Standing Committees
Reports of Special Committees

Report of Secretary-Treasurer
Reading of papers, discussions, etc.
New business
Election of officers
Appointment of committees
Adjournment
Section 9. The meetings of this Association shall be held annually at such time and place as may be designated by the Executive Committee. (1909).

Section 10. A suspension of the By-laws may be made by a two-thirds majority for the purpose of changing the order of business to facilitate important business. (1909).

Section 11. All proposals for the alteration of the Constitution and By-laws of this Association shall be submitted in writing, and shall be referred to the Executive Committee of the Association. Proposed alterations submitted at any meeting shall not be acted upon by the Association until after publication in the annual report. (1921).

REFERENCES
A BRIEF HISTORY OF LIVE STOCK SANITARY CONTROL WORK IN
NORTH DAKOTA
1887–1952

T. O. BRANDENBURG

Bismarck, North Dakota

The first law pertaining to the control of contagious and infectious diseases of live stock under veterinary supervision was passed by the Territorial Assembly of 1887. Prior to this the work was handled by the Board of Health under the supervision of a medical doctor.

This law provided for the appointment of a "Veterinary Surgeon" by the Governor to investigate contagious and infectious diseases among cattle, horses, mules and asses. Sheep were not included.

The Governor was empowered to declare quarantine on stock from other states by proclamation. Also where the veterinary surgeon reported local epidemics the Governor was authorized to issue proclamation restricting the movement of stock from the infected territory.

The veterinary surgeon was authorized to order the slaughter of diseased animals, but in the instance of animals condemned not showing disease the veterinary surgeon must call into consultation two respectable practicing veterinarians, which, if not available, could call two freeholders.

All condemned animals were appraised, destroyed and the carcasses burned to ashes, or buried not less than six feet under the ground. The hides must be cut and scarified so as to be useless.

The law provided for indemnity for animals destroyed for incurable diseases as rinderpest, foot-and-mouth disease, anthrax and Texas fever among bovines and glanders among horses.

The appraised value of cattle could not exceed $50, except registered stock which was limited to $150. The appraised value of horses not to exceed $100 except registered stock which was limited to $300.

The fund for indemnity was established by a one mill tax on the dollar upon the assessed valuation of all cattle, horses and mules constituting the "Stock indemnity Fund".

The Veterinary Surgeon's salary was $2500 per annum and necessary expenses incurred.

Provision was made for the appointment of not more than five deputies at $5.00 per day.

Qualifications were not indicated.

The first veterinary surgeon for the Territory was Dr. C. John Alloway of Grand Forks, who took office March 28th, 1887, served until 1890, and rendered a report to the Governor for the period from that date to November 30th, 1888.

This report indicates that Dr. Alloway was a well educated and competent veterinarian, although it appeared he could not attend to half the investigations the conditions called for.
To give an idea of conditions at this period, I am quoting from Dr. Alloway's report, as follows:

"On entering upon the duties incumbent on my office I found their discharge was not by any means popular. Although a general willingness was prevalent that disease should be eradicated from the territory, yet in many instances signal opposition was evinced, especially was this the case with those persons possessing horses affected with the equine disease, glanders.

Ignorance of its virulent character and apathy to the risk to human life which harbouring the disease engendered were certainly not what should have been expected in an intelligent community. Patience in describing to individuals and communities its malignant, fatal and highly contagious character has been exercised.

These efforts, together with explanation of the law, have resulted in bringing about an understanding and change of feeling to such an extent that calls from all parts of the territory have been multiplied, accumulating much faster than they could be taken care of.

Those aware of the great extent of our territory and the many outlying farms, and hamlets, tens and scores of miles from the line of railway, must realize that much time and tiresome travel are involved in reaching them.

The long Dakota winter, with its often times low temperature, sudden blinding storms, obliterating landmarks and roads in the snow, and lack of hotel accommodations in many places, render the faithful performance of sanitary duties not unattended with risk, hardship and discomfort.

On more than one occasion, when owners of diseased horses were unwilling to submit to their destruction, the official of this Department has been threatened, which sometimes necessitated the work being done not only under adverse circumstances but where even life itself was in danger."

It also appears from this report that considerable dissatisfaction existed among owners of horses condemned for glanders, regarding operation of the indemnity law.

As the tax levy to create the stock indemnity fund did not become available until March, 1888, there was no money to pay for animals destroyed the first year, and the report indicates that services were suspended for quite a period on account of lack of funds.

To quote further from the report,—"Many requests were received which, upon investigation, were found to be utterly frivolous or with malicious intent. Others again though the office was created for the benefit of any and all who might require the services of a veterinary surgeon for any of the ills to which farm stock are liable.

Over 50,000 head of livestock have been inspected during the period referred to and it can be asserted without fear of contradiction that, speaking generally, the livestock of Dakota is in a more healthy condition than that of any state or territory in the Union".

The greater number of horses destroyed for glanders were in that part of the territory that is now South Dakota.

Two outbreaks of anthrax occurred in what is North Dakota.

No more reports of territorial work were available.
We find that during the first session of the legislature after statehood, 1890, a law was passed for the investigation of contagious and infectious diseases among cattle, horses, mules and asses, (hogs and sheep omitted).

We find that the law was similar to the territory law, with the exception of a few changes. The provision for the qualifications of the State Veterinarian was changed to read: Graduate of a recognized Veterinary College, or instead not less than five years actual practice as a veterinary surgeon.

The mill tax for the stock indemnity fund was omitted. So there was no provision for indemnity payments.

Dr. W. C. Langdon was appointed as the first State Veterinarian in North Dakota, March 1890.

Dr. Langdon's report indicated that sheep scabies was the most difficult problem he had to contend with. Large bands had been imported from the western states to graze on the vacant land that was available. While the disease did not cause much loss during the summer season, the flocks that were held over during the winter were almost depleted.

The existence of black leg or symptomatic anthrax was quite prevalent.

Regarding this disease Dr. Langdon stated in his report: "No trouble has been experienced in checking the progress of this disease, wherever found, by simply giving one-half ounce of chlorate of potash twice daily and introducing a seaston wet with oil of turpentine through the dew-lap. The chlorate may be given in a little bran or with common salt. These remedial measures are to be adopted simply as preventatives".

He further states: "The principal causes of this disease are an extensive amount of nourishment suddenly thrown into the circulation and remaining unappropriated by the tissues. It begins to break down and undergo decomposition—thus causing gas which forms under the skin, and stagnant water, which may produce the disease when an animal is not too highly nourished, by throwing the decomposed material directly into the circulation.

There are other causes besides those enumerated, assigned, but I have never seen but one lot of cattle affected where these causes did not seem to be at the bottom of the trouble, and these were kept in a stable which had not been cleaned from fall 'til spring and they were standing on a bed of decomposing matter, at least four feet thick. In this case the foul gases exhaled and inhaled were the cause of the trouble".

In the report for year 1892 Dr. Langdon stated that while the State Veterinarian was authorized to appoint an unlimited number of deputies, qualified men were scarce. Plenty of theoretical veterinarians were available but lacked experience—report stating,—"Indeed I have met with graduates of colleges who have confessed that they never had seen a single case of glanders previous to their starting the practice of their profession". In further comment on glanders he states,—"Since for fifteen years I have been engaged in the investigation of glanders and have made during that time over four hundred autopsies upon subjects affected with this disease, I consider it possible to give such a description of its various forms and stages as will render unnecessary the various circumlocutious methods of detecting the presence of the malady, so extensively advised and practiced by some of the
profession, as subjecting the animal to the introduction of the cultivated bacillus into the system, and numerous other expedients, which, to say the least, are very difficult to demonstrate."

He also states that the farcy form of glanders was amenable to treatment and many cases had been cured.

Some 30,000 sheep were lost through scabies.

The election of 1892 changed the political situation. By the fusion of the Democrats and populists a Democratic governor was elected.

There were several applicants for the office of State Veterinarian.

Dr. I. Turcot of Minto received the appointment.

In 1892 after the legislature convened it was decided that more appointments could be made if the state was divided into districts. The first bill proposed was to divide the state into three districts, but this would not provide for all the applicants. So the bill was passed creating six districts—each judicial district comprising a veterinary district.

Practically all the provisions of the original state law were incorporated in this new law.

The district veterinarians were appointed by the Governor for a period of two years, and were given the same power and authority as had been previously granted to the State Veterinarian.

The district veterinarians were also authorized, with the consent of the Governor, to appoint deputies.

In cases of owners being dissatisfied with diagnosis, two other district veterinarians must be called and a consultation held.

District veterinarians were paid $600 per annum, with no allowances for expenses, except in cases of consultation.

Annual reports were to be made to the Governor by the district veterinarians indicating work performed and diseases investigated.

Four graduates and two non-graduates were appointed as district veterinarians.

It is interesting to note that Dr. Turcot reports that in July, 1893, he found a case of dourine in Pembina County. He states the animal was placed under quarantine and died a short time thereafter.

The reports for 1893 indicate that mallein was being used for the first time as a diagnostic agent for glanders. Tuberculin was also used to some extent to diagnose tuberculosis, but little attention was given to this disease.

Some of the reports indicated a knowledge of the true cause of blackleg, and the application of a vaccine as a preventative, although one of the district veterinarians stated,—"I have never failed to prevent the spread of blackleg by administering chlorate of potash or carbolic acid in drinking water".

This same veterinarian has this to say about glanders:—"A horse inoculated with the virus of glanders may produce farcy, or an animal affected with the taint of farcy may become glandered, yet all authorities set forth this claim that glanders is the most violent of the two diseases—thus it gives to the imperfect organic structure a longer lease of life".

One of the district veterinarians made an excellent report, one of the statements
made being, as follows,—“While I do not want to throw any cold water on the hog industry, I wish to refute an erroneous idea that hog cholera and swine plague will not exist in North Dakota. Just as soon as this industry is developed in this state to any extent hog cholera and swine plague will be prevalent. However, precautions can be taken by quarantine and disinfection that will help prevent great loss”.

It is to be noted that the non-graduate district veterinarians both had deputies. In one district the work was practically all performed by the deputy. It is also to be noted that these men had considerable difficulty in disposing of diseased animals without calling consultation.

During 1893 and 1894, 232 horses and mules were destroyed for glanders.

The law was changed in 1895. It provided that the Professor of Veterinary Science at the State Agricultural College should be Chief State Veterinarian, without compensation, and also created one more district, making seven veterinary districts.

Dr. T. D. Hinebauch became the first Chief State Veterinarian.

The Chief State Veterinarian was given authority to make quarantine regulations and enforce same after approval by the Governor, and also to prescribe rules and regulations necessary to carry on this work.

It seems that the non-graduates had the best political standing at this time, as five non-graduates and two graduates were appointed.

What little work that was done during this year was on glanders.

In one district the veterinarian said that there had not been a single case since his appointment. He stated he had destroyed two horses suffering from catarrh that would run into glanders in a short time. In a couple other districts there had been no calls.

The year 1896 was a bad year for glanders. In one district 94 horses were destroyed and 150 quarantined. The disease was found on over 50 farms.

In 1897 there was a very active campaign for the appointments of district veterinarians. While voluminous petitions were submitted, the appointments were largely decided by the members of the legislature in the different districts.

One applicant in whose district there was a bitter fight presented a personal letter from a preacher to the Governor stating that the applicant was exceptionally well qualified, of sterling character and excellent reputation. In contrast to this was a personal letter to the Governor in which a Congressman stated that the applicant was a drunken, disreputable character, absolutely incompetent, a disgrace to the community and his appointment would seriously reflect on the Governor’s judgment. The applicant was reappointed just the same.

Owing to the increased amount of work in some districts and the strenuous demand for appointments the legislature amended the law, making two more districts or nine veterinary districts in all.

This time five graduates and four non-graduates landed the appointments.

During this session of the legislature a law was passed providing, as follows,—“The district veterinarian shall seize and inspect all animals coming into his district, and the district veterinarian making such seizure and inspection shall require the owner or person in charge of such animals to pay five cents each for the inspection of sheep, fifteen cents for the inspection of cattle, and one dollar each for the inspec-
tion of horses, mules and asses; one-half of the money so collected to be immediately transferred to the Chief State Veterinarian, to be transmitted monthly by him to the State Treasurer.

On account of the low value of livestock during this period it was presumed that these charges would have a salutary influence in the prevention of stock being brought in. The veterinarians thought it was a good law, as under their construction they retained one-half of the fees.

At the beginning of this period there was a change made in the chair of Veterinary Science and Dr. W. C. Langdon became Chief State Veterinarian.

There was considerable controversy carried on between the Chief State Veterinarian and district veterinarians as to the proper interpretation of the law regarding the disposition of fees collected for inspection of stock coming into the state.

The Chief State Veterinarian contended that the district veterinarians should send him one-half the fees collected and remit the other half to the county treasurer of the county where the inspection was made. The Chief State Veterinarian called on the Governor and Attorney General to make the district veterinarians disgorge the fees they were retaining but there is no evidence that he was successful.

In the report for 1898 the Chief State Veterinarian elaborates extensively on this inspection work and indicated his belief that some of the district veterinarians did not remit any of the fees collected. He also criticized the law as to compensation for state work, showing that some of the veterinarians were rendering service commensurate with their salary while others were giving no attention to work in their district, except the inspection of stock with which fees were connected. Also the fact that no expenses were provided put a premium on the district veterinarians staying home in order to avoid incurring expense.

This report indicates that hog cholera had made its appearance, causing an estimated loss of 1200 head. The report also states that a horse serum was being prepared as a preventative against hog cholera, but its success had not been demonstrated.

Quite an extensive outbreak of rabies occurred—dogs, horses, cattle, pigs and sheep having been found affected with this disease.

Again in 1899 there was another strife for the appointments to the different districts. Again five graduates and four non-graduates were appointed, although there was some change in personnel of same.

There was no change made in the law during this session of the legislature in spite of the agitation of the Chief State Veterinarian. The fact that he resigned prior to the meeting of the legislature may account for it.

The next report is for the years 1899 and 1900. Dr. J. W. Dunham was Chief State Veterinarian during this period.

335 horses were destroyed for glanders. Hog cholera was reported very prevalent—it being estimated that $50,000 worth of animals were lost as a result of this disease. Contagious abortion was reported to be quite prevalent and treatment was recommended. Contagious ophthalmia and rabies were also contended with.

We quote the following from one of the district veterinarian's reports, as follows,—"Mr. Sheppard wishing to try the much heralded cure (so-called) for glanders of
Dr. W. C. Langdon asked permission to call Dr. Langdon and have him treat or suggest a treatment for his horses.

This was granted and two days later, June 27, 1899, Dr. Langdon saw the horses, agreed with my diagnosis of the cases and immediately proceeded to destroy the horses that were diseased.

Dr. Langdon refused to treat them, knowing full well that the horses had glanders and that his treatment would be an absolute failure. Dr. Langdon never cured a single authenticated case of glanders or farcy, and of the so-called cases of glanders he treated he never would allow other veterinarians to verify his diagnosis. This showed he feared an exposure of his methods, which since have been an injury to the stock interests of the state”.

We were unable to find that any report was made by the Chief State Veterinarian for the years 1901 and 1902 or any record of work performed by district veterinarians during that period.

In 1903 another veterinary district was created, making ten districts—the appointments being equally divided, five graduates and five non-graduates.

During this year Dr. L. Van Es was appointed to the chair of Veterinary Science and became Chief State Veterinarian.

During this year the Chief State Veterinarian issued bulletins dealing with infectious abortion, scours in calves, blackleg, cattle scabies and stock poisoning.

The first reference to cattle scabies occurred during this year.

The Chief Veterinarian reports that as a result of interviews with cattlemen in the western part of the state it was determined that cattle scab existed to quite an extent and caused considerable loss during the past winter. Stockmen stated that the loss in some herds from scabies reached 50 per cent, and that something would have to be done to eradicate the disease or they would be forced out of business.

The Chief State Veterinarian requested the Attorney General to give an opinion as to what line of action could be pursued under the law to eradicate this disease. The Attorney General gave as his opinion that there were no funds available, under the law, that could be used for this purpose and that the stockmen would have to take care of the situation at their own expense. A proclamation was issued, placing a quarantine where cattle scabies was known to exist. Considerable dipping was done during this season, but as no systematic procedure was adopted little benefit was derived, as the dipped cattle were again exposed to diseased cattle that were not treated—this being on the open range.

Reference is made in this report to bovine tuberculosis and the importance of the control of this disease on account of the danger of transmission to the human family.

Hog cholera existed to quite an extent, and a proclamation was issued placing the hogs in Cass County under quarantine.

During this year a laboratory was established by the Chief Veterinarian and the preparation of tuberculin and mallein was started. This laboratory was also made available for the examination, microscopically, of such material as might be received.
Two hundred and seventy-one horses were destroyed for glanders during this year.

The report for the year 1904 indicated that cattle scabies had spread to an alarming extent and was a serious menace to the industry. The previous winter had been a severe one and in herds where scabies existed the loss was very great.

On account of the prevalence of cattle scabies, the United States Department of Agriculture placed a quarantine on the cattle in North Dakota, restricting the interstate shipments of any cattle diseased or exposed unless properly dipped. As this meant that the cattle in the localities where scabies existed could not be moved to market unless dipped, the situation became a serious one.

This was a hard year for the Chief State Veterinarian as the burden of organizing the work fell on him. He was compelled to neglect his college duties to give the work attention, sacrificing his time and labor without compensation, which was a rank injustice.

In conjunction with the United States Bureau of Animal Industry a system was established. The Governor authorized an appropriation for the purpose of erecting dipping tanks and purchasing dipping material in the unorganized counties, which comprised the greater area of the infested district.

Deputies were appointed to supervise the dipping. The Federal department detailed a large number of veterinary inspectors to direct and assist in the work. After overcoming many discouraging features dipping over the infected area was established, and the prospects were bright for a general clean-up that season. However, through the influence of a delegation of Montana cattlemen, who visited Washington and conferred with President Roosevelt, the Secretary of Agriculture was forced to modify the regulation and permit the movement of beef cattle without dipping. When this order was issued all dipping came to an end for that season.

Eighty-seven dipping vats were established and about 250,000 cattle were dipped during that season.

It is interesting to note at this time that while it was anticipated that scabies could be eradicated in one season it was six years before the quarantine was raised, and in some states the disease has not been eradicated yet. In North Dakota an occasional sporadic outbreak has occurred.

Considerable mange in horses was found during this year, and 320 horses were destroyed because of glanders.

The legislature of 1905 created two more veterinary districts, making twelve in all. Eight graduates and four non-graduates were appointed.

The dipping of cattle for scabies was continued through the season and principally by the United States Bureau of Animal Industry—a large force of inspectors being detailed for inspection of cattle and directing dipping.

The report for 1906 indicates that the dipping of cattle for scabies was continued. It also shows that under the district veterinarian system disease was on the increase and in some districts the work became so great that the district veterinarians resigned, which put a new phase on the situation.

Some work was done on tuberculosis, showing a very high percent infection. One thousand six hundred twenty-six cattle were tuberculin tested, 329 reacting positively to the test, 20.2 per cent.
Owing to the number of tuberculous animals found a proclamation was issued by the Chief State Veterinarian and approved by the Governor requiring that all dairy and breeding cattle must be subjected to the tuberculin test before being admitted.

Four hundred seventy-six horses were destroyed for glanders during this year.

In this report the Chief State Veterinarian made very strong recommendations for a change in the law. This concludes the history of livestock sanitary control work under the district veterinarian system.

As any one interested can have access to reports of the State Livestock Sanitary Board we will only briefly allude to the work performed under this system.

As stated in the report of the Chief State Veterinarian, Dr. L. Van Es, the work under the district veterinarian system was not accomplishing the desired results. Communicable diseases were on the increase, especially glanders, and calls for investigations were not given the attention they were entitled to. The Chief State Veterinarian did not have enough authority to change the conditions.

After giving the subject considerable study, Dr. Van Es decided that a law providing for a livestock sanitary board, comprised of stockmen and veterinarians with authority to elect an executive officer and such agents of the board as were necessary, also power to establish such rules and regulations as were deemed necessary to control and suppress contagious diseases of livestock, was the most desirable.

Accordingly, our present law was drafted by Dr. Van Es and was introduced during the legislative session of 1907 by Senator Frank Talcott of Cass County. After a somewhat stormy experience it was passed by the legislature and signed by the Governor. The law carried the emergency clause, placing it in effect at once. However, it was a month after the law went into effect before the Board was appointed.

The Board met immediately after appointment and organized as follows: Mr. Dugald Campbell, Kintyre, President; Dr. J. W. Robinson, Garrison, Vice President; Mr. M. L. Richards, Dickinson, Secretary. Dr. E. J. Walsh, Willow City, and Mr. Andrew Veitch, Grand Forks, were the other members.

The Board elected Dr. W. F. Crewe to act as Executive Officer and State Veterinarian.

The Board also appointed agents to act as assistant state veterinarians.

The Board also drafted and established rules and regulations for the control and eradication of the different communicable diseases.

This law has been in operation for over forty-five years.

The successful operation of any law of this nature depends largely on its intelligent enforcement. The success acquired by this livestock sanitary board is largely due to the faithful and intelligent cooperation received from the practicing veterinarians who acted as the board’s agents.

During the 1907 session of the legislature a law was passed providing indemnity for animals destroyed for glanders. While the law was found defective, as it did not create any fund for this purpose, it did help a great deal as the claims were made out and filed, the owners being told that the next legislature would provide funds for their payment.

The Board realized they had a serious condition to deal with, especially glanders.
It was found necessary to destroy over 1,000 horses the first six months. When it was considered that the animals destroyed were clinical cases it can be appreciated that there would be a large number of contact animals to be taken care of.

On account of this disease and the very limited funds available for carrying on the work, very conservative methods were adopted.

Outbreaks of glanders occurred in every county in the state.

Later on more rigid regulations were established, requiring the mallein testing of all exposed or suspicious animals.

After the first and third years there was a gradual decline in the number of animals destroyed because of glanders. Up to the past year, when only one animal was destroyed because of this disease, a total of 7,084 glanders infected horses have been destroyed.

The work on cattle scabies was continued until 1910, during which year the state was considered free from this disease and the Federal quarantine was raised. For several years no cases of cattle scabies were reported. Within the last few years a few sporadic outbreaks have been taken care of by dipping.

During the winter of 1912 and 1913 reports were received of considerable loss of stallions and mares in the range section in the western part of the state, also in eastern Montana. Investigations were made by federal and state authorities and it was determined that these animals were dying from dourine. The disease was also found on the Standing Rock Reservation. The United States Bureau of Animal Industry was appealed to for action toward the eradication of this disease. The Bureau stated that it would be necessary for the state to cooperate on practically a 50-50 basis. As no funds were available and no provision by law to provide indemnity, the Governor was appealed to for help in the matter.

Governor Hanna advised the Board to establish a regulation to take care of the situation and that proper provision would be made by the next legislature.

The regulation provided for the blood testing of all breeding animals in the districts where the disease occurred. Provision was made for payment of indemnity for animals destroyed. The maximum for grades was $100, and for registered pure-bred stock, $150. A force of federal and state inspectors were detailed to secure blood, that was forwarded to Washington, where the complement-fixation test was applied, 23,227 animals were tested—780 being found infected were destroyed. No cases have been found since 1922.

In connection with the work on dourine, an incident occurred that was rather aggravating at the time, but terminated with satisfactory results. Three mares were condemned because of dourine. When we came to destroy them we found the owners had secured an injunction against their destruction. The case was tried in the District Court and the Sanitary Board was sustained. The case was carried to the Supreme Court, where again the Sanitary Board was sustained by a very broad decision. This decision removed any doubt as to the constitutionality of the law and the authority granted the Livestock Sanitary Board.

Outbreaks of anthrax were reported during 1913 and several outbreaks have occurred during succeeding years. Fortunately, very little loss has been incurred in this State through anthrax.
The State Veterinarian of South Dakota stated that he did not know of a county in that state that did not have an outbreak of anthrax at one time or another. Outbreaks of rabies occurred in Ward, McHenry and McKenzie Counties. Both horses and cattle contracted this disease.

Fortunately, few outbreaks of rabies have occurred in North Dakota.

The State was fortunate in the 1915 outbreak of foot-and-mouth disease by escaping the infection that spread to so many states through infected cattle being shipped out of the Chicago stockyards. A shipment of cattle from Chicago destined to Montana was unloaded at the Mandan stockyards. Five head showed symptoms of foot-and-mouth disease. The shipment comprising 800 head was loaded out and proceeded to Montana, where the disease spread very rapidly, and the entire shipment was destroyed.

The disease spread to two other localities but was finally brought under control. The Mandan yards were placed under quarantine with guards.

A few sheep that were in the yards were killed and buried. The yards were thoroughly cleaned and disinfected. Fortunately, no other cases occurred.

Another shipment of cattle from Chicago was unloaded and fed at Jamestown stockyards. This shipment was destined to Spokane, Washington and was found infected with foot-and-mouth disease at destination.

The Jamestown yards were quarantined and disinfected. All animals that had passed through the Jamestown yards were quarantined and kept under observation but, fortunately, no infection occurred.

In spite of the most stringent laws, livestock people were occasionally being defrauded through the purchase of tuberculous cattle. The Livestock Sanitary Board decided to establish a regulation that all purebred cattle entering this state must be subjected to a sixty to ninety day retest. This regulation had a good effect in limiting these frauds. A suit for damages was successfully prosecuted against a dealer in Wisconsin who had sold two cars of holstein cattle to a North Dakota citizen that were found extensively tuberculous.

The campaign against bovine tuberculosis continued, accelerated by the use of the intradermal method of testing and proper laws and regulations to make area testing possible. By 1924 the fight was being pursued in many of the counties and by 1932 the entire state was classified as a modified tuberculosis-free area.

The most common diseases of cattle, such as scabies, blackleg, hemorrhagic septicemia, coccidiosis, infectious keratitis, contagious abortion and others have occurred and have been pretty well controlled by segregation, sanitation and vaccination, so that no general serious loss has existed.

In horses, glanders was the most serious disease, with dourine a close second. Occasional loss occurred from swamp fever, irregular strangles and forage poisoning.

In swine, cholera, swine plague, necrotic enteritis and other diseases, as well as parasites, had to be contended with.

Few diseases occurred amongst sheep.

Dr. W. F. Crewe, first State Veterinarian under the Livestock Sanitary Board Law, died in November 1932 during the meeting of the United States Livestock
Sanitary Board at Chicago. The Board at considerable loss as to how to fill a position which had been so efficiently held by Dr. Crewe for 25 years, finally selected Dr. T. O. Brandenburg, a practitioner and agent of the Board, who has served in the capacity of State Veterinarian and Executive Officer of the Livestock Sanitary Board since that time.

At the first Board meeting Dr. Brandenburg made the following statement about Dr. Crewe's work:

"During the period of this report this department sustained a great loss in the death of its Executive Officer and State Veterinarian, Dr. Wilton F. Crewe—who passed away November 30th, 1932.

Dr. Crewe was our first State Veterinarian—having served in that capacity since the organization of the Livestock Sanitary Board in 1907. He devoted the best years of his life to the livestock interests of North Dakota, and during that time was able to practically eradicate glanders, dourine and scabies. Under his leadership North Dakota's cattle were all tested and the percentage of tuberculosis reduced below one-half of one per cent. The state became a modified accredited tuberculosis-free area July 1st, 1932. It was the second state west of the Mississippi River and the eighth in the Union to achieve this signal honor.

Dr. Crewe was a man of sterling character and high professional attainments. He was endowed with executive ability, and was able to hold the loyalty of the veterinarians in the state and bring out their best efforts in the eradication of infectious diseases of livestock.

Dr. Crewe was given the opportunity to build the structure he did by being unhampered by politics and by being supported by one of the best Livestock Sanitary Boards in the United States. The aim and only thought of this Board has been the livestock interests of North Dakota. They have backed their Executive Officer to a man in his infectious disease control program. Considerable credit is due this Board for the success made by North Dakota along these lines, and the fact that the majority of the members have served continuously has had much to do with the progress made.

These were especially trying periods in North Dakota. The drought conditions, coupled with the depression had resulted in many bank failures, and in failures among the livestock people and farmers. The result was that the Legislature of 1932 cut appropriations for all State purposes to a very low figure, making it imperative for the Livestock Sanitary Board to eliminate its full-time assistant state veterinarian and also curtail all activities in connection with livestock sanitary work. It was fortunate, indeed, that the state livestock sanitary work had been so efficiently carried out by Dr. Crewe, since all major diseases had been or were almost completely eradicated. The State had become a Modified Tuberculosis-Free Area. Glanders, dourine, sheep scabies and cattle scabies were eradicated, making it possible to continue with a very modest appropriation for several years during the balance of the drought period.

Beginning about 1938, the appropriations for livestock sanitary work were gradually increased and greater and greater emphasis placed on the control and eradication of brucellosis. The State was assisted at that time by large appropriations and a good sized working force of men supplied by the Bureau of Animal Industry. The
work of area testing was started and in a very few years over half the counties of the State were accredited as Certified Brucellosis-Free Areas.

At this time sale rings made their appearance and have gradually increased until, at the present time, we have about twenty-five (25) licensed sale rings. These called for additional legislation in order to control the spread of infectious diseases out of them. At the present time they are under splendid control and facilities are provided for the testing of all female cattle and bulls going back to North Dakota farms and for the immunization of hogs. Since there is no sheep scabies in North Dakota, sheep were allowed to move through the sale rings from scabies-free areas without dipping.

The greatest handicap to livestock sanitary work in North Dakota from the beginning has been the shortage of veterinarians. A state with very inclement weather, such as is to be found here, does not encourage veterinarians to come here if they can find employment elsewhere, and since veterinarians have been on the scarce list all over the United States, it is natural to expect that we would continue with a considerable shortage. The livestock population of North Dakota at this time is about as follows: one million seven hundred thousand head of cattle, probably not over two hundred thousand horses, swine about two million and sheep about a half million. We have about sixty (60) practicing veterinarians, varying in ages from 24 to 70 years of age.

The Livestock Sanitary Board has depended almost entirely upon veterinary practitioners to carry out its work. Practicing veterinarians are paid by the day, by the hour and by the head and, in ordinary times, most of the practicing veterinarians take care of the livestock sanitary work in their locality by direct orders from the Livestock Sanitary Board at Bismarck.

Since this Department has not been handicapped by politics in carrying out any of its work, we have been able to do a greater amount of livestock sanitary work with a limited personnel and a limited appropriation. The office help has been kept at a minimum and just large enough to take care of the filing of records and directing the activities in the field. The majority of the money is spent on farms. The accomplishments of the Livestock Sanitary Board for the past twenty (20) years might be summed up as follows: A continuation of the tuberculosis testing program, to the extent that tuberculosis in cattle is almost unknown; the establishment of an efficient control system at the various auction saleyards; the control and the gradual eradication of brucellosis in cattle and a complete eradication of all types of scabies.
ADDRESS OF WELCOME

Hon. Louis Cox

State Senator, Kentucky

Thank you, Mr. President:

Ladies and gentlemen, after looking over your program and seeing so many titles of so many distinguished people who will speak to you on so many important subjects, I am a little worried about how to address you.

I am reminded of a story about one of our former Governors who was to give an address in our State penitentiary to some 1,500 prisoners. He started out by saying, "My fellow citizens." The prisoners all laughed at that. He became a bit confused and began again, "My fellow prisoners." They laughed some more, and then he said, "I am glad to see so many of you here this morning."

I, too, in the role of welcoming you to what we think is a great State, am happy to see so many of you here and so many of you in Kentucky.

At the outset I would like to express both the regret and the good wishes of our Governor, Lawrence Wetherby, who is unable to be present this morning and for whom I am substituting. As you know, we have a race track here. The races are now going on—but he is interested in another kind of race. The barrier has been sprung, but the race won't be over until Tuesday. He has been trying to jockey a horse, and he has been pretty busy.

I also want to take this opportunity to thank you and particularly to thank Dr. L. L. Breeck and your committee for selecting Kentucky as your meeting place. I understand you haven't met in Kentucky for more than fifty years, your last meeting having been held here in the year 1900. I hope we treat you better this time, and that your visits won't be so far apart in the future.

It is entirely appropriate that you hold your meeting in Kentucky. As you know, we are an agricultural state. We have fine dairy herds in Kentucky. We raise a lot of sheep in Kentucky, and I think perhaps Kentucky and the city of Louisville still have the largest spring lamb markets in the United States. Kentucky also is famous for its fine horses, whether they be saddle horses, standard-bred or thoroughbred.

We have done a lot in our State in the past four or five years to make it more attractive to those who are not only Kentuckians but those who are our neighbors. I would give anything if you gentlemen had the time to see what has been developed by our Division of Parks in this State. I wish you could see what we have done in an attempt to make your stay and your visit here more pleasant.

We have Kentucky Lake in western Kentucky, which, as you know, is the largest man-made lake in the world, with a shoreline of about 2,500 miles. We have two fine hotels down there that are owned and operated by the State. We are now developing Dale Hollow and Cumberland Lake, and I believe I can say with real assurance that there is no finer fishing in all of America than in those two lakes.

We have other developments in our park system, but I know time will not permit you to visit them all. However, I do hope that while you are here you will take an opportunity to see some part of our State. I know you can go to Lexington and see the blue grass and the fine thoroughbred and dairy farms up there.
As a member of the legislature, I think there is nothing more important to the farming or livestock industry in Kentucky or in any other state than proper and adequate and intelligent veterinary advice. We have looked forward to and hope that some day we will be successful in having established at the University of Kentucky a school of veterinary medicine. We think it is needed, we think Kentucky is the place for it, and I hope that if any of you who are here can put in a word somewhere to help us get that, you will do so.

We are very happy to have you with us. We are proud of our State. We think the more one sees of it the more one likes it. You may have heard the story which originated with that great writer, Irvin Cobb, of Paducah: "Don't ever ask a man where he is from, because if he is from Kentucky he will tell you so in the first five minutes, and if he is not you shouldn't embarrass him by asking him."

We hope a little of that spirit, a little of the history and tradition of Kentucky, will rub off on you. Therefore, we want you to see more of Kentucky. We would like to help you make your stay here a very pleasant one. Maybe some of you will go out to Churchill Downs. We can't help you if you want to bet, because I went to the races for three days and didn't cash in one ticket. It might be better if you stayed away.

If there is anything any of us can do for you to make your stay more pleasant, please call on us. I am sure I speak for the Mayor and the official staff of the city of Louisville when I say that they will do anything they can to make you more comfortable. I say that also on behalf of and for the Governor and his staff. I know you have many important subjects to discuss this week, and you have a most interesting program, so I shall not speak any longer.

It is a pleasure to be with you, and I do hope you will come back soon. Thank you, gentlemen.

Dr. R. L. West: We are doubly honored this morning. We also have with us a representative from the Mayor's office in the city of Louisville, Mr. Handon, who will add to Senator Cox's remarks of welcome.

Mr. Handon: Thank you, Dr. West.

On behalf of the city of Louisville may I welcome your convention to this city. Senator Cox has told you about some of the glories of the State of Kentucky, and I hope that while you are in Louisville you will see some of the things we are proud of in this city.

We are proud of our library, probably the most progressive library in the country. We are proud of the Louisville University, and we are proud of our parks. I hope you will have an opportunity to see these facilities while you are here.

It is always a great pleasure for us to have visitors, because we are Kentuckians and there is a lot to be said about Kentucky hospitality; but really we shouldn't take any credit for it, because we are just sort of curious when it comes to meeting other people. It's just ornery curiosity on our part, so don't give us any credit for it. We are delighted to have you with us, and if there is anything we can do for you in the City Hall, as long as it is legal, we will be very happy to oblige.

As a token of our welcome to you I would like to present to your President the key to the city of Louisville.
RESPONSE TO WELCOME

H. U. GARRETT

Des Moines, Iowa

Mr. President, Senator Cox, Mr. Handon, Members of the U. S. Livestock Sanitary Association and Guests: On behalf of the U. S. Livestock Sanitary Association I want to thank you gentlemen for your very kind words of welcome. They are appreciated very much.

Those words of welcome bear out the traditional reputation of Kentucky. Kentucky’s hospitality has been known all over the country for years and years.

A few days ago I went into the office of the Governor of that great Corn State some 500 or 600 miles northwest of here. I asked him if he knew of a good story that I could tell on this occasion. He said, “Sure; tell them about the Kentucky colonel who died.”

It seems this colonel was brought before St. Peter, and St. Peter said to him, “Where are you from?”

“I am from the great State of Kentucky.”

“What does Kentucky have that other states do not have? Why is it such a great State?”

“Why, it has the finest scenery, the fastest race horses, the finest bluegrass and the most beautiful women in the world.”

“In that case,” said St. Peter, “I will grant you one wish.”

The Kentucky colonel thought for a moment and then said, “Well, if it’s all the same to you, just send me back to Kentucky.” [Laughter]

Speaking of the great Corn State reminds me of Monday evening, when I went to a party in the hotel and learned something. I learned that all the corn that is produced in Kentucky, as well as the corn which is imported, is not used as we use it in Iowa—to feed pigs and cattle and to make pork and beef fat, but it is used for other purposes. I also found that the profit you Kentuckians make from that product is sometimes spent about two miles away from here. We went there yesterday, and we saw how you spend your money. [Laughter]

It is quite fitting that we should come to Kentucky for this meeting. History records that on October 2-3, 1900, the Association held its fourth meeting here. This Association had been founded some three years earlier, simply because of the desire of people to control disease in livestock. The particular disease at that time was Texas fever.

Fifty-two years have elapsed since then. We have seen a considerable change in our way of living. We have seen changes not only industrially but agriculturally and in disease control problems. The problems of that day were somewhat different from what they are today, yet they no doubt were just as serious then as now. Since that time we have made great progress, yet I believe our problems today are greater than the problems fifty-two years ago.

Our transportation has changed considerably. Some of us came here by plane, others by automobile and by train. I heard one fellow say he hitchhiked here and
would like to have company back. [Laughter] Our problems today in so far as the control of livestock disease is concerned, are much greater than they were then. Statisticians in the Bureau of the Census tell us that our population is increasing at the rate of two million annually. That is over 5,000 a day, or 200 each hour, which means that by 1975 we will have a population of two hundred million people.

We have no vast frontiers to conquer and put into production. We must use what we have; but when we think that thirty-five out of every 100 pigs farrowed never reach the market—that five out of every ten calves dropped never reach the market—that three out of every ten chicks hatched never reach the table—we have a large problem ahead of us. We must conserve what we do produce. We must find out how to control disease better than we have in the past.

I really and sincerely believe that the only way to control disease is by cooperative action, not only with veterinarians, but the livestock industry as well must work together toward that one goal of controlling disease so that by 1975 we still may be able to feed our people, since we do not have any more frontiers to conquer and put into production.

Today we are in a war. It may be called a "cold war", but I understand some of it is pretty "hot". Some call it a police action. A boy on the battlefield is no more dead in an all-out world war than he is in a police action. We must lend our efforts to take care that such things do not continue to happen. They must be controlled. We must be a peaceful people rather than a people at war.

With enemies like we have abroad, biological warfare is not out of the question. It could happen. We are very vulnerable. Recently we have experienced an outbreak in our swine population, vesicular exanthema, which stayed in one state for over twenty years—and yet in a period of only three weeks it spread to fourteen states across our nation. In some of our areas we have controlled the disease; in some areas we think it has been eradicated. In Iowa we had our first outbreak. It was diagnosed on July 7, and by August 25 every hog had been slaughtered, processed or tanked. By September 30 we had cleaned and disinfected every premise. There are some states yet that have not completed their cleaning and disinfecting. Some of them have not even started.

With the spread of disease like that across the country, and we know what foot and mouth disease has done—we know what rinderpest and many other diseases could do if turned loose in this country, and we know our experience with anthrax—it sometimes does not sound reasonable that they could occur on premises when we cannot trace the origin of the infection. We must all lend our best efforts to try to control disease throughout the country, through our cooperative effort.

Again, Senator Cox and Mr. Handon, on behalf of the Association I want to thank you for your very warm welcome.
PRESIDENT'S ADDRESS

RALPH L. WEST

St. Paul, Minnesota

This has been a momentous year in the history of livestock disease control in this country. It has been necessary to face a number of unusual problems with extremely serious potentialities. On the whole, I believe Livestock Sanitary Officials on both the State and Federal level have met these problems with reasonable promptness and competence. On the other hand, it does not seem we can be particularly proud of our record. In retrospect, two deficiencies in our control procedures stand out with deplorable clarity. First, is the absence of any systematic plan for coping with an emergency such as is now presented by the appearance and spread of vesicular exanthema throughout the middlewest, and second, is the absence of effective leadership which the livestock industry has a right to expect from the Federal and State governments, when disaster strikes.

Had prompt, positive and effective leadership been available when anthrax appeared in areas where it had been previously unknown, apparently introduced in imported bone meal, and when vesicular exanthema suddenly spread from California into the middlewest, involving large marketing centers, the losses incident thereto, would have been insignificant in both of these cases. No effective action was taken until pressure was built up by the industry itself in these instances to adequately protect the livestock industry, nor until extensive damage was already done, and the spread of disease had resulted in multiplication by many times the cost of control and eradication. Also because there was no preconceived systematic plan and no leadership available to advise soundly, the various states in self-preservation, were forced to promulgate orders and quarantines which resulted in an intolerable situation, encouraging violations and causing in many instances, unnecessary loss and inconvenience to the livestock industry which we are trying to protect.

I recommend that the incoming President of this Association appoint a committee to work with the Bureau of Animal Industry, United States Department of Agriculture to devise a systematic plan of approach for use in future emergencies, and to study the laws now in effect and to urge new legislation, if it seems desirable. Much time is provided on the program for detailed discussion of the diseases above mentioned, so further discussion will not be made here.

BRUCELLOSIS

The eradication of brucellosis in domestic animals continues to require the greatest expenditure of funds and personnel by most state livestock disease control agencies, and is a major project of the Federal Government. In spite of a tremendously increased demand by the livestock industry and the general public, progress remains slow. Control agencies are still behind the parade in this undertaking, instead of undertaking the leadership which was so effective in the eradication of tuberculosis, Texas fever and other diseases a few decades ago.
If we are to accomplish the job we are obliged to do, we must in some way get back to the basic principles of disease eradication. It is essential we discontinue the vacillation and procrastination all too evident in some state programs. One particularly deterring factor has been the tendency on the part of control agencies, to make exceptions for pure bred herds in order to "save blood lines." It should be remembered, the best and only satisfactory way to preserve valuable breeding stock, is to eradicate disease. This cannot be done while centers of infection, whether existing in purebred or grade, beef or dairy herds, are allowed to exist. The policy presently followed in too many states has apparently been dictated by groups or segments of the industry more interested in regulations which will permit the ready movement of cattle or dairy products, or which will give credit for meeting certain arbitrary standards than in prompt eradication. This is surprising when such highly satisfactory results have been and are being attained by those states and areas which have courageously and steadfastly refrained from deviation, urged by selfishly interested groups.

Here again the Livestock Sanitary Officials have shown lack of leadership. Encouraging as is the surge of public sentiment for prompt action to wipe out this vicious enemy of livestock and human health, especially rural human health, it does not appear that we as sanitarians, can take much pride in the role we have played. In too many instances, failure of leadership and direction by authorities who have the answer at their finger tips, have allowed the promulgation of laws and regulations by well intentioned but not sufficiently informed persons, which have sidetracked and diverted funds and personnel into haphazard and ineffective efforts; and then when these efforts result in failure as can be expected, many persons become discouraged and the mistaken and unfortunate idea again becomes prevalent that eradication is unobtainable and the best that can be done is to reduce losses as much as possible but to continue to live with this insidious enemy.

Too many of us as sanitarians, have completely forgotten that we have available a systematic plan of eradication, known as the Area Plan. For years, we have had available uniform methods and rules under which this plan can be activated and carried out. Admittedly, these rules have been amended and reamended until they have become difficult of clear interpretation. I believe and recommend they should be rewritten in a clear and understandable manner, and preferably to provide for credit to be given to areas which have attained various stages toward eradication. For instance, it seems most practical to permit certain practices in a county or other area after initiating the Area Plan of control which would under no circumstance be permitted after the incidence of disease has been reduced to a definite point. Perhaps several stages might be provided with increasing standards as eradication progresses.

Whatever changes are made, however, we will surely fail unless authority is provided to require three cardinal principles of eradication. (1) participation of all cattle owners and systematic blood testing of all cattle. (2) Proper and permanent identification of all animals showing a positive reaction, and (3) Proper restraint and early destruction of all diseased animals.

It seems essential also that the uniform methods and rules for the Area Plan of brucellosis eradication be simple, practical, and applicable to all sections of the
country. It is essential that provision be made for range and semi-range areas which because of the difference in management of the cattle therein, must differ from the regulations for farming areas. Care must be taken, however, regardless of the area to which the rules shall apply, not to deviate from the course leading to prompt and complete eradication as the ultimate goal. Experience has shown that it is possible in most areas with reasonable expenditure to carry out the provisions necessary for area control under the uniform methods and rules in their present form. Care must also be taken in revising the rules that the requirements for testing do not involve prohibitive expenditures.

The change adopted last year reducing the period of certification from three to two years, was to my mind, impractical and discouraging to states which might be on the verge of adopting a sound program. Also it seems such change was entirely unnecessary in view of the history of area control in this country. Reinfection of once clean areas, has never been shown to occur because of the three year period of certification, but rather from failure on the part of the sanitary officials to properly enforce the regulations pertaining to the plan.

The advent of the ring test makes the abridgement of the period of certification still more unnecessary and it is hoped the present Committee on Brucellosis will again provide for a three year period of certification following systematic blood testing of all animals in the area.

TUBERCULOSIS

We have not been very consistent in the establishment of uniform rules for the eradication of our two major, firmly established diseases of cattle. While we have been tightening the rules for the area plan of eradication of brucellosis almost to the point where compliance is impractical, we have relaxed our rules for tuberculosis eradication far beyond the danger point. Allowing continued and repeated reaccreditation of areas as free from tuberculosis without a systematic program, involving periodic testing of all cattle in the area, is an invitation to disaster. We will be fortunate indeed if we do not wake up some fine morning to find the tremendous job of the 1920's and 1930's to do all over again. Should this occur, and to me the danger seems very real, I do not see how we can justify again expending the stupendous funds which will be required to again attain the favorable position we now enjoy.

It is an axiom in disease control that the period of greatest danger is after the most obvious obstacles have been overcome and before complete eradication is attained. Complacency can soon undo years of effort. We can ill afford to ignore the centers of tuberculosis we will have with us. I strongly urge a reversal in the trend of recent years, and that we come to a realization that bovine tuberculosis still exists. The Uniform Methods and rules for the eradication of this disease should again provide for and require systematic testing of all cattle at regular intervals in order to maintain a Modified Accredited status.

The duties of livestock sanitarians are ever increasing. One of the most challenging problems is now in the offing, namely, the eradication of hog cholera from the United States. Ground work is now being laid for this extensive project and there
is no question that we now have the tools and the knowledge, that with courage and determination will bring about this most desirable objective.

Also new problems are continuing to appear on the horizon. Sound methods for the control of anaplasmosis are imperatively needed. Research to disclose facts on which practical control measures can be based for leptospirosis, atrophic rhinitis, and many other diseases of livestock and poultry which are becoming increasingly prevalent, should be intensified. It is imperative that prompt and energetic measures be taken to stop the spread of these newly recognized diseases if these United States are still to hold the enviable position as the safest country in the world in which to raise livestock.

Now what of our Association? Conceived in necessity more than fifty years ago, the United States Livestock Sanitary Association has given and continues to give an outstanding service to the livestock industry so essential to our public welfare. The value of this Association is well demonstrated by the active and virile part it has played during prosperous times and depression; and in spite of misfortunes, which from time to time must occur over a period of half a century. The more one contemplates the principles the Association stands for and the goals we have accomplished, the more one admires the sagacity and wisdom of the men who founded this organization and formulated the Constitution and By-Laws under which we have accomplished so much.

Perhaps the most serious crisis the Association has had to face, occurred in the few years immediately past. Most of the members of the Association are familiar with the efforts of a certain group of self-appointed agents, who objecting to sound recommendations of the Association for the advancement of disease control, made strenuous efforts to radically change our Constitution and By-Laws, to make it possible for organized minorities to dictate the policies and activities of the Association. Had these efforts been successful, scientific disease control policies would have been relegated to the background and such groups as instigated this move, would have had the reputation of this Association to play on, in order to bring into being legislation and policies based on selfish interests of whatever group or organization happened at the time to be most strongly represented. Fortunately, the Association was able to defeat these efforts even though they were aided and abetted by a few high officers of the Association and supported by a packed membership on the floor. Again the foresight of the founders of the Association is grandly illustrated, when even against such organized attack, the Association has been able to retain the democratic, or perhaps I should say republican representative administration and management that has for so many years, resulted in scientific progress and achievement.

It seems inconceivable, that anyone could question that the Chief Livestock Sanitary Officials of the forty-eight states, the Chief of the Bureau of Animal Industry of the United States Department of Agriculture, and the Veterinary Director General of the Dominion of Canada truly represent the livestock industry of their respective jurisdictions in livestock sanitary matters. If they should fail to do so, they would not and could not long stay in office and be eligible to serve on the Executive Committee of this Association. It is primarily because the final decisions
and policies of the Association have been made by this group, that the United States Livestock Sanitary Association has attained the position of influence it now enjoys.

It is of course realized, that the world progresses and conditions change from year to year. It is entirely possible that some changes in the constitution and by-laws may be desirable from time to time. Perhaps some advantages might derive from a change in the makeup of the Executive Committee, although after long study, I cannot personally, conceive of a more sound and democratic arrangement. In any case, there is a safe and sound way of bringing such changes about in accordance with the present Constitution and By-Laws.

Because of the nature of the debate involved in recent attempts to take over the Association, resulting in conflict of personalities, charges and counter charges raising feelings to a high pitch, the time does not seem opportune to make such changes at this time. However, I recommend that the incoming President appoint a committee to again study the Constitution and By-Laws in detail and present recommendations for any changes that may seem desirable because of changing conditions. I believe that a cool and careful appraisal by a representative body at this time might suggest some worth while amendments without altering in any major respect, the essential organization upon which this Association is founded.

An account of the unsuccessful efforts to break down the basic structure of the Livestock Sanitary Association would be incomplete were I to omit a report on certain activities of the group actively engaged in those efforts, since adjournment of the last meeting.

A meeting was called in Chicago last February 12th, sponsored I understand, by the American National Cattlemen’s Association for the purpose of forming a new organization to represent all branches of the livestock industry on sanitary matters. Representatives of many livestock organizations were invited to attend. While an official report of the meeting is not available, I am reliably informed that opposition to the proposed plan by dairy and other livestock groups, resulted in authorizing only a permanent committee to keep the industry informed of pending problems, legislative and otherwise. However, under date of September 25, 1952, one of our past Presidents, Mr. Ferd Mollin, Executive Secretary of American National Cattlemen’s Association, wrote to Secretary of Agriculture, Brannan, on the letterhead of the American National Cattlemen’s Association informing him of the establishment of the National Livestock and Farm Organization Sanitary Committee, stating that Dr. B. T. Simms, Chief of the Bureau of Animal Industry had been informed that Committee planned to “deal with all important sanitary matters affecting the livestock industry.” Mr. Mollin also informed Secretary Brannan in this letter, and I quote, “The United States Livestock Sanitary Association does not speak for us in any way in sanitary matters, whether pending before your Department, before committees of Congress, or before State Sanitary Officials”.

To the best of my knowledge, the United States Livestock Sanitary Association has never tried or pretended to speak for any organization except for themselves. The American National has not suffered in the past from inability to express themselves, and certainly no effort has been made by this Association to muzzle them, to speak for them or even to take over the management of that organization. On the
other hand, the United States Livestock Sanitary Association, by its very makeup, does and must speak on Livestock Sanitary matters for the great livestock industry of this country, organized or unorganized, including producers, processors and consumers whose interest each member of the Executive Committee is sworn to protect in his respective jurisdiction. This Association could not evade this responsibility even if it wished, and will of necessity, wield an influence in present and future undertakings in any way related to livestock sanitation.

The United States Livestock Sanitary Association is the only organization now existing in the United States, where an opportunity is given for a meeting of minds and free discussion of sanitary problems from the viewpoint of the research laboratory worker, the livestock owner, the practicing veterinarian, and the trained sanitarian. Anyone, who will take the time to peruse the proceedings of the last several years, can obtain indisputable evidence of this splendid participation and cooperation. Under these conditions, we can look forward to many years of accomplishment, equal or surpassing our accomplishments of the past.

There is one more recommendation I would like to make, and I cannot express it too strongly. Many of the members of this Association, as well as members of the Executive Committee, have been disturbed because of the lack of opportunity to study in detail, important reports of committees before acting on their adoption. This applies particularly to those reports that include uniform methods and rules, such as the reports of the committees on Tuberculosis and Brucellosis. I urge that whatever and whenever radical changes in such uniform methods and rules are recommended by these committees, that an effective date shall be included, which shall be at least one year following the adoption of the committee's report, in order that livestock sanitary officials and livestock growers may have an opportunity to study the regulation in the publish proceedings, and to take such action as may be necessary at the next meeting of the Association before such changes go into effect.

In closing, I wish to take this opportunity of thanking the Association officers, and the Committee Chairmen and members for their splendid cooperation during the past year. I wish especially, to thank, on behalf of the Association and personally, our worthy Secretary, Dr. Ralph A. Hendershott for his help and encouragement. Only one who has served with him, can have a real appreciation of the energy, ability and devotion to this Organization, that Dr. Hendershott has shown. Lastly, with all my heart, I wish to thank the members of this great Association for the opportunity to serve as your President during the past year. It is an honor that I will always remember and cherish.

DISCUSSION

MR. HERMAN AABERG: Dr. West, ladies and gentlemen: I don't propose to reply to the President's address. What I have in mind is to make a certain clarification with reference to the relationship of the various livestock and farm groups that have been meeting from time to time since the Kansas City meeting, on the question of their relationship with this group.

I would like to say that perhaps many of you were just like I was after Dr. West's speech. It was such a hard-hitting, straightforward speech that we were really
speechless. I am sure it will go down in history as one of the most hard-hitting speeches that has ever been made by any President of this organization.

I would like at this time to read a letter that I sent to Dr. B. T. Simms, Chief of the Bureau of Animal Industry, on April 28, signed by myself as acting Secretary of the National Livestock and Farm Organizations Sanitary Committee, and also I would like to give the names of the organizations and individuals that constitute that Committee. I think that will clarify their position:

Dr. B. T. Simms, Chief
Bureau of Animal Industry
U. S. Department of Agriculture
Washington, D. C.

April 28, 1952

"Dear Dr. Simms:

"On February 12th representatives of most of the major livestock, dairy and farm organizations participated in an informal conference at the Morrison Hotel in Chicago, to consider ways and means for livestock producers to make constructive contributions and to have a more definite voice in the development of rules and regulations in the control and eradication of livestock diseases.

"The group recommended that a National Livestock and Farm Organizations Sanitary Committee be established, to function on an informal basis as a clearinghouse to help inform the member organizations and associations of any new regulations, proposed changes or any laws or legislation involving livestock, sanitary matters, etc., the purpose of this being to assist the administrative officials of these groups in being more effective in representing the views of their producer members in these matters.

"It was recommended also that federal officials responsible for the administration of sanitary laws be advised that the U. S. Livestock Sanitary Association as presently constituted does not and cannot speak for the livestock industry. We do not mean by this that we have closed the door to further cooperation with the Association; in fact, the primary purpose of the Committee is to function until such time as a satisfactory compromise might be worked out.

"Most of the national livestock and farm organizations have named official representatives to serve on the National Committee. It is the wish of this Committee that you, as head of the Bureau of Animal Industry, keep us closely advised regarding the above problems, in order that we might inform the respective heads of various livestock and farm organizations constituting the National Committee.

"Yours very truly,
American Farm Bureau Federation
HERMAN C. AABERG, Director,
Livestock Department Acting Secretary, National Livestock and Farm Organizations Sanitary Committee"
Here are the official representatives of the National Livestock and Farm Organizations Sanitary Committee:

Thomas F. Arnold, *Chairman*; National Livestock and Farm Organizations Sanitary Committee, National Cattlemen’s Association, Valentine, Nebraska

Herman C. Aaberg, Director; Livestock Department, American Farm Bureau Federation, 221 North LaSalle Street, Chicago, Illinois; *Acting Secretary*

Lyle V. Springer; American Aberdeen Angus Breeders’ Association, 9 Dexter Park, Chicago, Illinois

J. V. Cavanaugh, *Assistant Secretary*; The American Jersey Cattle Club, 1521 East Broad Street, Columbus 5, Ohio

Mr. Ted Anderson; Missouri Livestock Association, Montreal, Missouri

P. O. Wilson; National Livestock Producers Association and National Council of Farmer Cooperatives, 139 North Clark Street, Chicago 2, Illinois

Ray Teagarden; National Grange, LaCygne, Kansas

W. H. Steiwer; National Wool Growers Association, Fossil, Oregon

Ray Willoughby, *President*; Texas and Southwestern Cattle Raisers Association, First National Bank, San Angelo, Texas

Mr. President, I merely want this to be in the record, if we may have that privilege, following your presentation, so that this group and others interested will know that the livestock and farm organizations as here represented do not wish to close the door to cooperation with this Association.

I think it can be said fairly here that this is no small clique, and that there is no intention by this responsible group, these Associations, to take over the work of this Association.

We hope that in the year or two ahead it will be possible to work out something constructive. However, with the statement that was made, I am afraid a lot of the folks in this Association are going to get the impression that they are no longer welcome in this organization. I don’t believe that is really what you intended to say.

Thank you, Mr. President, for this privilege.

President West: May I say that I meant exactly what I said, and I still mean it. If anyone wishes to take the attitude that he is not welcome because of what I said, that is his privilege. However, I did not and I do not mean to say that any cattlemen or any organization of livestock people or individual livestock people are not welcome in this Association, as I am sure they all fully understand.
REPORT OF THE SECRETARY-TREASURER

R. A. HENDERSHOTT, D.V.M.

Trenton, New Jersey

As many of you know, this has been a busy year for those charged with the control of infectious diseases of livestock. First, we had an outbreak of anthrax in swine in the Corn Hog States, due to infected raw bonemeal imported into the country from Belgium and coupled with the outbreak in swine several states had, out of the usual season, anthrax occurring in cattle.

In March of 1952, President West requested a meeting be called to study the unusual anthrax situation. A meeting was held in Washington, D. C. on March 22, out of which came a request that the United States Bureau of Animal Industry inaugurate more stringent control over the importation of bonemeal for animal food and fertilizer.

In the wake of an unusual winter outbreak of anthrax in cattle, there was an increased demand for anthrax bacterin. Following the use of one manufacturer's product, post bacterination anthrax occurred in hundreds of cattle, principally in Kansas and New Jersey. Only the intelligent and untiring effort of the veterinary practitioners and the prompt administration of antibiotics, held the death loss to a minimum.

I might say that during the course of the first six months of the year we in New Jersey had a total of eighteen sporadic outbreaks of anthrax. Usually anthrax in our State will attack one animal and we will have one death loss in a herd. Here-tofore we have immediately administered a #2 spore vaccine to the exposed animals in that herd and also to any herds that adjoin it, which in our opinion are in jeopardy. We have never had any difficulty in the twenty-five years of my experience in the State with that type of procedure.

However, during the last year or two we have had a young veterinarian added to the State Department of Health staff, and this man, reading the reports of Stein, of the Bureau of Animal Industry, and using them as his bible, has insisted that we follow that recommendation religiously. In other words, if we were to use a spore vaccine in the immunization of dairy animals, we must follow the program of quarantining all of the milk from that farm for a period of three weeks, and quarantine the livestock out of slaughter pens for a period of at least six weeks.

This drove us to the employment of bacterin. The #2 spore has always given us adequate protection, but this year we used the bacterin and we really got into difficulty.

The experience gained with anthrax this year certainly points to the urgent need to review the requirements for imported products, as well as those for the production of biologic products, produced under federal license, to see that the disaster this year is not repeated.

The outbreak of foot-and-mouth disease in Regina, Saskatchewan, was cause for considerable concern among us and certainly indicates how vulnerable all on this side of the Atlantic are to the introduction of animal diseases from abroad. Certainly
we need to review seriously again all of the possibilities open to the introduction of infection.

Recently, a firm in New Jersey, engaged in the manufacture of burlap backing used in rug and linoleum production, purchased bales of old burlap sacking in Europe. Some of these sacks arrived in a state of disintegration to the extent that they are valueless for the manufacturer’s purposes. These cast off bags are disposed of as fertilizer to farm people.

One of our reformatories received a truck load of decomposed bags and ploughed them under. Later it was found that these bags contained the golden nematode, a parasite of potatoes common in some European countries.

Our department, this year, has made inspections of over 10,000 acres of farm land to seek out infestations with this parasite. The question arises, to what extent could these bags carry anthrax or even foot-and-mouth virus and what an opportunity is presented to foreign agents to sabotage our plant and animal industry? Still we are, or at least say we are, alarmed about the possibility of biological warfare and we have held numerous meetings across the nation to bring the biological warfare problem to the attention of the veterinary profession.

In the light of this year’s experience, should we not seriously review avenues not heretofore given consideration and others as well, in order that we might be a little better prepared?

Our past American Veterinary Medical Association meeting in Atlantic City on June 26, on anthrax and foot-and-mouth disease, was well attended and in spite of the unseasonably hot weather, the room was filled and practically everyone remained until the close at 5:30. None of us at that time knew what was in store for us. Personally, I arrived home from the AVMA meeting at 11:30, Sunday, June, 29 to be greeted with the information that a shipment of 210 head of feeder pigs from Fremont, Neb., had been landed in the middle of a 77,000 swine concentration area in Secaucus, N. J., and were suspected of having an undetermined vesicular condition thought to be vesicular exanthema but which might be foot-and-mouth disease or vesicular stomatitis.

In spite of quarantines placed at state level, shipment of slaughter swine from the Midwest continued to arrive in New Jersey showing active lesions. Swine, apparently healthy but definitely a part of the lot affected with vesicular disease in the acute blister stage, continued through slaughter in federal inspection establishments to add their bit to the further widespread dissemination of infection.

On July 8, the first meeting was held in the United States Bureau of Animal Industry in Washington, D. C., attended by your Secretary and E. Robert Shannon, Secretary of the Swine Records Association. We requested the Bureau to prevail upon Secretary Brannan to declare the situation an emergency, but without success as fiscal officers of the United States Department of Agriculture failed to see how a disease present for 20 years in California could now be considered in the nature of an emergency and all argument to the contrary had no effect upon their decision.

I recommended that a meeting of the regulatory officials of states involved with V.E. be called in an endeavor to standardize and unify the procedure for dealing with the disease.

I might say that this came about as a result of my ordering 210 head of Fremont
pigs slaughtered along with 400-odd hogs that were contact cases on the farm where these pigs landed. We went up on July 5 to decimate this population and to tank them, and I was greeted with the information from the owner that in the great State of Nebraska they had this disease and they were not handling it in that fashion, and he demanded dollar for dollar value for the hogs I was going to shoot. He not only wanted dollar for dollar value as they were at that time, but he said, "I have a lot of feeders here that I usually market at 230 lb. in weight, and I want you to pay me the price they would be worth at 230 lb."

I told him I had no authority to do it, and I referred him to my superior officer. He also had no authority to do it, so we had nothing to do but put a quarantine on the farm. The fact that he could point to another state that was not handling it in that fashion led me to the conclusion that the states had better get together and have some unified method of handling the situation, and for that reason we asked for the second meeting in Washington.

Out of this conference called on July 14 and 15, 1952, came the recommended procedure to process the meat from swine recovered from V. E. infection in a manner to insure death of the virus. A temperature of 160 F. for 30 minutes was adopted.

The group also requested that the Chief of the Bureau make a strong recommendation to Secretary Brannan to declare the disease, which had spread in less than 30 days to 16 states, an extraordinary emergency. Had this been done, the federal government could proceed to eradicate the disease without the necessity of awaiting the appropriation of funds at state level to assist in the eradication program.

It was also requested that Dr. B. T. Simms arrange a meeting between the representatives of the major packing companies and state and federal regulatory officials in an endeavor to work out a program of moving recovered hogs into special processed products.

This meeting was called for July 23, 1952 at the invitation of the American Meat Institute. At this meeting, Doctor Simms very ably presented the problem posed by V. E. infection in swine, not only to the pork industry but, because of the possibility of V. E. serving to mask the more serious foot-and-mouth disease, to the beef and dairy cattle industry as well.

Out of this meeting came an invitation to members of the swine industry, stockyards, packers and regulatory officials, to meet on July 25, 1952, so that all interests involved in this disease of swine might be briefed on the importance of the virus disease sweeping the nation and their aid marshalled to activate a sound eradication program.

This group met in the Palmer House on July 25, 1952 and following a review of the disease by members of the Bureau of Animal Industry and a report of the disease situation in the respective infected states, appointed a committee to formulate a plan of action. It was my privilege to serve as a member of this committee representing the United States Livestock Sanitary Association.

Out of this meeting came a resolution to Secretary Brannan to declare V. E. an extraordinary emergency. A sub-committee of three members was appointed to obtain an audience with Secretary Brannan and personally present arguments in
support of Dr. B. T. Simm's request that vesicular exanthema be declared an extraordinary emergency.

I understand this sub-committee received an appointment with Secretary Bran-nan, who was at that time attending the Democratic convention in Chicago.

On August 1, 1952, the Government declared V. E. a national emergency and proposed to assist the states in their eradication program through the payment of 50 per cent of the indemnity to be paid swine farmers when the state elected to pay a like amount.

Meanwhile, states in which the infection had not been diagnosed immediately passed regulations designed to prevent the introduction of the infection.

The meat packers complained bitterly that some state regulations prohibited them from handling any recovered hogs for processing. As a consequence, the American Meat Institute called a meeting in Chicago on August 12, 1952, in an endeavor to work out a program that would be adopted by all states and provide a way for the major packers to process this pork and still be able to do business in all states.

Mr. H. Aaberg, representing the American Farm Bureau Federation, stated they would endeavor to bring pressure to bear on the several states whose regulations were seemingly responsible for the forced lack of cooperation on the part of the packers. He was confident that through their members in the various states, a change would be brought about in the state requirements.

With the exception of one or two instances, my interpretation of the various state regulations is that they were designed to prevent the introduction of the virus infection and were certainly justified in order to protect the swine industry of the respective state.

What have we learned through the rapid spread of vesicular exanthema to 27 of the 48 states in the period of three months?

1. If this is a preview of what would take place in an outbreak of foot-and-mouth disease, the livestock industry and the meat supply of the nation is in a sorry situation.

2. That our meat inspection laws were designed to protect the health and well being of the consumer and nothing beyond that. From an animal disease control viewpoint, they are valueless.

I made this statement before, and I know that at the present time I am probably persona non grata in the Bureau more so than ever before. That is an unfortunate thing, but I can’t avoid it. We have to have some sound thinking and some sound judgment and some sound procedure, and I believe in calling them where I find them. Once in a while I find myself calling some that I was in error about, and at this time I want to state that we have had a previous meeting this week with our state regulatory officials, and I was pretty persistent and vociferous about my dislike of what the bureau was doing in regard to the protection of animal health in our meat inspection regulations.

Last evening I encountered Dr. A. R. Miller, whom I esteem very highly. I repeated to him what I had said before, and we went to my room and talked it out. In part I was wrong. I want to admit that I was wrong, and I want it a matter of record, that this is the way it can be handled.
He informed me that the federal government has no right to impose a quarantine; that if the quarantine is going to be put on, it must be put on by a state agency. Their Paragraph 9.18, dealing with vesicular diseases, reads:

"Paragraph 9.18: Vesicular Diseases: A: Immediate notification shall be given to the local, state and federal livestock sanitary officials having jurisdiction when an animal is found to be affected with a vesicular disease. B: No animal under quarantine by state or federal livestock sanitary officials on account of a vesicular disease will be given ante mortem inspection."

Now, in the event the state is either not notified or fails to put on a quarantine, then the meat inspection requirements under Paragraph 1134 dealing with vesicular diseases has this to say. Understand, if we ask that a quarantine be placed on them, they will not go through federal packing houses, and there is no ante mortem inspection; that point I lost sight of in view of Paragraph 1134, which reads as follows.

"1134 Vesicular Exanthema and Vesicular Stomatitis. (a) Any carcass affected with vesicular exanthema or vesicular stomatitis shall be condemned if the condition is acute or if the extent of the condition is such that it affects the entire carcass or there is evidence of absorption or secondary change.

(b) Any carcass affected with vesicular exanthema or vesicular stomatitis to a lesser extent than in paragraph (a) of this section may be passed after removal and condemnation of affected parts, if the carcass is otherwise in good condition."

As I understand it, all that we as state regulatory officials need to do is to delegate in writing the federal inspector in charge at the federal packing house the authority to quarantine in our name. We take the responsibility for the quarantine. We have to hold it, and that is as it should be. That is states' rights. If we don't want this pork moving in, and they disclose some vesicular disease on ante mortem inspection, and we have already authorized them to quarantine it, then it is their neck if they don't quarantine it but let it go in.

3. That we have observed the contamination of yards and markets, their subsequent cleaning and disinfection and release to continue business as usual and in far too many instances, their reinfection.

**What is Needed?**

1. Change in federal meat inspection regulations to provide some control of infectious diseases of animals.
2. Change in the method of markets and yards which presently provide an outlet for farmers whose livestock is visited with an infectious disease.
3. A program of prompt reporting by veterinarians and a quarantine placed on stock affected with transmissible diseases.
4. Where infection exists, prevent the movement of exposed animals through markets.
5. The cooking of all garbage fed to animals.

This situation is likely to continue to be repeated until the markets and yards provide some regulations on the docking of animals so that they know their premises are not being employed as a means of disposing of exposed stock in order that the owner may be able to harvest a few dollars out of animals exposed to infectious disease but not yet exhibiting observable symptoms of the infection. This is a farm practice engaged in all too often and at the expense of the purchaser
and with an utter disregard for the health of livestock throughout the nation. Until markets and yards inaugurate a system of inspection at farm level of all classes of stock on the farm from which animals are started on their way to market and a system of health certificates accompanying such animals to the markets and yards, there is little hope for improvement. The only recourse open to regulatory officers is to embargo against the receipt of livestock from markets and yards which demonstrate their inability to remain free from infection.

Other measures that should be taken are the prompt reporting of the existence of infectious diseases on the farm by the attending veterinarian and the prompt placement of a quarantine on such a farm by the livestock sanitary official, such quarantine to be maintained until all danger of transfer of the infection is eliminated.

Since, in this nation, it is known that the garbage fed hog constitutes the principle source of *Trichina spiralis* infection for man; and since the last two outbreaks of foot-and-mouth disease were introduced through the medium of raw garbage fed to stock; and since garbage fed swine were responsible for the source of vesicular exanthema and vesicular stomatitis as well; and since it has long been recognized that garbage fed swine in a large measure keep hog cholera virus alive; and particularly since our neighbor to the north, Canada, has, through the licensing and control of garbage feeders, been able to maintain their swine population free from hog cholera, is it not long past the time when we, in this nation, provided at both national and state levels, legislation for the licensing of garbage feeders, prescribing the sanitary construction and waste disposal and the mandatory heat treating of garbage in order to insure freedom from these virus and parasitic diseases of swine?

Why the health of all of our livestock should be in constant and continuous jeopardy for the benefit of the few citizens who make a profit out of feeding raw garbage and maintaining as well, premises which are anything but a credit to an enlightened people, is beyond my comprehension.

Immediate steps should be taken to end once and for all time, the possibility of garbage fed swine serving as a means of spread of infectious diseases of livestock.

In summary, it seems to me the following points need consideration:

1. Better control over products imported into this country which could serve as a vehicle for the introduction of animal and plant diseases.

2. A review of the requirements of the serum-virus-toxin act and its enforcement to provide the licensed products are:
   (a) Safe to use.
   (b) Have a predetermined, proved value in the amelioration or prevention of the condition for which they are advertised.
   (c) That safeguards surround the production methods to prohibit the product from serving as a vehicle for the transmission of disease-producing agents.

3. That a committee of this association be appointed to study and develop model legislation governing:
   (a) The licensing of garbage feeders.
   (b) An economic, practical system for heat treating garbage to make it a safe food.

4. That a list of important infectious diseases be prepared as a guide to regulatory officials, veterinarians and farmers.
5. That anyone having knowledge of the existence of an infectious disease on any farm, be required by law to make a report to the livestock sanitary official of the state.

6. That quarantines be placed upon farms and stock where infectious disease of a serious nature is found and maintained until animals are safe to move from the farm for any purpose.

7. That recommendations be presented to yards and markets setting forth the things they can require of those sending livestock to their markets, to protect them from being infected and serving as they did this year as a source of infection for healthy stock moving through their places of business.

8. That model legislation be prepared to govern the activity of dead animal removers and rendering plants which would provide for licensing, construction of buildings and the sanitary conditions about the plant, including adequately constructed trucks, the keeping of records of carcasses removed from farms.

9. That all states that are not now exercising control over livestock markets, auction sales, etc., endeavor to obtain legislation providing for adequate control.

10. When all of these things are accomplished, we should then meet and discuss the possibility of control of biological warfare and sabotage. To do so with so many avenues open for the introduction of infection, seems to me to be mainly toying with words and a waste of time and aiding and abetting the generation of a false sense of security among those concerned.
REPORT OF THE AUDITING COMMITTEE

A. P. SCHNEIDER, Boise, Idaho, Chairman; H. J. O'CONNELL, Madison, Wisconsin;
J. B. WHEELER, Baton Rouge, Louisiana

Gentlemen:

We have carefully audited the books and records of receipts and expenditures of
this Association and find them in good order and correct as reported by the Secre-
tary-Treasurer to the assembly on October 29.
PRESENTATION OF KEY TO PRESIDENT R. L. WEST

R. A. HENDERSHOTT

One thing I neglected to list on the program, but which did not slip my memory as far as performing this very pleasant duty is concerned, is the presentation of a key to the Past President. You men will recall that some three years ago, I believe it was, we decided to honor our Past Presidents in some small way for the real job they do during the year, and that we present to them some memento of their service.

In Phoenix, Arizona we made a presentation to all the living Past Presidents at that time, and annually since then it has been my happy privilege to act on your behalf in presenting to the retiring President of the Association this memento of his service to our organization.

We in the Association have been in the main very fortunate in the election of men who serve as our President. In the long line of Presidents we would have to look far to find anyone who would excel the one that is retiring this year, Dr. West, who today is completing his year as President. I know all will agree with me when I say that he has demonstrated over the years a steadfastness of purpose and the spinal fortitude we all admire in a regulatory officer and he certainly has carried on the business of this Association in a very commendable way this year.

I have worked with him and I certainly enjoyed it. We all know how well he served in our Executive Committee meetings, and I don't think I need to tell you further how much real, honest-to-goodness work he has done during the course of the year just closing.

Dr. West, it certainly is a pleasure for me to present to you this very inadequate token of the debt that the Association owes you for serving as our President. [Applause]

PRESIDENT WEST: Gentlemen, words fail me. I can say only that I certainly appreciate having served in the capacity of President of this Association. I don't know of any honor that I have ever enjoyed or appreciated as much. I guess I am getting old. My voice shows the depth of my feelings.
MEMORIAL SERVICE

J. L. AXBY

Indianapolis, Indiana

Mr. President, Members of the Association, Ladies, and Gentlemen:
The following members have died during the past year:

Dr. I. S. McAdory, 70, died of a heart attack on July 5, 1952. A past president of the
United States Livestock Sanitary Association in 1942, and state veterinarian of Ala-
bama during the war years, Doctor McAdory was particularly active in Association
affairs. At the time of his death, he was professor of veterinary medicine in the College
of Veterinary Medicine, Alabama Polytechnic Institute.

Mr. Rufus M. Howard, Director of Agriculture for Nebraska died during the year,
following long illness. Mr. Howard, in his position, always sought veterinary advice
and counsel relative to disease control and eradication. He was a valued member of
the Association during the past decade.

Dr. Lester Moore of the Health of Animals Division of Canada passed away during
the year.

Dr. James T. Burris, 46, of Columbus, Ohio died suddenly on July 29, 1952. He
had been an active member of our Association for the past decade. He will be remem-
bered by those attending the post-convention meeting on anthrax at the Atlantic
City meeting of the AVMA on June 26, 1952, in which he took a prominent part. He
is survived by his widow.

Dr. Harry T. Moss, An outstanding practitioner of Dayton, Ohio, died June 5,
1951. He maintained active membership in the United States Livestock Sanitary
Association.

Dr. James H. Murphy of St. Paris, Ill. A member of the United States Bureau of
Animal Industry, died on June 13, 1951.

Dr. M. E. Howell of Columbus, Ohio died October 7, 1951.

Dr. George Rathman of Topeka, Kans. Veterinary advisor to the Livestock San-
itary Commissioner of Kansas was stricken while attending the 55th Annual Meeting
at Kansas City and died on November 13. Dr. Rathman served our Association as a
member of several of our committees.

Dr. Victor S. Larson, 68, died on November 22, 1951. Dr. Larson, long an active
member of our Association, was well known to most of us as an outstanding state
veterinarian of Wisconsin.

Dr. Mansel O. Barnes, 48, died from a heart attack on December 28, 1951. Doctor
Barnes formerly served the United States Bureau of Animal Industry in the foot-
and-mouth disease eradication in Mexico, and for several years, up to the time of
his death, he served with distinction as the Director of Livestock and Dairying (state
veterinarian) of Washington. At the time of his untimely death, he was engaged in
setting up county disease control committees in an endeavor to eradicate brucellosis.

Dr. Andrew L. McNabb of Guelph, Ont., and long a member of our Association, died
on February 16, 1952.

Dr. Ira C. Brown of Phoenix, Ariz., died February 7, 1952.

Dr. John R. Mohler for the past 40 years had been an active member of the Asso-
ciation. He served with distinction as president of our Association in 1926 and ad-
dressed our meeting on numerous occasions, one of the important ones of which was
the report of the research of the bureau with strain 19 Brucella abortus vaccine. Doctor Mohler served the country for years as chief of the Bureau of Animal Industry and was prominently associated with everything veterinary for the past 50 years. Dr. Mohler passed away February 29, 1952.

Dr. D. M. Campbell, 72, died March 27, 1952. Formerly secretary-treasurer of our Association in 1919 and 1920 at a time when the office was a most difficult one because of the few members carried on our roll. To him, credit is due for injecting new life in the Association and inaugurating practices which resulted in an increase in individual memberships. Doctor Campbell maintained a very active interest in Association matters up to the time of his death. At the last annual meeting, he introduced an amendment to the constitution and by-laws and served as our representative to the Poultry Branch of the Production and Marketing Division of the United States Department of Agriculture. For years, he was editor of Veterinary Medicine, through which medium the highlights of our annual meeting are presented to thousands of veterinarians throughout the world.

Dr. Raymond A. Kelser, dean of the School of Veterinary Medicine, University of Pennsylvania, died of a heart attack while at work at the school. Doctor Kelser spent most of his professional life in the Army Veterinary Corps and rose to the rank of Brigadier General and head of the Corps during World War II. He was a member of the National Research Council and served on many of our important committees and was particularly active in the interest of rabies control.

Dr. John P. Stout of Chatham died suddenly on May 20, 1952. He was a long time active member of our Association and is survived by his widow, Villa M. Stout.

Dr. Jean V. Knapp, 62, of Tallahassee, Fla., died June 7, 1952 after a short illness. Doctor Knapp will be remembered as the oldest member of the Executive Committee of the Association in point of years of continuous service. He was appointed state veterinarian of Florida in 1922 and held that position at the time of his death. Doctor Knapp served our Association in many areas, including holding the office of president in 1948.

Dr. H. J. Shore, 70, vice-president and laboratory director of Fort Dodge Laboratories, died June 19, 1952 of coronary thrombosis. He was associated with the development of the serum-virus method of immunization of swine against hog cholera. He aided in the development of the Virus-Serum-Toxin Act of 1913. Doctor Shore maintained continuous membership in our Association for 40 years. He is survived by his widow, a daughter and a granddaughter.

Having read the names of the departed members, may I respectfully request all present to arise and remain standing for a moment of silent prayer for the peaceful repose of their souls.

SILENT PRAYER

My friends, I find myself feeling definitely inadequate to do justice to this service today. Many of these men were friends of mine for decades as well as friends of many of you here assembled.

At the funeral of each, men and women were brought together to take advantage of a spiritual opportunity, an opportunity to take leave of the frenzy of modern business competition long enough to do a little serious thinking about life, and gain perspective. I would like that situation to prevail and apply here today, and trust
that we will take time out to think and to ask ourselves why we are on earth and where we are going.

Certainly, if ever, this is the time to make some good resolutions we are determined to keep and to cease the pagan worship of the "almighty dollar".

It may be later than we think. We shall see these departed members no more with mortal eyes. They are gone from their established places on earth to higher realms of immortality. They are gone from the home, the forum, and friends. We will follow them; they will return no more to us.

As long, however, as memory treasures pure lives and faithful service, as long as public and private virtues, stainless and without blemish, are revered, so long will their names and memory be cherished by the people as an example worthy of the highest emulation.

Monuments of granite may lift their heads toward heaven in their honor, but a monument more fitting and precious has already been founded in the hearts of the people they served so faithfully and with such signal ability.

In the busy harvest time of death, in the year 1952, there were gathered on that Beautiful Isle of Somewhere no nobler spirits, no finer minds, no fairer souls.
REPORT OF THE COMMITTEE ON RULES AND REGULATIONS

E. P. Anderson, Lincoln, Nebraska, Chairman; J. F. Cavanaugh, Columbus, Ohio; T. B. Clower, Atlanta, Georgia; Lee Davisson, Lansing, Michigan; H. U. Garrett, Des Moines, Iowa; T. C. Green, Charleston, West Virginia; H. H Hening, Albuquerque, New Mexico; W. E. Logan, Harrisburg, Pennsylvania; F. E. Messersmith, Alliance, Nebraska; William H. Shannon, Boston, Massachusetts; Roy A. Thompson, Springfield, Illinois; R. R. Younce, Salem, Oregon

This Committee recommends that no change be made in connection with the uniform regulations now in effect.

The new publication on health requirements governing admission of livestock into States has been printed and distributed to all livestock sanitary officials. Your Committee has reviewed this publication and, again, we recommend that no changes be made in the maximum regulations. Your Committee recommends schools of instruction be held with practicing veterinarians conducted by state livestock sanitary officials for the purpose of acquainting the veterinarian with the requirements and also how to properly issue health certificates so that the owner or shipper will have no trouble at destination point.

Your Committee also recommends that a study be made of all States' health certificate forms with the thought in mind of a uniform health certificate that can be used by all States. We would recommend that this assignment be given to the Committee on Laws and Regulations.
Mr. President and members of the Association: This assignment was originally given to Dr. D. M. Campbell and I was asked to carry on in his place. Two meetings were held during the year, one on February 9 and another on October 2; both in Chicago. At the time of the February meeting Dr. Campbell was too ill to attend. I have the minutes of these meetings and will attempt to give you a brief review of some of the things that were considered.

Mr. Miller, from the PMA, was in charge of that meeting, and pointed out these particular facts, that on July 1, 1951 there were 154 plants which maintained the inspection service on poultry, and on February 9, 1952 there were 193 plants, an increase of that number. Of the 193 plants which at that time had the inspection service, 123 of them were producing eviscerated poultry for sale in various forms other than canned poultry.

He pointed out further that a goodly portion of the 193 plants which have the grading service (and the grading service, of course, is different from the inspection service) identify their products with grade marks.

They have been making changes through the years in the organization of the Inspection and Grading Division, and have been tending toward the development of sanitarians to look after the sanitary aspects of the work. Dr. Weckler, whom I do not know, was assigned to that position in the PMA, with the title of Acting Assistant Chief of the Inspection and Grading Division.

They have conducted a number of so-called sanitarian schools throughout the country, and one was held at Purdue University which was attended by approximately sixty individuals. Those schools were conducted with individuals from the United States Public Health Service and also from the Production and Marketing Administration.

Dr. Steele was there, from the Veterinary Public Health Service, and he spoke about the schools that were being conducted.

They have been using bonded personnel, that is, personnel employed by the companies themselves, under bond, for some of this grading work. The discussions have been up before, but they were gone into again, about whether or not to use bonded personnel paid by the plants themselves, or civil service men employed by the state or the city or by the federal government. That was given quite a little consideration. They seem to be tending toward the use of civil servants rather than bonded personnel.

They went on at great length and considered quite a few things, including the public health aspects, and particularly they referred to personnel within the plants. They have had some instances wherein certain conditions arose which made it hazardous for people working in the plants.
SUMMARY OF MEETING OF PUBLIC HEALTH-INDUSTRY TECHNICAL ADVISORY GROUP
Chicago, Illinois—October 2, 1952

The meeting was under the chairmanship of Mr. Henry G. F. Hamann, Chief, Inspection and Grading Division.

1. Review of progress in U.S.D.A.'s poultry inspection and grading program. Poultry Branch representatives reviewed the progress and growth, changes in regulations, and the problems associated with staffing the grading and inspection programs. Discussion centered particularly around the problems incurred by the increased need for inspectors. The use now being made of lay inspectors in the inspection program was explained and various possibilities for training lay inspectors and expanding their use were discussed. It was emphasized that a proper balance of veterinarians and lay personnel must be maintained if inspection is to function properly.

2. Proposed programs in cooperation with State Marketing Agencies and similar groups. The new Syracuse poultry ordinance was discussed by Mr. Spencer Duncan, New York State Department of Agriculture, who explained some of the problems that this law presented to the local producers adjacent to the Syracuse market. The ordinance forbids the selling of New York dressed poultry and requires inspection for wholesomeness of ready-to-cook poultry after January 1, 1953. The problem of providing inspection at the producer-small processor level at a cost which they can afford was considered in some detail.

Dr. Bendix of the Virginia Department of Agriculture presented his views with respect to the operation of a State poultry inspection system, with coordination by the Federal Government. Considerable discussion centered around the use of lay inspectors in such a program, as well as the extent of supervision necessary to properly conduct such an inspection system. A comment was made that inspection is not going to be of much protection to public health until it covers the majority of the poultry that is being processed and until a method is devised to carry the poultry all the way through to the consumer, properly packaged and identified. There was considerable discussion of Dr. Bendix's comments pertaining to the importance of the disease problem in poultry, as well as the necessity of individual post-mortem examinations and the amount of supervision necessary for the conduct of an adequate poultry inspection system. It was suggested that the Department of Agriculture consider the practicability and value to be obtained from a study of this problem and possibly submit it to an unbiased agency, such as the National Research Council, for consideration.

3. Progress in development of uniform poultry processing sanitary code. The proposed model sanitation and poultry inspection code which is being developed by the United States Public Health Service at the request of certain industry organizations was discussed by Dr. Lieberman of the Public Health Service. The plan of approach to the problem was explained quite thoroughly. The project was well received by the group. The public health representatives indicated that they would use their influence to delay State and local ordinances until after the model code had been issued; thereafter, they would direct their efforts toward the adoption of the model code by local jurisdictions in order that uniformity may be achieved.
4. Subcommittee report. Dr. Koonz presented a report of the subcommittee appointed in February to consider the adequacy of the poultry grading and inspection regulations from the standpoint of the health and hygiene of plant employees, as well as the occupational hazards to processing plant personnel. The subcommittee found that absenteeism due to occupational diseases was no higher in the poultry processing field than in any other industry. Some discussion developed concerning the merits of mandatory health examinations for food plant workers and also the various requirements imposed upon such personnel by State and local jurisdictions and individual firms. It was agreed that the requirements of the grading and inspection regulations pertaining to this problem are adequate.

5. Review of activities of Public Health Groups in the field of poultry processing. The representatives of the health groups explained the activities that they have been carrying on in connection with the poultry processing and sanitation problem. There was a general expression of satisfaction with the manner in which the poultry inspection and sanitation program of the U. S. Department of Agriculture was being carried on and with the progress that has been made in the past year.

6. Next Group Meetings. In view of the development of the model sanitation and inspection code, it was recommended by the group that another meeting be held at the time of the next Fact Finding Conference in Kansas City, for the purpose of reviewing the proposed code, as well as other pertinent problems.
REPORT OF COMMITTEE ON LEGISLATION


During the past year no national legislation has come to the attention of your Legislative Committee for consideration. However, your 1951 Committee on Rabies presented through Dr. H. J. Rollins, of North Carolina, to Congressman Harold Cooley of the same state, for consideration and study, proposed legislation on rabies. The bill as yet has not been introduced into the Congress of the United States.

Your Committee on Legislation recommends that this association go on record as endorsing such proposed legislation.

During the past summer a highly contagious and infectious disease known as vesicular exanthema was diagnosed in 29 states. Investigations have determined that the feeding of raw garbage is largely responsible for the spread of vesicular exanthema to swine, thereby affecting the economy of the swine industry.

Therefore, your Committee on Legislation recommends the following:

WHEREAS, the feeding of raw garbage is largely responsible for the perpetuation of the life cycle of Trichinella spiralis causing the disease trichinosis in humans, and

WHEREAS, the feeding of raw garbage may be incriminated in the perpetuation of other parasitic diseases of swine, as well as other virus diseases such as hog cholera, vesicular exanthema, foot-and-mouth disease, and other contagious and infectious diseases, and

WHEREAS, the unsanitary conditions associated with current practices of feeding garbage is conducive to the breeding of rats which are proved carriers of leptospiroses and trichinosis infecting man and other animals, and

WHEREAS, the livestock disease control officials of the several states, the American Veterinary Medical Association, the American Swine Records Association, the United States Livestock Sanitary Association, and the Association of the Public Health Officials have urged and recommended the promulgation of regulations for the cooking of raw garbage that certain swine diseases may be controlled and eradicated,

Therefore, your Committee on Legislation recommends that all states give consideration to passage of adequate laws or regulations providing for the licensing of garbage feeders and the requiring of all raw garbage to be heat-treated to a temperature sufficient to insure the destruction of all virus and further providing for the sanitary feeding of swine.

PROPOSED LAW OR REGULATION

Section I. As used in sections 2 and 3 of this Regulation, garbage shall mean all refuse matter, animal or vegetable, and shall include all waste material, by-products of a kitchen, restaurant, or slaughterhouse, every refuse accumulation of animal, fruit, or vegetable matter, liquid or otherwise.
Section II. Unless special permission in writing is first obtained from the Chief, Division of Animal Industry, of said state department of agriculture, no person shall feed to swine or permit swine to have access to or be fed on his own premises, or on the premises of any other person, corporation, or municipality, any garbage, raw or cooked, which has been obtained elsewhere than on the premises where fed.

Section III. It shall be unlawful for any person, firm, partnership, or corporation, to feed garbage to animals unless such garbage has been heated to a temperature sufficiently high throughout the mass being processed, to render such garbage safe for animal feeding in so far as the transmission of diseases is considered.

Your Committee further recommends that the Bureau of Animal Industry of the United States Department of Agriculture and the United States Public Health Service be requested to promulgate regulations requiring all garbage to be sterilized prior to inter-state shipment.
BREEDING PROBLEMS OF THOROUGHBRIDS

FLOYD C. SAGER, D.V.M.

Paris, Kentucky

I feel greatly flattered at being asked to appear before this group. I have been familiar with the work of this association for many years, but it has never been my good fortune to be able to attend a meeting until now.

Since there are so many problems in the breeding of Thoroughbreds, they can best be discussed under several headings:

1. Breeding health of the mare.
2. Establishment of the sexual cycle with determination of the true oestrus.
3. Fertility of the stallion.
4. Protection of the fetus during the gestation period.
5. Transition from fetus to foal with the attendant dangers of parturition.
6. Rearing of the foal.

With the short time allotted for this paper, the entire situation cannot be covered. Therefore, we will discuss those phases which appear to be most important, with emphasis on the fundamentals.

BREEDING HEALTH OF THE MARE

Broodmares are divided into three classes; maiden mares, barren mares and foaling mares. Unless there is evidence of abnormality or infection, it is common practice to accept the maiden mare for breeding without veterinary examination. The first step in the examination of the mare is a careful scrutiny of the vulva and surrounding area, including the buttocks and tail. If the mare is discharging there will be evidence on the hair of the tail and on the buttocks as well as on the vulva. Conformation of the vulva is noted with the possibility of wind-sucking in mind. A speculum is inserted into the vagina and the presence or absence of exudate is noted, and the color and condition of the mucous membranes and cervix are observed. The phase of the estrus cycle is estimated. In order that the examiner may have full information concerning the condition of the cervix and vagina, it is necessary to examine the mare during both the estrual and diestrual period. During the diestrual period the vagina is pale and covered with a thick sticky mucus; the cervix is pale and so tightly constricted, there is no evidence of an opening. It protrudes slightly into the vagina. The vagina should be collapsed at this time. During the estrual period or when the mare is in heat, the appearance of the mucous membrane changes to a glistening pink and the sticky gummy covering of the membrane changes to a viscous, lubricant-like mucus. The cervix opens and relaxes and the lips which are often edematous, lie on the floor of the vagina. The cervix must be examined for old tears or scar tissue. It should be noted as to whether or not the vagina is ballooned. An “angry” red color of the cervix and vagina or presence of exudate on the floor of the vagina are evidence of bacterial invasion and the mare should be cultured. This is accomplished by passing a sterile platinum
loop through the cervix and then streaking agar slants which are incubated and the bacterial growth identified.

The aspiration of air through the vulva into the vagina and uterus is undoubtedly the most common cause of barrenness in the Thoroughbred mare. Undoubtedly most bacteria find their way into the genital tract along with the filth carried in with the aspirated air. This wind-sucking may be possible because of unrepaird tears of the vulva but more often it is a result of the conformation of the vulva, age of the mare, or continuous relaxation of the vulva due to atrophy of the tissues. The sound of air entering or leaving the vagina is the most usually detected evidence of this so called wind-sucking. It varies from a smacking sound to a gurgling noise. The lips of the vulva may turn in or they may not be in direct apposition, the one seeming to be on top of the other. If, when the speculum is inserted, the vagina is ballooned and inflamed and there are particles of fecal material in the vagina or the exudate on the floor of the vagina is foamy, it is almost positive proof of the aspiration of air. When symptoms are not conclusive and the examiner feels that there is still a strong possibility air is being aspirated, it is well to close the lips of the vagina with temporary michel clips and after a week has elapsed remove the clips and re-examine the mare with a speculum. If the mare has been sucking air, the improvement in the appearance of her vagina after such a test will prove it conclusively. This condition can be corrected by suturing the lips of the vulva from the top down to a point just below the floor of the pelvis. When the aspiration of air has been stopped, improvement starts at once. The length of time required for complete return to normal with complete freedom from infection varies greatly in different individuals. It may be a few weeks or it may take two years. To reduce this time the treatment of choice may be employed. The most common causes of genital infection in mares are, Streptococci, Escherichia coli, Staphylococci and Pseudomonas aeruginosa.

A rectal examination of the uterus and ovaries is made to determine the size, tone and position of the uterus, freedom from neoplasms and size, consistency, and freedom from cysts and neoplasms of the ovaries. The small hard, fibrous ovary is least apt to function. Other pathological conditions commonly found are: flabby toneless uterus, chronic metritis, tumified ovary, infantile ovaries and uterus.

The examination of the foaling mare on the sixth, seventh or eighth day after parturition is the most important one of the year to the broodmare. At this time we must decide whether the she will be bred back on her first heat period (usually the ninth day after foaling) or be passed over to the second period. The mare should not be bred in her first heat period unless the involution of the uterus is complete, all lacerations resulting from parturition are completely healed, bruises especially on the cervix have completely recovered, the mucous membranes of the vagina have regained their normal pink color, the walls of the vagina have regained their normal muscular tone, the vagina is free from exudate and urine, and the placenta was not retained more than three hours and did not weigh more than 14 pounds. This examination is made on the sixth day, and if there is doubt as to the proper decision the mare may be examined again on the eighth day. If there is still doubt as to the decision the benefit of the doubt should go to the mare and she should be passed on.
this first heat period. Those passed over the first heat period are again examined on the eighteenth day to determine their fitness for breeding on the second heat period.

DETERMINATION OF ESTRUS

The estrual cycle is divided into estrual and diestral periods, or "in heat" and "out of heat". Ovulation takes place while the mare is in heat. Victor R. Berliner states that ovulation takes place in the mare during the last 48 hours of estrus. That the spermatozoa do remain in the uterine cavity for a long time is evidenced by the fact that sufficiently large numbers of sperm to effectuate fertilization and conception make their appearance in the ovarian bursa only around eight hours after service, according to Hammond, even though some sperm may be found there as early as 15 to 18 minutes after coitus. A service given two to six hours after ovulation will not result in conception because the spermatozoa cannot reach the ovum during its life span. Anderson states that sixteen hours after service no live sperm can be recovered from the uterus. Milovanov states that spermatozoa in the uterus are rapidly destroyed by phagocytosis and that the number of leucocytes in the mare's uterus is highest during estrus. The mare ovulates spontaneously, the onset of ovulation is not influenced by copulation.

For the best breeding results the interval between service and ovulation should not be greater than 24 to 48 hours because only a few stallions produce spermatozoa of sufficient vigor and vitality to survive a longer interval. Hammond has stated that stallion sperm in the female genital tract remain capable of fertilizing ova for four to six days and the length of time the free ovum remains capable of fertilization in the mare is four hours. This shows how important it is to determine the time for presenting the mare to the stallion. I once asked Dr. E. A. Caslick what he considered the best time in the estrual period to breed the mare. His answer was, "When nature cries the loudest". His records show that the highest rate of conception resulted from service on the third day of the estrual period.

All breeding farms keep one or several teasers. The mares are tried with the teaser thus giving them an opportunity to manifest their desire or willingness to take the horse. There are different methods of teasing. At some farms the mare is lead from her stall to the "teasing bar" and there interviewed by the teaser who remains on the opposite side of the bar. Some prefer to ride a teaser through the bands of mares. I personally prefer to tease each mare in her own stall, leading the teaser from stall door to stall door and with at least three men available to assist the man with the teaser. One man precedes the teaser as he enters the barn, observing the actions of the mares before the stallion actually reaches the stall door; a second man follows the teaser observing the actions of the mares after the teaser passes on to the next stalls, and the third man assists the man with the teaser, catching mares in the stalls, holding them as directed by the man in charge of "teasing".

There has been wide difference of opinion as to the time interval that should be allowed in the teasing routine. Twenty years ago it was common practice to leave a mare alone for 18 to 21 days after breeding and then try her at seven day intervals. Many heat periods were missed by this method. I favor teasing every day or at least every other day. The most important single phase at a Thoroughbred breeding establishment is the teasing of the mares. It is the role of the man in charge of
teasing to determine when a mare is in heat. This means that he has the most trying and difficult job on a Thoroughbred nursery and also the most important one. This man must be experienced with broodmares and wise in the ways of the female. Every year that he remains with a band of mares makes him more valuable to the owner. As his knowledge of the individual mares increases so does his value to the nursery. Teasing must be conducted in a gentle manner, continued roughness with the mares tends to make them fight the teaser at all times and this obliterates all signs of estrum.

A mare that shows perfectly to the horse will lift her tail, squat and urinate at the approach of the teaser or back up to the horse and continue to strain as he nuzzles her. Anyone can tell when the mare truly shows herself in heat, but unfortunately very few mares react in exactly the same way. Some mares show signs of estrus when they hear the teaser calling as he approaches but will fight him viciously when he arrives at their stall. Other mares seem to ignore him while he is at their door but show signs after he has passed on. The reaction varies from the mare that shows perfectly to the one who demonstrates no evidence of estrum whatever. Often a good teaser will recognize the estrous period although the mare shows no signs to the man doing the teasing. The normal sexual cycle is from 18 to 21 days in length. The estrual period can be expected to last five days. The variation in type of sexual cycle is tremendous. The long estrus type is most common in the maiden and barren mare. I have known a maiden mare to stay in heat for 120 days. The long diestrus type may occur in any mare but is common in the foaling mare. The irregular type usually comprises only a very small part of the mares in the band. In this type the estrual period almost always exceed the diestral. The last type is the one in which there is no demonstrable heat period; they act the same toward the teaser at all times. Ovulation takes place as regularly in this group of mares as in any other group. Since the estrual period in this group must be determined with the speculum they are known as "speculum mares". As a rough estimate, 3 per cent of barren and maiden mares will be speculum mares. In foaling mares this percentage is much higher, as great as 20 per cent in some bands. This applies to those that were not bred on their first heat period, or if bred failed to conceive from that service. Probably the majority of these allow their protective instinct for their foal to overshadow their sexual desire in the presence of the teaser. Sometimes a mare that will not "show" to a teaser in the presence of her foal will react normally when taken far enough away that she cannot hear the foal. Other mares, both barren and foaling, which fight a teaser at all times will "show" during their estrual period to other mares or geldings. This seems to be more noticeable where the mare in question can contact other animals over a pasture fence.

The estrual period of mares which do not "show" must be determined by speculum examination if they are to be bred. Nearly all foaling mares will be in estrum between the 25th and 30th day after foaling unless conception occurred from a 1st period breeding. A vaginal examination of this group should be made twice weekly starting the 25th day after foaling. All other mares of this type should also be examined twice weekly. It is dangerous to use the vaginal speculum more often than twice weekly lest the same condition result as in the wind-sucking mare.

Great care must be taken in cleaning the external genitals and in inserting the
clean speculum that no infection is introduced into the vagina. As in examining the mare for breeding health, the first observation is made of the tail. Check whether the tail is damp where it comes in contact with the vulva. Note the constriction or relaxation of the lips of the vulva. The majority of mares in heat will have a relaxed vulva and the lower commissure will be moist from the vaginal secretions which will also make a damp place on the tail where it touches the vulva. Since no one sign is conclusive, a vaginal examination must be made. The speculum should be dry in order to determine the degree of resistance and to note the type of exudate which clings to it when it is withdrawn. When in heat, a clear lubricious exudate will adhere to the speculum and it will come away easily especially if it is passed along the floor of the vagina as it is withdrawn. A dry vagina always means a diestrus period. Membranes should be pink and glistening, the amount of congestion is variable. The observation should be made as quickly as possible after inserting the speculum as the presence of air causes congestion and the color changes rapidly. The cervix should be congested but relaxed; the lips are often somewhat edematous. I like to see the lips of the cervix lie on the floor of the vagina. The cervix may be contracted and the mare still be in estrus. Since there is great variation in this picture from mare to mare, and from time to time, doubt may exist as to the true stage of the cycle after the speculum examination and manual examination must be resorted to. If the cervix is found open and the membranes soft and well lubricated, it is safe to declare the mare in estrus.

In the mare with the long estrous period, the sexual cycle seem to be quite regular with the true estrus appearing regularly when determined by speculum examination. While the mare continues to show “in heat” to the teaser day after day for long periods, the vaginal examinations reveal that she has a diestrual and estrual period with fair regularity if the sexual rhythm is observed. Thus, if while showing estrum but not in true estrus, the mare is bred, there is no hope for conception since there is no ovulation, but if “true estrus” is determined and the mare served, ovulation can be expected to take place and the chances for conception are as usual. The same general situation exists in the case of the long diestrual period. Mares found to be in true estrus by speculum examination will, even though they refuse to show to a teaser, accept the stallion when presented. These same mares often show normally to the teaser at the breeding shed after fighting the horse at their own stable. There are truly anestrus mares. I have never observed this type however, except in the mare nursing a foal, and then very rarely. In a group of more than 150 foaling mares I have seen but two in the past five breeding seasons. These mares at every vaginal examination not only appeared to be diestrous but closely paralleled the appearance of a pregnant mare.

Early examinations for pregnancy are valuable, but not for the reason mares declared in foal can be taken from the teasing list. Their teasing should be continued to the end of the breeding season. The value of the early examinations lie in the number of mares found empty. Measures can be instituted at once to find these mares in estrus and breed them again before the end of the season.

Most sutured mares can be bred with no further precaution than the placing of a cross stitch just above the lowest point at which the vulva was closed. Some mares, however, due to very bad conformation, must be sutured so close to the
lower commissure of the vulva that they must be cut out to make possible the sexual
act and resutured immediately thereafter.

It is highly desirable that accurate records be kept of the heat periods of all
broodmares, both the teasing record and the results of vaginal examinations. The
teasing of all barren and maiden mares should be started early enough to establish
the sexual cycle before the actual breeding season starts. With the breeding season
of Thoroughbreds lasting but four months, (it starts in February and ends early in
June on most farms,) the very shortness of the season is one of the greatest handi-
caps. Very few breeders breed their barren mares before the middle of March.
Experience has taught that they do so much better after they have shed their
winter coat. Maiden mares are usually started even later in the season. With
the majority of mares foaling in March and April, and a goodly number in May,
the breeding season for this group is cut down to two and one half months for early
mares and down to nothing for the latest ones.

FERTILITY OF THE STALLION

With the proved sire, very little is done to determine fertility. A sample of the
semen is taken from time to time and examined under the microscope. Nothing can
be determined as to numbers of sperm from this, but an idea is given as to the
morphology and activity of the sperm.

When a young horse is placed in the stud, however, it becomes necessary to
determine his fertility as far as possible before the breeding season starts. Much
could be written concerning the handling of a young horse at this time. It is most
important that he be handled quietly and gently, but firmly, not allowing him
to form any bad habits. Care should be exercised in selecting the first mare for the
horse. She should be in perfect heat, very quiet and gentle and not too large.

In order to know the volume of the ejaculate and determine the actual numbers
of sperm per cc in the whole ejaculation, it is necessary to use a condom. The
artificial vagina has never been at all satisfactory for me, nor has the usual breeders
bag. A condom essentially the same as that used by man, works best. Even so,
many stallions refuse to serve with the condom in place. I have never been able to
use one successfully at the first cover of a horse. When the horse is ready to serve,
the condom is placed in position and secured with a wide rubber band. The condom
is lubricated and the horse allowed to complete the service. The condom is removed
immediately and the contents emptied into a graduate. The volume is noted and
a sample taken for checking the motility under the microscope. A smear is made
for morphological study and a sample set aside for counting the sperm. Motility
must be estimated. Semen examined as soon as can be after collection usually
shows about 80 per cent of the spermatozoa active. This activity is intense but
apparently without purpose. The cells move in every direction. This activity
decreases rapidly and in semen left at room temperature most activity has ended in
from six to eight hours. However, this is one gauge of fertility. The larger the
number of sperm which remain active at room temperature for a given length of
time the greater the expected fertility.

The morphological examination is made to check the size and shape of the cells,
the numbers with short stubby tails, broken tails or no tails at all. The deformed sperms usually have twisted tails, double heads or double tails.

The following is from the work of J. MacLeod and W. R. McGee:

Average volume of semen 60 cc.
Average count spermatozoa per cc. 265 million.
Average total count per ejaculation 14 billion.

If there is no life in the ejaculate, it is safe to declare the stallion sterile. However, it seems next to impossible to estimate the fertility of the animal on the number, activity and morphology of the sperm. With a low percentage of normal active sperm, it is to be expected that the horse will be a "shy breeder", but on the other hand, I have seen horses with low cell counts of active normal sperm that were excellent foal getters and also those that appeared to be normal in every way that fail to stop a mare. Hence the real proof of fertility is percentage of mares stopped each season by the particular stallion. The service must be watched closely to be sure the sexual act is completed. The twitching of the tail as the horse ejaculates is usually accepted as evidence of completion. This is known as "flagging". It is well to check the semen drip under the microscope after each cover. The presence of live spermatozoa proves the sexual act was completed, and that it was not a blank. I used a horse one entire season without ever being positive ejaculation had taken place until the check was made with the microscope. This horse was very sure when he covered, but had a history of going an entire season without stopping a single mare.

After the mare has been determined ready to breed and has been brought to the breeding shed, she should again be teased to induce her to empty her bladder and vagina before the actual service. The tail should be bandaged and the external genitals thoroughly washed with soap and water and then carefully rinsed with clean water. The stallions' penis should be washed with soap and water prior to breeding and rinsed with clear water, making sure all soap has been removed before he serves the mare. After service the stallion should be washed or rinsed with a mild antiseptic solution to protect him from infections from the mare. Cleanliness cannot be over emphasized and unless it is well done it is probably better to not interfere with nature at all. The breeding shed should have a good resilient footing and be free of dust.

PROTECTION OF THE FETUS DURING THE GESTATION PERIOD

After the mare has been found pregnant, everything possible must be done to achieve a normal termination. The mares should be kept in excellent condition, in good flesh but not overly fat. They should have sufficient exercise, preferably being turned to pasture daily. All pregnant mares should be vaccinated against Salmonella abortivus equi. This bacterin is highly effective. The disease seems to be controlled in this section, but I still do not consider it safe to ignore it. Virus abortion while probably not on the increase is ever with us and remains an unsolved problem. I am convinced the vaccination with the killed tissue vaccine is effective and certainly in this locality it should be used. The abortions due to Streptococci, E. coli and staphylococci infections are to be prevented by breeding only mares in perfect breeding health under the most sanitary conditions. Dystocias
and diseases of the newborn that result from prenatal infection are to be prevented in the same manner.

PARTURITION

As the time of parturition approaches, the mares are moved into the foaling stalls where they are kept under constant observation by experienced men. They continue to go out in paddocks during the day but return to large well-bedded, foaling stalls at night. Sutured mares should have the vulva opened to its original size before parturition. It is most essential that a qualified attendant be present when a mare foals. While there are many indications that foaling time is close, such as the relaxation of the muscles of the croup, the relaxation of the vulva, wax appearing on the ends of the teats or milk actually running from the teats, none of these signs can be used to set the hour of the event accurately. Usually, however, when a mare begins to walk her stall and warm up, even breaking out in a sweat, parturition is sufficiently close that the attendant should not leave her. As a rule no examination of the mare should be made until after the water breaks. Then a check should be made to be sure that the foal is right side up and in proper position with anterior presentation. A large number of foals are on their backs when foaling time arrives. When a mare which apparently is ready to foal lies down and gets back on her feet repeatedly, an upside down foal is to be suspected. The early discovery of this condition or that one or both forelegs turned back or the head turned back, makes the correction relatively easy and prevents a difficult dystocia case from building up. The trained attendant not only can discover this situation but usually can correct it and deliver the foal long before a veterinarian could possibly reach the foaling barn. I find it most difficult for both attendants and veterinarians to refrain from applying traction to a foal that is entering this world in a perfectly normal manner. Many mares are needlessly injured by this unnecessary aid. When, however, obstacles to birth are present they must be overcome quickly or the foal will be lost. Everything possible should be done to induce the mare to remain lying quietly after the foal has arrived. The foal will usually struggle around enough to break the umbilical cord. As soon as it separates the stump should be dressed with a mild antiseptic. On rare occasions it becomes necessary to break the umbilical cord manually. If so, it should be separated by traction. It should never be ligated. The loss of blood from the cord is insignificant. At one time only in my experience has it been necessary to ligate the stump to control bleeding. When the umbilical stump has been cared for, the foal should be dragged around to the head of the mare where she can nose and lick it. The afterbirth will ordinarily come away within an hour. The mare should be given ample opportunity to clean herself before manual removal is resorted to. I wait at least twelve hours and if the membranes are tightly adherent I leave the mare and try again at a later hour. The next morning the afterbirths of mares which foaled during the night are weighed and examined for entirety and conditions. The vulvas of foaling mares are examined for tears and bruises. Mares which were opened up to foal are resutured at this time and injury repaired as far as possible. All foals receive an enema of warm soapy water with enough salt added to approximate physiological saline at this time in the morning unless it
has been necessary to give the enema at an early hour to prevent colicky pain. At times the removal of the meconium is quite difficult, the balls may be large and hard and removal by enema impossible; then they must be removed manually. A pair of long handled blunt forceps may be used. The nearer to the handle the hinge is located the easier the operation will be.

If mare and foal are normal and weather permits they should be out in a small paddock for at least 20 minutes the first day. Daily exercise is most necessary for the mare at this time. It will aid in emptying the uterus and also hurry the return of normal tone to the muscles, both inside and out.
PRESENT STATUS OF THE COMPLEMENT FIXATION TEST FOR
THE DIAGNOSIS OF ANAPLASMOSIS

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Ever since anaplasmosis was first recognized in the United States, veterinarians have felt a growing need for a practical method of diagnosis. The nature of anaplasmosis is such that the acute stage of the disease is accompanied by anemia. The persistence of the infective agent in the blood of recovered animals results in most of these animals becoming carriers of the disease for life. The carrier animals cannot be differentiated from noninfected animals in a herd and remain a constant source of infection.

The diagnosis of anaplasmosis constitutes one of the most important and difficult problems confronting both the veterinarian and the research worker investigating this disease. This problem, however, does not apply to the acute stage of the disease, as in such cases a diagnosis may be made by demonstrating the characteristic marginal bodies in the erythrocytes.

Animals in the carrier state of anaplasmosis usually fail to show symptoms of the disease and marginal bodies are not present in the blood in sufficient numbers to establish a diagnosis by microscopic examination, therefore, only through the aid of some special diagnostic method or test can there be any hope of determining the presence or absence of the disease.

Early in the history of anaplasmosis it was discovered that if carrier animals were splenectomized, a relapse would follow in which marginal bodies reappear in the blood and the animal develops a condition similar to that experienced in an initial attack of anaplasmosis. This discovery gave research workers a new tool. Simply by removing the spleen, observing the symptoms and the blood picture it was possible to determine the status of a carrier animal. This procedure is considered quite accurate but is limited in its use as a diagnostic agent to the testing of small numbers of carrier animals.

As a result of the previous discovery, the subinoculation test was devised to demonstrate the presence of the disease. In this test the procedure is to collect a quantity of blood from the suspected animal and inject it into a normal splenectomized calf. Microscopic examinations of stained blood smears from the splenectomized calf are made, not less than three times weekly, over a period of sixty days. If marginal bodies fail to appear in the erythrocytes of the splenectomized calf, the animal on test is declared negative for anaplasmosis. The subinoculation test is accepted throughout the world as being approximately 100 per cent accurate in the detection of anaplasmosis. However, this test is expensive to conduct and requires two months for completion. It is suitable for testing comparatively small numbers of cattle where accuracy is the prime factor. The test is usually required of animals offered for export and is also used as a criterion for measuring the accuracy of other anaplasmosis tests.

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For a number of years the Bureau has been attempting to develop a standard antigen to be used in a serological test for the diagnosis of anaplasmosis. The successful use of the complement-fixation test for the detection of dourine and glanders in various species of animals suggested that it might be made applicable to the diagnosis of anaplasmosis in cattle. The adoption of this test would make it possible to test large numbers of samples daily. Workers in the Bureau proceeded to make use of the above mentioned method in such a manner as to make it suitable for the diagnosis of anaplasmosis. All of the reagents necessary for the complement fixation test had been previously prepared with the exception of the antigen. Difficulties were encountered when attempts were made to prepare antigen, which is an important component of the test.

Numerous attempts to prepare an antigen for the complement-fixation test from spleens, livers and other organs of animals infected with anaplasmosis were unsuccessful. However, definite antigenic value was demonstrated in the washed centrifugate of distilled-water-laked blood drawn from a carrier animal. Owing to the lack of quantity it was considered impractical to produce antigens of this nature for continuous experimental work, therefore, the work on complement fixation was discontinued.

In 1933 the work on the preparation of antigens was resumed. Antigens were prepared from the cattle tick, *Rhipicephalus sanguineus* which had engorged on the scrotum of bulls in the carrier stage of the disease and gave specific reactions to the complement-fixation test for anaplasmosis. Although it was possible to produce antigens by this method, it was discovered that the ticks sometimes failed to engorge on the blood of infected bulls over a period of months, therefore, it was impossible to obtain antigen by the use of this method. Other species of ticks, when made into antigens, were anticomplementary and as a result, the production of antigen had to be discontinued.

An attempt to prepare antigen by lysing the erythrocytes of infected animals with staphylococcus toxin gave negative results. Early in 1943 attempts were made to produce antigen from animals in the acute stage of anaplasmosis. A high degree of parasitism was considered important in the production of a satisfactory antigen and as a result a number of serial passages were made in splenectomized calves in order to obtain the maximum number of parasitized cells. This antigen was prepared according to the technique used by the Army for the production of malaria antigen, and consisted of lysing the parasitized erythrocytes by the addition of distilled water followed by rapid freezing and thawing. This product was known as a crude blood antigen. Although antigens prepared by this method gave encouraging results, they were found to be not entirely satisfactory due to the difficulty in reading the final reactions of the complement-fixation test.

As a result of further research, an improvement in the technique of preparing antigen was accomplished. A modification of the method described by Heidelberg and Mayer, in which the parasitized erythrocytes were lysed by the addition of distilled water saturated with carbon dioxide, was used. This procedure eliminated most of the dark red color previously noted in crude blood antigens. The previously described product is known as a carbon dioxide antigen. A large quantity of the above mentioned antigen was prepared and placed in storage for future use. Antigen
production was discontinued. Workers were under the impression that the antigen production problem was solved and a satisfactory antigen could be produced at will. This conclusion was proved to be false when antigen production was again resumed in 1950. During that year two series of antigens were prepared from thirty-three individual calves. These antigens were prepared according to the regular carbon dioxide method heretofore mentioned. After completion of the titration on the first series of antigens it was noted that only approximately 20 per cent of the antigens demonstrated any antigenic value and the remaining antigens were either negative or anticomplementary. The second series of antigens was prepared using similar technique and of these antigens 70 per cent had very definite antigenic value.

At the present time it is not possible to produce a satisfactory antigen consistently, however, by varying the method of preparation and pooling individual antigens demonstrating a high degree of antigenic value, it is hoped to obtain a sufficient amount of standard antigen. When this type of antigen is produced, it will be possible to conduct a large number of uniform tests.

Late in 1950 the problem of antigen solubility arose. With no apparent change in the technique the lyophilized antigen suddenly became insoluble. This problem was finally solved by lyophilizing two lots of the same antigen on two separate machines. It was noted that the antigen lyophilized on one machine was soluble while that lyophilized on the other machine was not. This was a definite indication that the apparatus used for the preservation of the antigen was defective and the cause of the insolubility.

A number of antigens were subdivided in an effort to estimate the best possible method of preservation. A portion of the lyophilized and shell frozen antigen was stored at 4°C. and a like portion was stored at −70°C. When these antigens were titrated five years later it was found that the lyophilized antigen stored at −70°C. retained all of its antigenic value. Lyophilized antigens stored at 4°C. gave almost identical reactions.

The test was first applied to the anaplasmosis experimental herd consisting of approximately 50 animals of known status located at the Animal Disease Station, Beltsville, Maryland. These animals were tested at 30-day intervals. The work has been going on for the past eight years and as a result much information has been collected in regard to the efficiency of the test.

During the past few years the Bureau has forwarded antigen to several laboratories in an effort to promote cooperative testing of animals in herds where anaplasmosis is known to be present. The laboratory at the University of California in Berkeley tested several thousand serum samples from such herds and the Bureau retested the same samples which were forwarded to our laboratory, with almost identical results.

Other states also entertained the idea of doing comparative testing. Montana is using the test at the present time. Cooperative work with officials from the state of Maryland has given much information that would have been difficult to obtain without their help and effort. Since the testing of bovine serum samples was begun in our laboratory, every effort has been made to render service to the practicing veterinarian and state officials in diagnosing suspected cases of the disease.
False reactions have occasionally been noted. These reactions may be due to certain substances, in the serum or possibly in the antigen at the time of the test, the nature of which is as yet unknown. In some cases the difficulty can be remedied by testing a freshly drawn serum sample, or by the centrifugation of the antigen used in the test.

In conclusion we wish to state that the complement-fixation test is being successfully applied within limits to the diagnosis of anaplasmosis with results comparable to those obtained in other infectious diseases. The limiting factor, however, is the inability to produce a satisfactory antigen consistently. Variations in the titer of the individual antigens further complicate the problem. Although research is still in progress, the problem of producing a satisfactory antigen consistently remains unsolved and until the difficulty of producing such antigens is overcome, it will not be possible for the Bureau to test individual animals or herds of animals for the presence or absence of anaplasmosis.
DR. H. SCHMIDT, College Station, Texas, Chairman; DR. A. L. BRUECKNER, College Park, Md.; DR. H. W. SCHOENING, Washington, D.C.; DR. JOHN MILLIGAN, Auburn, Alabama; DR. A. P. SCHNEIDER, Boise, Idaho; MR. RAY WILLOUGHBY, San Angelo, Texas; DR. VERNON CHADWICK, Jackson, Miss.; DR. D. H. RICKS, Oklahoma City, Okla.; DR. D. A. SANDERS, Gainesville, Florida

Your Committees on anaplasmosis, since the first report in 1944, have reviewed many of the problems facing us in the control of this insidious disease. Each committee has been cognizant of the fact that the key to the problem of its control is the carrier animal. This year your committee is bringing you up to date on the identification of the carrier animals with the paper just presented by Doctors Gates and Mohler on “The Present Status of the Complement Fixation Test for Anaplasmosis.”

Your committee can offer you no definite information on the number of cases of anaplasmosis occurring annually in the United States because not only are no accurate morbidity records available but many cases are not even seen by a veterinarian. “I had no sooner mailed a copy of this report to the Secretary when I had a long distance call from a lady in Beaumont, Texas, who told me the following story, which illustrates the point I am trying to make. She was seeking additional advice other than that available from a practicing veterinarian. She said that a neighbor was running a dairy, and that he had sixty animals in the herd. They had been running in a rice field where there were a lot of black horseflies present, and soon he had thirty cases of anaplasmosis, from which twenty-four animals died. Twenty-one days later animals in her herd came down with anaplasmosis, and she lost nine up to the time she spoke to me. She was frantic because she could get no help from the veterinarian. She said that they had bought enough aerosol to float a battleship, but they had had no results from its use.

Even if such records were available it would not reflect the possible number of carriers in the herds because many animals become carriers in calfhood at which time no manifestations of anaplasmosis are apparent. From reports available, however, it would seem there is no abatement in the annual occurrence of the disease.

The question of premunization has been brought to the attention of your committee with the request for information on it. This phase has been pointed out before in the report of one of the committees. Your chairman, during a period of 30 years, has premunized many hundreds of calves at the Texas Station which were brought to Texas from north of the Texas Fever tick quarantine line and has found the method very successful. By injecting calves less than one year old with one ml. of carrier blood, the mortality is practically nil while a solid premunity is established. It was the method used to displace the longhorn cattle of Spanish descent in the South and Southwest by members of the European breeds long before the tick was eradicated. But the question is not “Is premunization practical?” but rather “Under what conditions shall I practice premunization?” or “Shall I
practice premunization at all?" The problem is closely related to the problem of identifying carrier animals in the herd. When these are removed from the herd, premunization no longer serves a useful purpose.

In the field of therapeutics there may be a bright star appearing on the horizon. From Oklahoma and Louisiana came favorable reports of the action of aureomycin and terramycin on anaplasmosis. These preliminary reports need corroboration on a larger scale with a view of exploring the precise limits of their therapeutic action on anaplasmosis. No progress in the control of vectors has been reported during the past year. Last year your committee urged the industry and the manufacturing chemist to come to the aid of the research veterinarian in obtaining funds and new drugs to carry on research on this insidious disease. The response, if any, has been very meager. The solution of the control of the disease lies with the researcher and must await the outcome of his labors. The answers are not available now. He should be supported and encouraged in every effort that might promise progress in the solution of this vexing problem. So far no funds have been made available through the Research and Marketing Act to the state experiment stations to carry on the pretentious program of research on this disease outlined by the researchers in animal diseases of the southern states some years ago.
ANTHRAX IN LIVESTOCK IN THE UNITED STATES AND
ITS CONTROL

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The limited time available will not permit a discussion of all aspects of the anthrax
problem. This paper, therefore, will deal chiefly with the incidence, diagnosis, and
control of the disease in livestock.

Although anthrax of livestock has been a problem in the United States for more
than 60 years and is one of the most serious diseases with which livestock sanitary
officials have to deal, it has received very little attention in the veterinary literature
in recent years.

Probably no disease of livestock causes more consternation and apprehension
than anthrax when it first appears in a new area. This is not surprising when one
considers the suddenness with which it strikes, its rapid spread, the heavy toll it
takes and the danger of its transmission to man. The wide publicity sometimes
given by the press to the occurrence of the disease in a heretofore anthrax-free area,
also adds to the general state of alarm.

Historically anthrax has a fourfold significance. In addition to being one of the
oldest diseases recorded in history, it was the first disease of man and animals
shown to be caused by a microorganism, the first disease against which a bacterial
vaccine was found to be effective, and the principal subject for study by the early
investigators who laid the groundwork for the modern science of bacteriology.

Anthrax exists in certain areas on all the continents and
occurs from the tropics
to the polar regions. The worldwide distribution of the disease and the difficulty
encountered in combating it is due to the marvelous tenacity of the anthrax spore.
Anthrax is spread from one country to another principally through infected ani-
imals and the interchange of contaminated objects closely associated with animal
life, such as hides, hair, wool, bonemeal, fertilizer, forage, and other materials.
When anthrax is once established in an area, it may spread to adjoining localities
and even to distant points by (1) contamination of soil, drinking water, and pasture
plants with discharges of diseased animals; (2) by dogs, coyotes, and other carnivora;
(3) by carrion-eating animals and birds, especially buzzards; (4) by flies
and possibly other types of insects; (5) by streams contaminated with surface
drainage from anthrax-infected soil, and tannery wastes; and (6) by contaminated
food.

HISTORY AND INCIDENCE OF ANTHRAX IN LIVESTOCK

The early history of anthrax in livestock in the United States is somewhat ob-
scure. The presumption is that it was implanted in the Rio Grande Valley and
Mississippi Delta by explorers and primitive settlers from the Old World. In Louisiana,
it has been traced back to the time of its settlement by the French. Widespread
outbreaks in livestock and cases in man were recorded as early as 1835, and later
in 1851 and 1884. The first cases in man recorded in the United States occurred in

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67
1834 during outbreaks in livestock in Pennsylvania in the vicinity of Philadelphia. Outbreaks in Mississippi are reported to have occurred as early as 1836, and later in 1865. In Texas outbreaks were recorded as early as 1860, and later in 1880. Outbreaks in New York were recorded in 1881; in Vermont and Massachusetts in 1887, and in California in 1888. Infected areas still exist in most of these States.

The anthrax situation in livestock in the United States from 1915 to 1944, as determined by Bureau surveys (1), shows a gradual increase in territory involved. Outbreaks in livestock during that 30-year period were reported from at least 43 States, involving a total of 438 counties. The five States that reported having no outbreaks during that period were Arizona, Indiana, Maine, Michigan, and West Virginia. (Fig. 1)

During the past two decades one or more widespread outbreaks of virulent nature have occurred in South Dakota, Nebraska, Mississippi, Louisiana, Texas, and California, while sharp outbreaks of a less severe nature have occurred in Arkansas, Alabama, New Mexico, Missouri, and Nevada. Numerous sporadic outbreaks occurred in other States. Recognized areas of infection of large dimensions exist in South Dakota, Nebraska, Arkansas, Mississippi, Louisiana, Texas, and California, while small areas exist in Vermont, Missouri, New Jersey, Delaware, Wisconsin, Utah, Nevada, and Oregon.

During 1951, 483 outbreaks of anthrax in livestock were reported from 25 states with a total loss of 2,753 head of livestock, The large number of outbreaks of unknown origin in swine, resulting in a loss of 1,088 animals and condemnation of 232 swine carcasses under federal meat inspection, was of unusually interest. Outbreaks in new areas in 1951 were reported from 51 counties in 15 states.

During the seven-year period 1945 through 1951, there were 1,141 anthrax outbreaks reported from 35 states with losses of 11,257 head of livestock (2-4). Outbreaks in new areas were reported from 133 counties in 27 states. A greater number of outbreaks occurred in 1951 than in any single year from 1945 through 1950. During this seven-year period, 29 cases of agricultural anthrax were reported in man, eight of which were in veterinarians. (Table I, table II, and fig. 2)

It is significant that the records of the Federal Meat Inspection Division show that from July 1945 through December 1951, 367 hogs and 39 cattle were condemned for anthrax at establishments operating under federal meat inspection. The widespread outbreaks of anthrax (principally in swine herds) that occurred, especially in the Midwest during the first quarter of 1952, received wide publicity in the press and aroused considerable interest and much apprehension among livestock sanitary officials and livestock owners. In the states of Illinois, Indiana, Iowa, Michigan, and Ohio, a total of 395 outbreaks occurred involving 144 counties with losses of 846 swine (5). The available history and circumstantial evidence in most instances indicated the infection in swine in the Midwest to be of food origin.

Outbreaks in swine were characterized by the following unusual aspects: (1) wide distribution; (2) occurrence in noninfected areas; (3) low morbidity and mortality rate; (4) failure to spread from one premises to another; and (5) failure to spread by contact from animal to animal or from swine to other species. (Table III and fig. 3)

Incomplete data covering the incidence of anthrax for the first 9 months of 1952
Numerous instances are no record to show that spores retain their viability in the soil, in water, on hides, and in storage for many years (6). Evidence has been reported to show that they may survive and retain their virulence in the soil for at least 25 years (7) and that dry anthrax spores may survive at room temperature for more than 40 years (8).

**ANIMALS SUSCEPTIBLE**

Virtually all animals are susceptible in some degree to anthrax. Cattle, horses, sheep, and goats, are most commonly affected. Man and swine possess a greater natural resistance to the disease. Under certain conditions, dogs, cats, and wild animals of prey, birds, frogs, and toads may become infected. Mice, guinea pigs and rabbits, which are commonly used in the laboratory diagnosis of anthrax, are very susceptible, while rats are less so.

**TABLE I**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NUMBER STATES REPORTING</th>
<th>NUMBER COUNTIES</th>
<th>NUMBER OUTBREAKS</th>
<th>LIVESTOCK LOSSES</th>
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<tr>
<td>1945</td>
<td>14</td>
<td>52</td>
<td>97</td>
<td>583</td>
</tr>
<tr>
<td>1946</td>
<td>18</td>
<td>82</td>
<td>163</td>
<td>4,019†</td>
</tr>
<tr>
<td>1947</td>
<td>19</td>
<td>65</td>
<td>124</td>
<td>880</td>
</tr>
<tr>
<td>1948</td>
<td>14</td>
<td>63</td>
<td>120</td>
<td>1,554†</td>
</tr>
<tr>
<td>1949</td>
<td>16</td>
<td>57</td>
<td>93</td>
<td>773</td>
</tr>
<tr>
<td>1950</td>
<td>12</td>
<td>55</td>
<td>61</td>
<td>595</td>
</tr>
<tr>
<td>1951</td>
<td>25</td>
<td>113</td>
<td>483</td>
<td>2,753</td>
</tr>
</tbody>
</table>

* In some States losses were estimated.
† Heavy losses were reported during severe epizootics of the disease in Louisiana. 35 States reported 1141 outbreaks with total livestock losses of 11,257.

Infection in cattle, horses, mules, sheep, and goats, usually is the result of grazing on infected pasture land. Infection may also be caused by contaminated fodder or artificial feedstuffs, such as bonemeal, blood meal, oil cake, and tankage; by drinking from contaminated pools; or by the bites of contaminated flies. Dogs, cats, and mink usually acquire the infection from consumption of infected meat. Outbreaks from consumption of contaminated food have been reported in many species of wild animals kept in captivity.

In the United States anthrax occurs in epizootic form in regions in which the soil is known to be infected. However, it may occur sporadically anywhere, at any time and thus may appear where previously not identified or where it has been quiescent for a long period.

In areas commonly designated as "anthrax districts" it constitutes a perennial problem, making its appearance during a definite period, known as the "anthrax season," usually late summer and early fall when grazing is closer due to scanty pasturage and when flies are very numerous. In such areas the disease can be kept in check by preseasonal vaccination with appropriate types of immunizing agents.
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Number Outbreaks</td>
<td>Live-</td>
<td>Number</td>
<td>Live-</td>
<td>Number</td>
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<td>239</td>
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<td>113</td>
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<td>0</td>
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</tbody>
</table>

**TABLE II**

*States Reporting Anthrax Outbreaks in Livestock from 1945-1951 Inclusive, and Data on Incidence of the Disease*
<table>
<thead>
<tr>
<th>State</th>
<th>Cases</th>
<th>Cows</th>
<th>Bulls</th>
<th>Sheep</th>
<th>Pigs</th>
<th>Losses</th>
</tr>
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<td>0</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Pennsylvania</td>
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<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>South Dakota</td>
<td>12</td>
<td>32</td>
<td>29</td>
<td>80</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>Tennessee</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>Texas</td>
<td>7</td>
<td>204</td>
<td>19</td>
<td>277</td>
<td>14</td>
<td>233</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
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<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
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<td>0</td>
<td>1</td>
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<td>0</td>
</tr>
<tr>
<td>Wyoming</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>97</td>
<td>583</td>
<td>163</td>
<td>4019</td>
<td>124</td>
<td>880</td>
</tr>
</tbody>
</table>

* Cattle, horses, sheep, and hogs.
† Major outbreaks involving numerous premises.
‡ Losses estimated.
Since symptoms and lesions are important in making a clinical diagnosis, they will be briefly discussed.

Anthrax may occur in a peracute, acute, subacute, or chronic form. The peracute form is most common in cattle, sheep, and goats, occurring at the beginning of an outbreak. It is characterized by sudden onset and a rapidly fatal course. Victims are frequently found dead without having shown any previous evidence of disease.

In the acute and subacute forms there is first excitement, followed by depression, spasms, respiratory or cardiac distress, trembling, staggering, convulsions, and death. During the course of the disease, pregnant animals may abort, ruminations cease, and the milk secretion is reduced. Bloody discharges may emanate from the natural body openings and edematous swellings may appear on different parts of the body. The acute form usually terminates in death in a day or two, while the subacute form may lead to death in three to five days or longer, or to complete recovery after several days. These types of the disease are common in cattle, horses, and sheep.

A cutaneous form of anthrax characterized by swellings in various parts of the body may occur in cattle and horses following vaccination or following bites by infected flies. (Plate 2.) Chronic anthrax occurs occasionally in cattle, horses, and dogs, with local lesions confined to the tongue and throat, but is observed mostly in swine, which are more resistant to the disease than any other domesticated farm animal.

Anthrax in swine usually results from feeding on an anthrax-infected carcass. However, swine may also acquire the disease by following cattle in areas where the disease exists, from pasturing on infected soil, and from the ingestion of contaminated feed. The outstanding symptoms of the disease in swine are marked swelling of the throat and tongue with frequently a blood-stained frothy discharge from the mouth. When infection in hogs follows feeding on anthrax-infected material, some of the animals may be found dead without having shown any previous signs of illness. Others of the group may show symptoms of illness with rapidly progressing swell-

**TABLE III**

*Incidence of Anthrax in Swine in the Midwest During the First Quarter of 1952*

<table>
<thead>
<tr>
<th>STATE</th>
<th>NUMBER OF COUNTIES</th>
<th>NUMBER OF OUTBREAKS</th>
<th>LIVESTOCK LOSSES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Swine</td>
</tr>
<tr>
<td>Illinois</td>
<td>22</td>
<td>30</td>
<td>168</td>
</tr>
<tr>
<td>Indiana</td>
<td>46</td>
<td>106</td>
<td>300*</td>
</tr>
<tr>
<td>Iowa</td>
<td>17</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Michigan</td>
<td>10</td>
<td>14</td>
<td>43</td>
</tr>
<tr>
<td>Ohio</td>
<td>49</td>
<td>217</td>
<td>308</td>
</tr>
<tr>
<td>Total</td>
<td>144</td>
<td>395</td>
<td>846</td>
</tr>
</tbody>
</table>

* Approximate losses.
ings about the throat, which in some cases, cause death by suffocation. A relatively large percentage of the group may become visibly sick for a few days, with or without moderate swellings about the throat, and then develop the disease in a chronic form.

**TABLE IV**

*States Reporting Anthrax Outbreaks During the First Nine Months of 1952 (Incomplete Data)*

<table>
<thead>
<tr>
<th>STATE</th>
<th>NUMBER OF COUNTIES</th>
<th>NUMBER OF OUTBREAKS</th>
<th>LOSSES FROM ANTHRAX</th>
<th>TOTAL LIVESTOCK LOSSES</th>
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<tr>
<td>California.</td>
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<td>32</td>
<td>10</td>
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<td>Colorado...</td>
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<td>1</td>
<td>1</td>
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<tr>
<td>Florida....</td>
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<td>11</td>
<td>96</td>
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<td>35</td>
<td>20</td>
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<tr>
<td>Total......</td>
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<td>1,480</td>
<td>1,534</td>
</tr>
</tbody>
</table>

* Losses estimated.
† Mink and dogs not included in total livestock losses.
or make a gradual recovery. However, weeks later, when some of these animals are presented for slaughter, evidence of anthrax infection may be found in the cervical lymph glands and tonsils on postmortem examination.

Carcasses of animals dead of anthrax decompose rapidly and soon become greatly bloated. Rigor mortis is either absent or incomplete. The blood is considerably darker than normal, does not clot readily, and is frequently spoken of as being "tarry." Hemorrhages beneath the skin are common. Clear or somewhat blood-tinged gelatinous exudates are found between the muscles and beneath the skin, especially in the areas where swellings were seen before death. The spleen in acute cases usually shows characteristic changes, which are of considerable assistance in making a diagnosis of anthrax. This organ is greatly enlarged, and the splenic pulp is dark red to blackish in color and soft or even semifluid in consistency. The liver, kidneys, and lymph glands are usually congested and enlarged and show areas of hemorrhage.

**DIAGNOSIS**

Anthrax should be suspected when animals die on or near premises where the disease has appeared previously. However, it is important to ascertain whether the death was due to anthrax. The diagnosis of anthrax based on clinical symptoms may at times be difficult especially when it occurs in a new area. Peracute anthrax may be confused with other conditions producing sudden death, such as lightning stroke, sun stroke, lead poisoning, and other acute, fatal disturbances. Less acute cases of anthrax may be mistaken for malignant edema, hemorrhagic septicemia, tick fever, anaplasmosis, blackleg, and sweet clover poisoning. In view of these facts it is always advisable to have a tentative diagnosis of anthrax substantiated by laboratory examination (9).

In order to insure a quick, conclusive and reliable examination, it is highly essential that suitable specimens be properly collected and prepared for shipment so as to reach the laboratory in satisfactory condition. Containers in which specimens are shipped should be labelled "Suspected anthrax" and each specimen should be properly identified. A history of the case should be furnished when available.

The importance of collecting specimens from the dead animal soon after death and before putrefaction occurs, as well as using clean, sterile instruments and containers in the process to avoid contamination with extraneous organisms, cannot be overestimated. Ears, spleen tissue, and blood samples when collected in sterile containers from animals a short time after death and brought to the laboratory within a few hours make very satisfactory material for examination, but many of the specimens of this type, particularly those shipped great distances and not properly prepared for shipment, arrive in varying stages of decomposition or may show considerable contamination with organisms other than anthrax, which may interfere with a satisfactory examination. Experience in laboratory diagnosis of anthrax has demonstrated that the most satisfactory material for examination when shipped great distances consists of blood which has been collected on swabs, blotting paper, or glass slides, and which has been allowed to dry and therefore sporulate. For this purpose blood may be collected from the jugular vein by means
of a sterile needle, or from the vessels of the ear or tail. Specimens from the spleen may be obtained through an incision between the ninth and tenth ribs. In carcasses showing evidence of decomposition, blood samples should be taken from a peripheral blood vessel.

Since opening an anthrax carcass promotes the formation of anthrax spores, is apt to establish a soil infection and increases greatly the danger of spreading the infection, postmortem examinations, which are extremely hazardous to the operator, should be performed only when necessary.

While some laboratory workers consider that anthrax can be diagnosed easily and quickly by microscopic examination, experience has shown that it is hazardous to base a diagnosis entirely upon examination of blood smears. Many organisms, particularly those found in specimens undergoing putrefaction, may be confused morphologically with *B. anthracis* and, even though the microscopic picture appears conclusive, it should always be checked by both cultural and laboratory animal inoculation tests to guard against possible error in diagnosis. (Plate 3, A, B, C.)

It should be pointed out that cultural tests for anthrax may frequently miscarry with specimens or material contaminated with (1) rapidly growing organisms of the spreader type, (2) organisms especially antagonistic to anthrax, or (3) anthrax-like organisms.

**CONTROL MEASURES**

The effective control of anthrax in livestock requires the combined action of livestock sanitary officials, local veterinarians, and owners of livestock. When a diagnosis of anthrax has been made, the following measures are generally recognized as the most effective means of control.

1. The prompt and proper disposal either by complete burning or by deep burial of animals dead of the disease, together with all the manure, bedding, blood-stained soil, and other contaminated material. (Plate 4)

2. A careful examination of the herd for animals showing early symptoms of
the disease; the prompt isolation of sick animals, and immediate treatment with large doses of anthrax antiserum and/or penicillin.

3. Vaccination of the apparently well animals in the herd as soon as possible, for prevention, in accordance with methods recommended by the state livestock sanitary officials and other experienced veterinarians.

4. Immediate change of pastures if possible. This precaution in itself has in many instances helped to reduce losses.

5. A strict quarantine of premises rigidly enforced to prohibit the movement of livestock or other commodities of a contraband nature from or into the infected area.

6. Use of effective fly repellents on dead animals, sick animals, and apparently well animals in an infected herd to prevent further spread of the disease by flies. During outbreaks of anthrax in some states, a limited area surrounding each premises where the disease occurred is sprayed at four or five-day intervals with DDT, BHC, or lindane in an effort to stop all insect movement.

When an outbreak of anthrax occurs in a dairy herd, the dairy should be placed under strict quarantine, and all milk should be withheld from distribution until the public health officials and state livestock sanitary officials consider circumstances satisfactory for issuing a clean bill of health. Precautions should be taken to prevent the contamination of milking cans, mechanical milkers, buckets, and other dairy equipment by direct or indirect contact with diseased animals and their excreta. Although there appears to be little likelihood of direct transmission of anthrax through the milk of infected cows, a few instances on record indicate that anthrax bacilli may be excreted in the milk of an infected animal (10, 11).

The length of time a dairy should be quarantined following an outbreak of anthrax will depend principally on the type of outbreak. The quarantine period varies in different states. It is our opinion that milk from infected cows, or milk believed to be contaminated with *B. anthracis*, should be destroyed by incineration, or be buried after boiling or treatment with 5 per cent lye or 10 per cent formalin to destroy the organism. The disposition of milk from healthy cows in an exposed or quarantined herd is a problem that must be decided by the livestock sanitary officials and public health officials concerned, and depends to a great extent on the circumstances attending the outbreak.

In the control of anthrax, prompt and effective disposal of carcasses is of the greatest importance. This can be accomplished either by complete cremation or by deep burial under a layer of quicklime covered with at least four feet of earth.

In disposing of a dead animal, the following method is recommended: Immediately after finding the animal, cover it with kerosene or crude oil to keep flies, dogs, buzzards, crows, and vermin from the carcass until it is disposed of. If conditions permit, cremate or bury the carcass where it is found. Lye is one of the most effective of the disinfectants. To disinfect premises against anthrax, a 5 per cent solution is recommended. To prepare such a solution, 2¼ pounds of commercial lye is dissolved in 5½ gallons of water. All places to be disinfected should be thoroughly soaked with the disinfectant, which should be allowed to remain on for at least a day, and should then be thoroughly washed off with clean water before the livestock are returned.
VACCINATION

Anthrax is one of the few serious diseases of livestock that can be largely controlled by preventive vaccination. A material reduction in the occurrence of the disease can be accomplished by annual vaccination of all stock in infected localities well in advance of the anthrax season. Vaccination of exposed animals in an infected herd will reduce losses and assist in controlling the anthrax. The recognized immunizing agents now being used in the United States for vaccination of animals against anthrax are of two types—sterile products (anthrax antiserum and anthrax bacterin) and the living-spore vaccines which consist of suspensions of living anthrax spores of different degrees of attenuation suspended in a solution of normal saline in combination with glycerine for intradermic or subcutaneous use and with saponin, or alum for subcutaneous injections only.

Anthrax antiserum is of value both as a preventive and as a therapeutic agent. It produces rapid immunity of short duration, while anthrax bacterin produces an active immunity of low degree but of longer duration than anthrax antiserum. Long experience, however, has shown that living-spore vaccines produce a higher degree of immunity than do bacterins. Experimental evidence to confirm this fact was obtained by Bureau investigators in immunity tests carried out with sheep in 1935 (12). While satisfactory results have been obtained with spore vaccines given subcutaneously by the single, double, or triple injection method, exceptionally good results following the use of intradermic spore vaccine have been reported by investigators and veterinary practitioners, both in Europe and the United States. Reports from the field indicate that in recent years the intradermic method of vaccination (with anthrax-spore vaccine) is gradually growing in favor, particularly in badly infected anthrax districts, and that the results obtained from its use have been highly satisfactory. It produces a rapid, solid, durable immunity with little or no reaction. It is of special value in immunizing exposed animals, usually stopping losses in four to seven days. During the period from 1939 to 1952, thousands of cattle on five Indian reservations located in known anthrax districts in South Dakota, were vaccinated by the intradermic method under direct supervision of Bureau of Animal Industry veterinarians, with excellent results.

The simultaneous administration of anthrax antiserum and subcutaneous spore vaccine (No. 2, 3, or 4) is likewise an effective method of immunization. This method has been used with great success in exposed herds and in California it is reported to be the method preferred for anthrax immunization. (Table V)

Sterne (14, 15) has reported excellent results following wide-scale vaccination of different species of animals in South Africa with a new type of avirulent anthrax spore vaccine. This vaccine, which is prepared from avirulent, non-encapsulated, dissociated anthrax organisms, consists of a heavy suspension of spores in normal saline, glycerine, and saponin. According to Sterne, the immunizing value of this vaccine can be determined easily by potency tests on guinea pigs. This vaccine has been used to some extent in England and other countries but never in the United States. The type of vaccine that should be used in a given area or in a particular herd can best be determined by the livestock sanitary officials and the practicing veterinarians. In anthrax districts, preseasonal annual vaccination is the surest means of controlling the disease. Interruption of annual vaccination often results
Plate 3.—Anthrax colonies on surface of plain agar plate. 18 hour growth. Seeded direct from saline suspension of bovine anthrax spleen. A. Typical rough, flat, granular, greyish white, irregular shaped colonies, natural size. B. Small colony. C. Large comet-shaped colony. Note rough ground glass appearance of both colonies, X10.

Plate 4.—Cross section of method of disposing of anthrax carcasses by cremation,
1. Saturate carcass with kerosene, crank case oil or any inflammable oil.
2. Cover carcass with a hayrack full of straw.
3. Place two loads of heavy manure on top of the straw and set it afire.
4. Add manure daily or when necessary to keep carcass covered until it is burned to a white ash.
Plate 5.—Typical lesion on the finger 5 days following autopsy and skinning of an anthrax carcass. Typical black center is surrounded by edematous tissue, beefy-red in color.


Plate 6.—Case of human anthrax acquired from handling fat trimmings from a hog suspected of dying from choke. Two cats fed on meat from the hog died suddenly. Diagnosis confirmed by laboratory examination. Courtesy of The Norden News, April–May 1934 issue, "Human Case of Anthrax."
in the recurrence of extensive outbreaks. Vaccination during an outbreak frequently falls short of producing the desired results owing to a state of lowered resistance following vaccination and before immunity is established and owing to the fact that the infection cannot always be overcome in animals already exposed. An occasional break following vaccination does not indicate that the herd should be revaccinated. Revaccination sometimes does more harm than good.

**TREATMENT IN ANIMALS**

For many years homologous anthrax antiserum was most commonly used for the treatment of the disease in animals. Intravenous injections of the serum in large doses of 50 to 100 cc. or more during the early stages of the disease gave the best results. Arsenicals and sulfa drugs have been used only to a very limited extent in treating animals, but penicillin, which has been used in human anthrax with excellent results, is now being used with equally good results in the treatment of infected animals. Excellent results in the treatment of infected livestock by penicillin therapy have been reported from different parts of the United States and France. In cattle intramuscular administration of 3,000,000 to 9,000,000 units or more of penicillin resulted in marked improvement in 36 hours or less with complete recovery in four to five days. Large doses of penicillin in combination with injections of anthrax antiserum have given good results in the treatment of animals affected with vaccine anthrax in Kansas.

Dr. W. W. Bailey (13) of Sussex, N. J., recently reported the successful treatment of a large number of cases of vaccine anthrax with a combination of penicillin and terramycin, and terramycin alone.

**TABLE V**

*Results of Comparative Potency Tests of Anthrax Biologics on Sheep*

(6 vaccinated animals and 6 to 12 controls used in each test)

<table>
<thead>
<tr>
<th>BIOLIGIC</th>
<th>NUMBER OF DAYS INTERVENDING BETWEEN VACCINATION AND EXPOSURE</th>
<th>IMMUNITY</th>
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<tr>
<td></td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Anthrax antiserum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum and spore, simultaneous</td>
<td>67</td>
<td>100</td>
</tr>
<tr>
<td>Spore vaccine No. 2 (single injection)</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Intradermic spore No. 2 (single injection)</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Spore vaccine No. 2 (in saponin)</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Bacterin (washed)</td>
<td>33</td>
<td>100</td>
</tr>
<tr>
<td>Controls</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>
Although anthrax is primarily a disease of animals, it is transmissible to man, either directly by contact with infected animals or indirectly by contact with infected animal material or objects contaminated with the organism. Anthrax in man, therefore, is classified either as an occupational or nonoccupational disease. Agricultural anthrax is acquired by close contact with infected animals or their carcasses, usually by handling, skinning, or making postmortem examination; while industrial anthrax is acquired by indirect contact, as in the manipulation of infected animal material such as hides, wool, and hair. Nonoccupational anthrax is acquired from the use of contaminated shaving brushes, wearing apparel, such as fur and leather goods, and other indirect sources. It is not encountered as frequently as occupational anthrax.

In man, anthrax usually occurs as a primary localized infection of the skin in the form of a carbuncle (plates 5 and 6) or as an infection of the lungs, which is known as "wool-sorters' disease." In countries where the flesh of animals dead of disease is eaten, an intestinal form of anthrax has been reported. Skin infections result from the handling of carcases of animals dead of anthrax or the hides, hair, or wool from such carcases. During outbreaks in animals, cases in man from fly bites have been repeatedly reported. Originating as localized infections in the form of small pimples, the lesions develop rapidly and may terminate in a fatal septicemia or blood poisoning. Prompt medical attention is most important whenever anthrax infection is suspected. The pulmonary form of the disease results from the inhalation of anthrax spores in factories where hair and wool are processed. This form of anthrax runs a very rapid course and terminates fatally.

The United States Public Health Reports covering the eight-year period from 1944 to 1951, inclusive, show a total of 508 anthrax cases in man, most of which were of industrial origin. These figures indicate that while human anthrax in the United States is not a common disease, it certainly cannot be considered rare. In the treatment of anthrax in man, promptness of diagnosis and early treatment are of first importance. While specific antiserum, arsenicals, and sulfa drugs have given excellent results in treatment of anthrax in man during the past 20 years, the trend in recent years appears to be toward penicillin which has been found to be highly effective. More recently some of the newer antibiotics, such as aureomycin, chloromycetin, and terramycin have proved to be extremely effective in the treatment of a limited number of cases.

RELATION OF ANTHRAX TO FOOD HYGIENE

Public health officials have pointed out the importance of preventing the transmission of anthrax to man through the consumption of contaminated meat and other animal products. Although the intestinal form of anthrax has been reported from countries where the flesh of animals dead of disease is consumed, there appears to be little likelihood of the infection's being acquired from meat in civilized countries where stringent meat inspection regulations are enforced. Some element of danger, however, may exist in the meat of animals slaughtered in uninspected abattoirs, or in meat from local rendering plants used as animal food.

The danger of infection through milk containing bacilli is remote, as the milk
secretion usually diminishes greatly, and the bacilli, as a rule, are present in the
blood only in great numbers just before death, and rarely occur in the milk se-
cretion.

The question may arise as to whether the meat and milk from vaccinated animals
are dangerous. So far as we know, no instance has been reported to indicate that
milk from vaccinated animals contains the organisms. However, milk from cows
showing a marked reaction following vaccination should not be used until animals
have returned to normal. Owing to the fact that viable anthrax spores may persist
at the site of inoculation for a considerable period following vaccination, the
Federal Meat Inspection Regulations require that carcasses of food-producing
animals treated with spore vaccines be condemned if the animals are slaughtered
in less than six weeks following vaccination, or if evidences of the reaction to the
injection remain, such as inflammation, tumefaction, or edema, regardless of the
period of time elapsing between treatment and inspection.

LIVESTOCK SANITARY CONTROL

Livestock sanitary laws and regulations for the control of anthrax have been
enacted in all highly civilized countries. In areas where the laws have been strictly
enforced, such as England, France, Germany, sections of South Africa, and certain
localities in the United States, there has been a marked reduction in its prevalence
both in animals and man.

The control of anthrax in the various states is carried out principally by the
livestock sanitary officials, the practicing veterinarians, and livestock producers.
The Bureau of Animal Industry has no direct supervision of these activities. How-
ever, in extreme emergencies when heavy losses from anthrax occur, and when
the combined forces of state and practicing veterinarians are inadequate to cope
with the situation, the Bureau has endeavored to furnish what assistance was
available.

In recent years the state livestock sanitary officials and livestock sanitary asso-
ciations in some anthrax areas have carried out an active, educational campaign
to combat the disease. They have emphasized the value of annual preseasonal vac-
cination for prevention and have stressed the importance of livestock owners' giving
full cooperation in carrying out the recognized sanitary police measures for checking
outbreaks. These organized efforts on the part of livestock sanitary officials in an-
thrax areas have no doubt reduced losses from the disease in livestock and decreased
the incidence of agricultural anthrax in man.

For the future control and prevention of anthrax in the United States certain
recommendations have been made which will be included in the report of the
Special Committee on Anthrax of this Association which will be presented at this
meeting.2

REFERENCES

1. STEIN, C. D., The History and Distribution of Anthrax in Livestock in the
2. STEIN, C. D., Incidence of Anthrax in Livestock during 1945, 1946, and 1947,

2 See report of Committee on Anthrax.


PUBLIC HEALTH ASPECTS OF ANTHRAX CONTROL

JAMES H. STEELE, DVM, MPH AND RAYMOND HELVIG, DVM, MPH

HUMAN ANTHRAX

Anthrax is not a highly infectious disease in man except in certain occupations where individuals may be directly exposed to the disease. Less than 100 cases are reported annually in the United States. In 1951 only 60 cases were reported to the National Office of Vital Statistics. In 1952 less than one-half as many cases as reported in 1951 have been observed. Nearly all of the 1951 cases occurred in the northeastern states and were attributed to occupational exposure. There were less than ten human cases in other states. A summary of human anthrax, 1945 to 1951 inclusive is depicted in Figure 2. The total number of human cases in that period was 365, of which 302 occurred in northeastern states where industrial exposure is usually stated to be the source of infection. In the remaining 41 states a total of 63 cases was reported, of which 29 (21 farmers and 8 veterinarians) were definitely attributed to agricultural exposure. Five of these cases reported in Florida were attributed to an outbreak of bovine anthrax in the fall of 1951. The individuals involved were a cowboy who skinned a cow dead of anthrax, two veterinarians who vaccinated cattle in this area, a laboratory technician who handled a suspected specimen, and a child in a nearby town. Five of the nine cases in Arkansas were associated with the skinning of a cow that had died suddenly. The farmer was assisted by his family and neighbors in the salvage operation. The two cases reported in Kentucky were reported in farmers who were removing the hides from mules that died of anthrax. The mule carcasses were then fed to swine and they developed anthrax. In California one of the cases occurred in a sheepherder who sheared infected sheep. Three California veterinarians on different occasions contracted the disease while performing post mortems on animals dead of anthrax. Veterinarians have the highest incidence of this disease. In New Jersey a farmer who killed and dressed an infected heifer developed the disease. Most of the human cases reported in the western and southern states occurred under conditions similar to those mentioned above. All of the cases were of the cutaneous type. There are no records of human pulmonary anthrax caused by the ingestion of contaminated milk or meat in the United States in recent years. A number of health and veterinary medical authorities are of the opinion that there are many cases which are not reported. Public health officials believe that the reported human cases will continue to decline because of the successful use of antibiotics. The substitution of synthetic fibers for carpet wool will further reduce the incidence of industrial anthrax. This may explain the 1952 decrease. So far as can be determined only one case of human pulmonary anthrax has occurred in the postwar period. This case had a fatal termination even though antibiotics and serum were administered. As stated earlier there are no reports of intestinal anthrax in the United States, although this disease is reported in countries where animals dead of anthrax are used for food. The World Health Organization is making a survey to determine the prevalence of the various types of human anthrax and will be available in 1953.
During the period 1945 to 1950 inclusive, 658 anthrax outbreaks were reported from 32 states with estimated losses of 8,504 head of livestock. Occurrences in new areas were reported from 51 counties in 16 states. In 1951 a noticeable increase in outbreaks was observed. There were 483 outbreaks in 25 states involving 113 counties with a loss of 2,753 head. It is apparent that three-fourths as many outbreaks occurred in 1951 as in the six-year period 1945–1951, although the total number of animal losses was less than in 1946 when there was a severe epizootic in Louisiana which killed over 3,000 head. Missouri had the highest losses in 1951 with 694 deaths, of which 440 were in horses and mules. Fairly large losses were reported in California, Florida, Illinois, Iowa, Kentucky, Nevada, Tennessee, and Texas.

An unusual feature of the 1951 losses was the great number of widely scattered outbreaks in swine. The Bureau of Animal Industry reports 1,088 swine losses compared to 1,001 deaths in cattle. The greatest swine losses were in Illinois, Iowa, Missouri, and Kentucky. Coincident with the increased number of swine cases is the condemnation of 232 infected carcasses by the Federal Meat Inspection Service.

Although swine are considered to be more resistant to anthrax than any other livestock species, the disease is not uncommon in swine in the areas where the infection exists enzootically. Although infections have also occurred in swine in non-infected areas from the consumption of contaminated feed, they usually appear after infection of other livestock. Infection in swine usually results from the feeding on carcasses of animals dead of anthrax, from following infected animals, or deep rooting contaminated pasture during warm weather. The disease in swine may take many forms including the acute or chronic forms with characteristic symptoms of septicemia or glossitis with enlargement of the cervical lymph nodes. In addition mild or latent cases often occur which are not readily diagnosed. The swine outbreaks that occurred in the midwest in 1951 were all on premises hitherto considered free from infection and far removed from enzootic areas. The history of some cases suggested that contaminated mixed feed may have been the source of infection. Laboratory examination of suspected feed samples failed to reveal Bacillus anthracis.

There were no human cases that were attributed to any of the swine outbreaks. In 1951 outbreaks were recorded in 51 counties which previously had no history of disease. These were in Indiana (1), Kentucky (1), Mississippi (1), New Jersey (1), Ohio (1), Florida (2), Minnesota (2), Oklahoma (2), Louisiana (3), Tennessee (3), Wisconsin (3), Missouri (4), Texas (6), Illinois (10), and Iowa (11).

The Florida outbreak was the first since 1928. The disease involved deer, beef, and dairy cattle. The cause was not determined although bonemeal was suspected. The laboratory examination of the bonemeal did not reveal Bacillus anthracis.

The Federal Meat Inspection Service reports that from July, 1945, through December, 1951, 367 hogs and 39 cattle were condemned for anthrax in establishments under their supervision,
Wisconsin reported 102 mink cases. These were thought to have been caused by infected animal food.

Figure 1 illustrates the prevalence of anthrax in cattle, swine, horses, sheep, and mink in 1952. The stippled areas are the known enzootic areas. These areas were not involved in the swine outbreaks. Twenty states did not report any animal anthrax. The largest number of cases was reported in swine in the midwestern states (Table I) during the winter and early spring. This unusual seasonal occurrence is of special significance inasmuch as anthrax is usually considered a warm weather disease among animals. Ohio had outbreaks in 57 counties involving over 400 farms. Indiana reported cases in 46 counties on 106 farms. Illinois reported 40 counties and 117 farms with anthrax cases. Michigan had 17 counties and 31 farms with infection. Wisconsin reported anthrax in 17 counties on 35 farms. All of these states reported the isolation of *Bacillus anthracis* from bonemeal and attributed most of their outbreaks to contaminated bonemeal. It is important to observe that none of these states is considered to be an anthrax enzootic area. Previous to the outbreaks of late 1951 and early 1952, anthrax had not been reported in Indiana and Ohio for more than 20 years. Illinois and Wisconsin had not had any case for years, and Michigan had not had a case since 1916. Dr. H. J. Stafseth, Michigan

<table>
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<th>DATE OF OUTBREAK REPORTED</th>
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<th>FARMS INVOLVED</th>
<th>HUMAN CASES</th>
<th>ESTIMATES</th>
<th>BONE-MEAL ISOLATION</th>
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Mink reported in Wisconsin, New Jersey, and New York.
State College, informs me that the 1916 case is the only known previously diagnosed case. The outbreaks in Ohio, Indiana, and Illinois largely involved swine while those in Wisconsin and Michigan were mainly on dairy farms. Wisconsin also had additional cases in mink as did New Jersey and New York.

Kansas reported bovine anthrax in February. In April anthrax was reported in beef and dairy cattle on over 100 farms. An investigation revealed that anthrax had only occurred in herds that had been vaccinated with bacterin. The incubation period was from 3 to 120 days.

Georgia reported the first outbreak of anthrax in animals since prior to 1945. Bonemeal was suspected as the vehicle of infection but was not proven.

Florida had a recurrence of anthrax in the summer of 1952 in the area where the 1951 outbreak was reported and spread to non-infected areas. There was also a report of anthrax following vaccination with a bacterin. Of a total of 300 beef cattle vaccinated by a rancher 15 developed symptoms of anthrax 4 to 8 weeks following inoculation. Seven died. These animals did not exhibit typical symptoms and at first were thought to have been bitten by a snake. An extensive swelling was noted around the site of inoculation behind the shoulder which in some cases extended forward to the brisket and back to the udder. The duration of disease continued for a number of days. After a laboratory diagnosis was established the animals were treated with 3 million units of penicillin daily but even under therapy 2 head died.

The Ohio swine outbreaks which began in February, 1952, were studied by the Ohio Division of Animal Industry and Ohio Department of Health. These investigations were the first to reveal that imported raw bonemeal was contaminated with *Bacillus anthracis*. Illinois, Michigan, Indiana, Wisconsin, and Missouri also reported isolation of anthrax spores from bonemeal samples. The bonemeal was traced to a New York importer who bought it in Belgium. Further investigation revealed that the bonemeal had been collected in Asia and southern Europe and brought to Belgium for reshipment to the United States and distributed in the midwest.

It is interesting to observe that nearly all the hogs involved were pregnant or nursing sows. This is readily explained in that they were the only animals receiving a high protein-calcium ration which is recommended for the pregnant or nursing animal. Few or no cases were observed among other animals except where some of the sow supplement ration was fed to other animals by mistake or the animals were able to reach it through their own efforts.

In June, 1952, the United States Department of Agriculture adopted regulations prohibiting the importation of raw bonemeal. All bonemeal entering this country must now be sterilized at a temperature of 250° under 20 pounds of pressure. Some states have adopted similar regulations.

One of the most important observations made in the Ohio outbreak was that penicillin or other antibiotics are to be preferred to immunizing agents in the control of anthrax in swine. The administration of 6 million units of penicillin in oil proved very effective in the large sows which weighed from two to four hundred pounds or more. Penicillin has also been used successfully in the treatment of cattle but is not recommended as a control measure in place of vaccination. In
some bovine cases there have been relapses following the injection of penicillin. Aureomycin and terramycin were used with success in these cases.

PUBLIC HEALTH

The numerous animal anthrax outbreaks of the past two years has raised a number of public health questions even though the disease is not readily transmitted to men. These questions include: (1) what measures should be taken in handling milk from infected premises, (2) how should meat animals be processed from known infected farms, (3) what steps can be taken to prevent occupational disease among animal handlers and (4) what procedures are recommended for animal disease control so as to remove any threat to public health.

MILK

The handling of milk from a farm where anthrax has occurred in a milking herd or other animals cannot be answered by a decision to prohibit movement of milk but requires an examination of the problem at hand. As previously stated, there are no reports in the United States of the transmission of anthrax in milk to man. The results of unduly stringent quarantine regulations may tend to discourage reporting of anthrax and cause a serious economic problem to the dairyman. In addition, I have had the opportunity to see some sizeable nuisance problems develop when the milk from 500 to 600 cows is dumped on a farm in a warm climate.

The following recommendations have been formulated by the Public Health Service with the assistance of the United States Bureau of Animal Industry, Federal Food and Drug Administration and Federal Civil Defense Administration. The United States Livestock Sanitary Association and the American Veterinary Medical Association have also assisted.

The recommendation is as follows:

1. All cases of anthrax, or suspected anthrax, should be reported by the dairyman to the local veterinarian and the health officer immediately, and such animals should be isolated from the herd and no milk from them sold until declared by a licensed veterinarian to be free from anthrax.

2. Where anthrax has occurred in the dairy herd and the animal or animals affected were stabled in the dairy barn:

   a. All feed, hay, straw, manure and dirt likely to have been contaminated, the carcass itself, and milk suspected of containing anthrax organisms or spores, should be removed and disposed of under the direction or supervision of the State livestock sanitary officials or in their absence by the State or local health department, the dust should be removed from the walls and ceilings; and the entire barn, including walls, ceilings, windows, floors, feed troughs, brooms, shovels, forks, spreaders, etc. should be thoroughly cleaned by washing, and treated with a 5% lye solution.

   b. The temperature of the remaining animals in the milking herd should be taken, immediately prior to each milking, by a veterinarian or some other official person qualified to take such temperatures, for a period of 10 days following the removal or recovery of the last case of anthrax. The records of such temperatures should be available at all times for examination by the
health officer and other concerned. All animals having a temperature of 103°F or showing any other evidence of disease, should be isolated from the milking herd immediately, and no milk from such animal mixed with the market milk supply until such suspects are declared by a licensed veterinarian to show no further evidence of disease.

c. The milking utensils which have been exposed to any secretion or excretion from the anthrax infected animal should be submerged in boiling water for a period of at least 30 minutes as soon as possible after contamination. This should be done under the supervision of the State or local health department, or the State livestock sanitary officials.

3. Where anthrax has occurred in any animal which has been in the same pasture or lot with the dairy cattle:
   a. The entire herd should be removed from such lot, pasture, or portion of pasture, which is likely to have been contaminated by the infected animal, for such time as the State livestock sanitary authority deems necessary.
   b. The temperatures of all of the cattle in the milking herd should be taken, immediately prior to each milking by a veterinarian or some other official person qualified to take such temperatures, for a period of 10 days following the removal or recovery of the last case of anthrax. The records of such temperatures should be available at all times for examination by the health officer and others concerned. All animals having a temperature of over 103°F or showing any other evidence of disease, should be isolated from the milking herd immediately, and no milk from such animal mixed with the market milk supply until such suspects are declared by a licensed veterinarian to show no further evidence of disease.

4. Where anthrax has occurred in any animal on the dairy farm, but has been completely separated from the dairy herd; or where anthrax has occurred on adjoining farm:
   a. The dairy herd should be kept under close observation for a period of at least 10 days and any evidence of anthrax reported immediately to the health officer and the local veterinarian.

5. Where dairy cattle are vaccinated for anthrax:
   a. Such vaccination should be done in a manner and with a product which is approved by the State livestock sanitary authority.
   b. The temperatures of all animals vaccinated with spore vaccine should be taken, immediately prior to each milking, by a veterinarian or some other official person qualified to take such temperatures, for a period of 10 days following vaccination or presence of anthrax infection on the premises. The records of such temperatures should be available at all times for examination by the health officer and others concerned. All animals having a temperature of over 103°F. or showing any other evidence of disease, should be isolated from the milking herd immediately, and no milk from such animal mixed with the market milk supply until such suspects are declared by a licensed veterinarian to show no further evidence of disease.

Cattle in hot humid climates often have body temperatures of 103°F. without having any infection. In this case, a recheck of the temperature in the late evening or early morning, would be indicated.
6. Where certain feeds are suspected by the State officials as being contaminated with anthrax organisms, such feed should not be fed to the dairy cattle. It should either be destroyed, in accordance with 2a above, be returned to the manufacturer, or be rendered free from contamination by a method acceptable to the State livestock sanitary authority.

It is realized that the livestock sanitary authorities in some States issue a quarantine that bars the movement of all animal products from the premises on which infection with anthrax has occurred, as a precautionary measure against the mechanical transmission of the disease from one premise to another. Therefore, it is imperative that the milk control authorities cooperate with the livestock sanitary authorities in the State concerned.

It is also important that the local and State milk control officials, and the State and local livestock disease control officials, maintain close liaison with each other with regard to reporting of anthrax cases and anthrax control measures. This is necessary to provide for the maximum protection of the health of the persons who may have come in contact with infected animals on the farm, as well as for the protection of the milk consumer, and for the economic welfare of the dairy farmer. Persons handling anthrax infected animals or materials should be protected by rubber gloves and boots, which can subsequently be decontaminated with chemical disinfectants.

MEAT

The processing of meat animals from infected or quarantined farms should be done in abattoirs or packing plants that are under the supervision of the Federal Meat Inspection Service or a local meat inspection service where a trained veterinary inspector is on duty. Although no cases of human anthrax attributed to meat have been reported in the United States the foreign literature has carried numerous reports. These reports have usually involved raw or semi-raw meat products such as hard sausages.

HUMAN ANTHRAX

The problem of preventing occupational anthrax among animal handlers can best be answered by health education. The farmer or animal handler must be cautioned against the treatment of sick animals or attempts to salvage the hide of dead animals. It is of interest that no human cases occurred among farmers in Ohio. This can be explained by the practice of the farmer in not making any effort to salvage a hog but burying or burning it, while with a cow or horse he will skin the animal before feeding it to the hogs, although this practice is disappearing with the availability of rendering plant pickups of dead animals.

During the first 6 months of 1952 only 19 human cases were reported. This compares with 39 in the first 6 months of 1951. Three of the 1952 cases occurred in Ohio. They were in a veterinarian, laboratory technician who handled specimens, and a carpenter who worked in a feed mill which had handled contaminated feed.

When anthrax is known to be present on the farm the operator should receive instructions either from the attending veterinarian or the health department on
how to protect his health. The most important thing to stress is personal hygiene and prompt medical care for any scratches, abrasions, or pimples that may appear.

Lastly is animal disease control. This is primarily the responsibility of the attending veterinarian and the livestock sanitary officials. The successful case of antibiotics in the treatment of animal anthrax has provided an excellent weapon to deal with this problem. The live spore vaccines have been used extensively in this country with good results although sometimes they fail. They should only be used on premises where infection has been proven or there is strong evidence of disease. The antibiotics may replace the anti-serum and bacterins that have previously been used in herds or droves adjacent to infected premises.

SUMMARY

Anthrax is not a serious public health problem except in certain occupations. Veterinarians have the highest attack rate. There is no report of its transmission to man in meat or milk in the United States. During 1951-1952 there was an increase of animal anthrax cases especially among swine. Some of these outbreaks were traced to contaminated bonemeal. Even though there was an increase in animal cases the human incidence continued to decline. Public health aspects are discussed as they relate to milk, meat, occupational disease, and animal disease control.
The Special Committee on Anthrax has reviewed the papers of Dr. C. D. Stein, A Review of Anthrax in the United States for 1952 and Dr. James H. Steele Some Aspects of Anthrax Control. We concur in their general conclusions and recommendations.

For the future control and prevention of anthrax in the United States the following recommendations are made:

1. In infected areas livestock kept on pastures believed to be contaminated should be vaccinated yearly with appropriate immunizing agents well in advance of the anthrax season.

2. In infected herds, the apparently well animals should be immunized while the sick animals should be isolated and treated with anthrax antiserum and/or penicillin.

3. Animals in exposed herds where danger of infection appears imminent should be immunized.

4. The prompt and proper disposition of the carcasses of animals dead of the disease, strict quarantine of premises, effective fly control and good sanitation should be strictly enforced.

5. Parts of pasture lands known to be heavily infected and pools and marshlands that are potential sources of infection should be fenced off in so far as possible, thus keeping livestock off the most dangerous parts of an infected premises.

6. Animal products in the process of manufacture such as bonemeal, horn meal, hoof meal, meat scraps, blood meal, and tankage, whether of imported or domestic origin, should be treated with heat sufficient to destroy anthrax spores especially if such material is to be used in mixed feeds and food supplements intended for feeding livestock.

7. Hay, straw, or other forage grown in known anthrax areas should not be fed to animals in clean areas.

8. This Committee endorses the action taken by the United States Bureau of Animal Industry to prevent the entry of bonemeal and other animal products that may be contaminated with anthrax spores. We recommend that the full support of the United States Livestock Sanitary Association be given to the Bureau to strengthen the regulation as be indicated.

9. The practice of feeding the meat of animals that die of unknown causes to mink and wild animals in captivity has caused a number of anthrax outbreaks in minkeries and menageries and should be prohibited.
10. Animals dying on a farm, especially in an anthrax area, should never be fed
to other livestock, dogs, cats, or chickens; to do so may spread the disease.

11. In an anthrax area, when animals die suddenly or where the cause of death
is unknown, it appears advisable to prohibit removal of the carcasses of such ani-
mals to a rendering plant without permission of livestock sanitary officials.

12. During an actual outbreak of anthrax, under no circumstances should the
carcasses of animals dead of anthrax, suspected anthrax, or from unknown causes,
be moved to a rendering plant.

13. Rendering plants should be operated under a state permit and should be
constructed and operated so as to insure the complete sterilization of any anthrax
contaminated animal material that may accidentally get into the plant.

14. Anthrax should be a reportable disease in all states. Monthly reports of
outbreaks should be made to the United States Bureau of Animal Industry and a
record of the exact location of each outbreak should be on file in the office of the
state veterinarian for future reference.

15. The livestock sanitary laws of all the states should include specific regul-
atations on the control of anthrax. A more uniform set of regulations is needed in the
various states covering (1) the length of the quarantine period; (2) the disposition
of anthrax carcasses; (3) the disposition of milk and the handling of animals in
dairies quarantined for the disease, and (4) in the control, distribution and use of
anthrax spore vaccines.

16. It is the opinion of this committee that the regulations governing production
and testing of anthrax biological products be so revised as to adequately safeguard
against the marketing of any product containing pathogenic or virulent organisms
or spores.

17. State laboratories should possess the facilities for examining suspected speci-
mens for the presence of Bacillus anthracis, as a prompt and accurate diagnosis is
of great importance whenever the disease is suspected.

18. Additional research is needed on the anthrax problem with the object of
developing improved immunizing procedures and gaining more definite information
on the biology of the organism in nature and in the animal body.

DISCUSSION

PRESIDENT WEST: Thank you, Dr. Rollins. This report will be referred to the
Executive Committee.

The two previous papers on anthrax and the report of the Special Committee
are now open for discussion.

DR. A. H. QUIN: Present West, may I ask Dr. Stein a question?

DR. C. D. STEIN, in your paper several times you referred to vaccine anthrax in
Kansas and New Jersey. Do you not feel it would be technically proper to refer to
that as bacterin anthrax in Kansas and New Jersey, in that there is a clear-cut
delineation between bacterin immunization and vaccine immunization as the terms
are used in practice? In practice there is a clear-cut delineation between bacterin
prophylaxis and vaccine prophylaxis.

DR. C. D. STEIN: The term "vaccine anthrax" was used more or less to cover
these cases, and for brevity. In other words, I would have had to state each time that cases of anthrax reported to the BAI were believed to be due to the administration of certain serials of bacterin. I just called it "vaccine anthrax".

In a broad sense I would say that any type of anthrax due to an immunizing agent, whether a bacterin or spore vaccine, would probably be designated as vaccine anthrax, and perhaps it would be more correct to refer to it as bacterin anthrax; but that is really a new term.

I have never seen it reported in the literature. I still think perhaps the term "vaccine anthrax" is a type of anthrax that follows the administration of immunizing agents, and whether they be spore vaccines or bacterins. That is the light in which I referred to it.

DR. J. D. RAY: I would like to ask Dr. Stein to tell us how he disinfects a contaminated wagon or pen or something of that sort. What is the antiseptic that you use, or the disinfection method you follow, in killing anthrax spores on a premise or on equipment?

DR. C. D. STEIN: It depends upon what type of contamination you have. Of course, if you are handling a carcass that has been opened within three or four hours, and you have the floor of the packing house or the stable floor, a concrete floor, contaminated with blood, that blood probably will contain organisms in the vegetative stage. In that stage the organisms can be killed very readily, even with ordinary disinfectants. But if it happens to be a carcass that has been open for some time, or fecal matter that has been contaminated with blood or secretions from the animal, urine, and so on, and that has been lying around overnight or for several hours, and has sporulated, then you have a different problem. Also, the type of material contaminated is different.

For instance, most of the work on the destruction of anthrax spores has been done with the spores floating free in a suspension of physiological saline. When the spores are imbedded in manure, or coated with blood or some type of albuminous material, then you have a different proposition. For a good many years in our experimental work, when we were handling virulent anthrax, we used mercuric chloride 1:500 or 1:1,000, and it worked very well.

If you fail to clean up properly or get rid of all the mercuric chloride that has soaked into the concrete floor or into feeding troughs, and so on, made of concrete, in time you may run into a few cases of dichloride poisoning. We now use a 5 per cent solution of lye. We think the longer you keep the 5 per cent solution on a given area which you want to sterilize, the better it will be, and we believe at least eight hours should be the time to keep it on.

The scientific work on that, however, in handling spores in saline and in albuminous material, indicates that it can be sterilized within two hours, but to be safe about it we think eight hours or even overnight is better. Probably you have in mind, "I want something that I can use to rinse out a truck." I think you should hold that truck for eight hours, and then, when you are through with the 5 per cent solution of lye, rinse it out thoroughly. That is the most effective way we know of at the present time for killing spores.

You might want to apply it to metal pans, or something of that kind, which you
can put in a vat, and bring it to the boiling point, that is very good; or if it is something you can put in a large autoclave, that also is very good; in fact, it is more reliable than a disinfectant.

Does that answer your question?

DR. J. D. RAY: It answers the question, but it does not solve the problem.

DR. C. D. STEIN: I know—you want a disinfectant that will do the job in thirty minutes.

DR. J. D. RAY: It is hard to keep a truck soaking for eight hours.

DR. C. D. STEIN: I agree with you.

PRESIDENT WEST: Is there further discussion of this report on anthrax?

DR. A. H. QUIN: Yes. I wish my old friend Dr. Stein would tell me what possible justification he has for the use of a killed anthrax spore bacterin in an infected area.

DR. C. D. STEIN: The chart that I showed you a while ago, showing the comparative value of potency of different anthrax biologics, indicates that bacterins do have a limited amount of immunizing value, and in areas where the infection is of a low type of virulence we do think that bacterins afford a certain amount of protection.

I happen to know of one area, not in the United States but in another country, where the problem is a severe one—anthrax infection in sheep. Sheep are very susceptible to anthrax. As a matter of fact, in many instances you can't start out and give a sheep a Number 2 vaccine without causing some trouble. They found it to be true in one particular country in South America. They are now using anthrax bacterins and have been using them for a number of years, but they give a very heavy suspension of the anthrax bacterin, probably a dose triple the amount we give to sheep in this country—maybe four times as much. The report is that they have been able to control anthrax in sheep in these particular areas that are known infected areas in this South American country.

In our own country we have, for instance, the State of Minnesota, that does not permit the use of a spore vaccine: The reports to the Bureau from various outbreaks in Minnesota, some in Alabama and in other states, indicate that they have used bacterins even in herds where infection existed, and they work very well.

So, we have to base our opinions on these few tests we have made on sheep, and the reports we receive from various states where bacterins are used.

I will concede the point that bacterins do not afford the amount of immunity that one gets from a spore vaccine, but if a bacterin is properly made it is a sterile product, it should not endanger the animals into which it is injected. That is another point about using bacterins. I don't know whether that answers Dr. Quin's question or not.

DR. A. H. QUIN: No, it does not.
Comparison of Immunity and Agglutinin Response in Cattle Vaccinated with Brucella abortus Strain 19 by the Intradermal and Subcutaneous Methods


Pathological Division, Bureau of Animal Industry, Beltsville, Maryland

Considerable interest has been shown by both owners of cattle and disease control officials in the intradermal method of inoculating cattle with Brucella abortus strain 19 vaccine. This interest has been stimulated by a limited amount of evidence that agglutinin response and degree of immunity induced in cattle by 0.2 ml. of strain 19 vaccine inoculated intradermally are equal to or greater than that induced by 5 ml. inoculated subcutaneously. Furthermore, it has been stated that a higher percentage of cattle vaccinated intradermally lose their vaccinal titers and these titers recede more rapidly below the minimum diagnostic level of 1:100. Unfortunately, very little data have been published comparing the immunity and agglutinin response in cattle vaccinated by the two methods.

The first results of research on intradermal vaccination of cattle against brucellosis that were enthusiastically received were reported by Rabstein and Cotton (10) in 1942. Heifer calves and cows were vaccinated by the intradermal and subcutaneous methods. The agglutinin response in the animals inoculated with 0.2 ml. of strain 19 vaccine intradermally was as great as in the animals that received 5 ml. of the vaccine subcutaneously. Furthermore, the agglutinin titers receded below the diagnostic level more rapidly in calves that were vaccinated intradermally. The authors also concluded that these calves developed a substantial immunity on the basis of their high opsonic indices and agglutinin titers. Relative to the last statement, research workers (3, 4, 5, 11) have demonstrated that neither opsonins nor agglutinins are measurements of immunity against brucellosis in cattle.

In 1945, Campbell and Rodwell (1) reported on the agglutinin response observed in cows and sexually mature heifers vaccinated with various doses of strain 19 vaccine by the subcutaneous, intradermal, and intracaudal methods. The agglutinin response to 0.2 ml. of vaccine given either intradermally or intracaudally was greater than that to the same dose subcutaneously. However, the agglutinin titers were higher in animals inoculated with 5 ml. of vaccine subcutaneously than in those that received 0.2 ml. intradermally. They also observed that the greater the agglutinin response in cattle the longer the time required for the titers to recede below the diagnostic level. The immunity in these cattle was not challenged by virulent Br. abortus infection.

The only results comparing the immunity response in cattle vaccinated by the intradermal, subcutaneous, and intracaudal methods with strain 19 vaccine were reported by McDairmid (9) in 1950. Immunity produced in sexually mature cattle.

1 Dr. C. K. Mingle transferred from the Animal Disease Station, Pathological Division to the Brucellosis and Tuberculosis Eradication Division on February 9, 1947. Dr. R. W. Carter transferred from the Animal Disease Station, Pathological Division to the Brucellosis and Tuberculosis Eradication Division on July 1, 1949.
heifers injected with 0.2 ml. of strain 19 vaccine intradermally or 1 ml. intracaudally was comparable to that produced with 5 ml. of the same vaccine injected subcutaneously. Mean agglutinin titers reached a higher level shortly after vaccination in the cattle vaccinated by the intracaudal method than in those vaccinated by either the intradermal or subcutaneous methods. The time between vaccination with strain 19 and exposure to virulent Br. abortus infection was insufficient to allow agglutinin titers to recede to their minimum level.

The information reported in this paper concerns a comparison of the immunity and agglutinin response produced in yearling heifers by the inoculation of various doses of strain 19 vaccine intradermally or subcutaneously.

MATERIALS AND METHODS

Research on effect of vaccinal methods and doses in cattle was conducted in two similar experiments. The breeds of cattle employed in both experiments consisted of Jerseys, Guernseys, and Holstein-Freisians. All of the animals were maintained in Brucella-free environment and tested periodically between the time they were four months of age and vaccinated or designated as controls.

Experiment No. 1—There were 30 heifers, 18 of which were vaccinated with Br. abortus strain 19 vaccine between 12 and 15 months of age and the remaining 12 of a similar age were retained as nonvaccinated controls. The vaccine employed was freshly prepared and contained $12 \times 10^9$ viable organisms per ml. at the time it was injected. The heifers are grouped according to method of vaccination, dose of vaccine and site of inoculation as follows:

- Group I. 6 heifers, subcutaneous, 5 ml., lateral surface of neck.
- Group II. 6 heifers, intradermal, 0.2 ml., caudal fold.
- Group III. 6 heifers, subcutaneous, 0.2 ml., lateral surface of neck.
- Group IV. 12 heifers, not vaccinated.

The three groups of vaccinated heifers were held together but separate from the nonvaccinated controls throughout the experiment. All animals were kept in Brucella-free lots until they were exposed to brucellosis.

All of the animals were exposed to virulent Br. abortus 18 months after the principals were vaccinated and when they were approximately 30 months of age. The exposure strain of Br. abortus employed was 2308. Exposure was by the conjunctival method with $26.1 \times 10^8$ viable organisms. Detailed procedure for exposing cattle has been previously described by the authors (8). The pregnancy status of each animal at the time of exposure is presented in tables 1, 1A, 2 and 2A.

Experiment No. 2.—A total of 42 heifers were employed, 23 of which were vaccinated with strain 19 vaccine between the ages of 12 and 15 months and the remaining 19 of a similar age were retained as nonvaccinated controls. The source and management of these animals prior to vaccination was similar to that in experiment 1. The vaccine was freshly prepared and contained $11 \times 10^8$ viable organisms per ml. at the time it was injected. These heifers were grouped in the same manner as those in the first experiment as follows:

- Group I. 8 heifers, subcutaneous, 5 ml., lateral surface of neck.
- Group II. 15 heifers, intradermal, 0.2 ml., caudal fold.
- Group III. 19 heifers, not vaccinated.
TABLE 1

Response of Vaccinated Cattle (Experiment No. 1) to Conjunctival Exposure with Virulent Brucella Abortus

<table>
<thead>
<tr>
<th>ANIMAL NUMBER</th>
<th>BLOOD SERUM AGGLUTININ TITER</th>
<th>GESTATION PERIOD (DAYS)</th>
<th>POST-EXPOSURE</th>
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<td>Time of Exposure</td>
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5.0 ml.—Subcutaneous Vaccination

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0.2 ml.—Intradermal Vaccination

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</tr>
<tr>
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### TABLE 1-A

Response of Nonvaccinated Control Cattle (Experiment No. 1) to Conjunctival Exposure with Virulent Brucella Abortus

<table>
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<tr>
<th>ANIMAL NUMBER</th>
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<th>Time of Parturition</th>
<th>Time of Exposure</th>
<th>Exposure to Parturition</th>
<th>Time of Parturition</th>
<th>Parturition Recovery</th>
<th>Recoveries of Brucella</th>
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<td>1:200</td>
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<td>1:100</td>
<td>1:400</td>
<td>1:400</td>
<td>158</td>
<td>97</td>
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<td></td>
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</tr>
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</table>

* = Titer at the time nonpregnant cattle were removed from the experiment; NP = Not pregnant; D = Calf dead; L-V = Calf living and vigorous; L-W = Calf living but weak; - = Negative for Brucella; + = Positive for Brucella.

D = Calf dead; L-V = Calf living and vigorous; L-W = Calf living but weak; - = Negative for Brucella; -c = Negative for Brucella but grossly contaminated; + = Positive for Brucella.
TABLE 2
Response of Vaccinated Cattle (Experiment No. 2) to Conjunctival Exposure with Virulent Brucella Abortus

<table>
<thead>
<tr>
<th>ANIMAL NUMBER</th>
<th>BLOOD SERUM AGGLUTININ TITER</th>
<th>GESTATION PERIOD (DAYS)</th>
<th>POST-EXPOSURE</th>
<th>RECOVERIES OF BRUCELLA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Time of Exposure</td>
<td>Maximum after Exposure</td>
<td>Time of Parturition</td>
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5.0 ml.—Subcutaneous Vaccination

0.2 ml.—Intradermal Vaccination
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<td>-</td>
<td>-</td>
<td>+</td>
<td></td>
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<td>+</td>
<td>-</td>
<td>+</td>
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<td>-</td>
<td>-</td>
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<td></td>
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</tr>
</tbody>
</table>

D = Calf dead; D# = Calf dead but fully developed; L-V = Calf living and vigorous; L-W = Calf living but weak; \( \overline{\text{--}} \) = Negative for Brucella; + = Positive for Brucella.
### TABLE 2-A

Response of Nonvaccinated Control Cattle (Experiment No. 2) to Conjunctival Exposure with Virulent Brucella Abortus

<table>
<thead>
<tr>
<th>ANIMAL NUMBER</th>
<th>BLOOD SERUM AGGLUTININ TITER</th>
<th>GESTATION PERIOD (DAYS)</th>
<th>POST-EXPOSURE</th>
<th>RECOVERIES OF BRUCELLA</th>
</tr>
</thead>
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<tr>
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<td>Time of Exposure</td>
<td>Maximum</td>
<td>Time of</td>
<td>Exposure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>after</td>
<td>of</td>
<td>to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exposure</td>
<td>Parturition</td>
<td>Exposure</td>
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<td>1:100</td>
<td>97</td>
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</table>

* = Titer at the time nonpregnant animal was removed from the experiment; NP = Nonpregnant; D = Calf dead; L-W = Calf living but weak; + = Positive for Brucella.
Each group of heifers was maintained separately during the course of the experiment, and in Brucella-free lots prior to exposure to virulent \textit{Br. abortus}. Cattle in this experiment were also exposed to virulent \textit{Br. abortus} 18 months after vaccination. The method of exposure was the same as that in experiment 1 except the animals in this experiment received $15.6 \times 10^6$ viable organisms of virulent \textit{Br. abortus} strain 2308.

Observations were made of local reactions at the site of inoculation in cattle in both experiments each time blood was collected following vaccination.

The frequency with which blood was collected for titer determinations from vaccinated and nonvaccinated cattle is shown in figures 1 and 2. Results of sero-

![Graph showing agglutinin titer changes over time for vaccinated and nonvaccinated cattle.](image)

**Fig. 1.**—Mean agglutinin titers of vaccinated and nonvaccinated cattle in experiment No. 1.

Agglutination tests on nonvaccinated cattle are not recorded on the two figures prior to exposure to infection because of the constant negative status of these animals.

Agglutination tests were conducted on the blood serums of cattle by both the tube and plate methods. Standard tube and plate \textit{Brucella abortus} antigens produced by the Bureau of Animal Industry were employed. End point titers were determined on all serum samples by the tube method. Serums were tested in two-fold dilutions, beginning with the 1:25 dilution. Any dilution showing 50 per cent agglutination or higher was classified as positive; whereas, any reaction below this point was considered negative.

Blood was collected for culture from each animal immediately before and at weekly intervals after exposure to virulent \textit{Br. abortus} until removal of animals.
from the experiment. Detailed procedures for collecting and culturing bovine blood specimens have been described by Manthei and Carter (7).

At the time of parturition, uterine material, colostrum, fetuses, and blood were collected for various laboratory tests. Uterine material and colostrum were cultured on potato infusion agar plates in an atmosphere of 10 per cent CO₂ at 37°C and inoculated into guinea pigs which were destroyed and cultured 30 to 35 days after inoculation. Specimens from various parts of the fetal viscera were cultured in the same manner as the uterine material and colostrum. Methods of conducting the seroagglutination test and culturing the blood have been previously described.

![Fig. 2](image-url)

**Fig. 2.**—Mean agglutination titers of vaccinated and nonvaccinated cattle in experiment No. 2.

All isolations of Brucella from direct culture and guinea pigs were subjected to routine typing procedures for identification and classification. Cattle were removed from the experiments as soon as bacteriological studies were completed on the specimens collected at the time of parturition. The nonpregnant animals were removed from the experiments when the last pregnant cow terminated her pregnancy.

**RESULTS**

*Local reactions.* Swellings produced by the subcutaneous inoculation of 5 ml. of strain 19 vaccine in the lateral surface of the neck were considerably larger and persisted longer than those produced by the intradermal inoculation of 0.2 ml. of the same vaccine in the caudal fold. The intensity and persistence of swelling caused by subcutaneous inoculation varied between individuals. Central necrosis and
sloughing of tissue occurred at all of the sites inoculated intradermally. The time required for healing of these areas was between three and four weeks. Local reactions produced by 0.2 ml. of vaccine inoculated subcutaneously were much less severe than those produced by the 5 ml. dose and disappeared within one month.

*Agglutinin response.* Blood serum agglutinin titers were never higher than 1:25 in any of the principals between four months of age and time of vaccination or in any of the controls between four months of age and time of exposure to virulent *Br. abortus* organisms.

Mean agglutinin titers of the various groups of vaccinated and nonvaccinated heifers in the two experiments are presented in figures 1 and 2. The trend of these titers was similar in each group of vaccinated animals, regardless of method of administration and dose of vaccine. Eratic mean titers observed nine weeks following exposure of cattle to virulent *Br. abortus* were caused by the marked effect that the titer of a single animal had on the average titer of constantly decreasing numbers of animals in each group.

Maximum serum agglutinin titers occurred in all heifers between 10 and 15 days following vaccination. In both experiments, the geometric mean of these titers was similar in groups of cattle inoculated with 0.2 ml. of vaccine intradermally and 5 ml. subcutaneously. The geometric mean of the maximum titers of six heifers inoculated with 0.2 ml. of vaccine subcutaneously was approximately one-third lower than those of the previous two groups. Although the number of animals in the latter group was small, these results are similar to those of Campbell and Rodwell (1).

The mean agglutinin titer of each group of vaccinated heifers in both experiments receded to approximately the same level at 78 weeks following vaccination. However, the number of animals with agglutinin titers below the diagnostic level of infection (1:100) was 17 per cent higher in the group inoculated with 0.2 ml. of strain 19 vaccine intradermally than in the group inoculated with 5 ml. of the same vaccine subcutaneously. Furthermore, the percentage of animals with titers less than 1:100 was eight per cent higher in the group inoculated with 0.2 ml. of vaccine subcutaneously than in the group that received the same vaccinal dose intradermally. The significance of this finding may be questionable because of the small number of animals inoculated subcutaneously with the small dose of vaccine.

Further detailed information on the agglutinin response of each animal in vaccinated and nonvaccinated groups of both experiments is given in tables 1, 1A, 2 and 2A.

*Immunity response. Experiment No. 1.*—The immunity response of cattle inoculated intradermally with 0.2 ml. or subcutaneously with 5 ml. or 0.2 ml. of strain 19 vaccine to an exposure of $26.1 \times 10^4$ virulent *Br. abortus* strain 2308 organisms is presented in table 1. Response of 12 nonvaccinated controls to the same exposure given to vaccinated animals is recorded in table 1A.

In this preliminary study, the immunity response was similar in the three groups of vaccinated cattle regardless of methods of vaccination or dose of vaccine employed.

Varying degrees of immunity were apparent in vaccinated animals of each group.
Two vaccinated animals, cow 2510 inoculated with 0.2 ml. of vaccine subcutaneously and cow 2634 inoculated with 0.2 ml. of vaccine intradermally, developed a temporary bacteremia following exposure to virulent \textit{Br. abortus} organisms. The only isolation of Brucella made from each of these animals was from the blood one week following exposure. Both cows calved normally.

In two nonpregnant vaccinated cattle, 2562 and 2536, it was impossible to isolate Brucella from repeated collections of blood and udder secretions. Neither cow was autopsied and cultured.

There also was one cow, 2540, in the control group that developed a temporary bacteremia. Only a single isolation of Brucella was made from the blood five weeks following exposure to infection. Agglutinins appeared in the 1:25 dilution of serum two weeks after exposure. This titer continued to rise slowly until it reached a maximum of 1:400 on the ninth post-exposure week followed by a recession to negative by the eleventh post-exposure week. The animal did not show an agglutinin titer for the remainder of the experiment and calved normally 16.5 weeks after exposure.

Bacteremias were more prevalent and persistent in controls than in principals.

Blood serum agglutinin titers increased in all vaccinated animals immediately following exposure to infection; but receded to within one dilution of the pre-exposure level in animals that resisted infection. In comparison, agglutinin titers increased rapidly and remained high in nonvaccinated animals, except in cow 2540.

\textit{Experiment No. 2}.—Results were comparable in most respects to those in experiment 1. The immunity response of cattle inoculated intradermally with 0.2 ml. of

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|c|}
\hline
\textbf{VACCINATION STATUS OF CATTLE} & \textbf{AGGLUTININ RESPONSE TO STRAIN 19 VACCINATION} & \textbf{IMMUNITY RESPONSE TO VIRENT BRUCELLA ABORTUS} \\
\hline
 & \textbf{Maximum} & \textbf{78 Weeks after Vaccination} & \textbf{Number} & \textbf{Number} & \textbf{Number} & \textbf{Number} & \textbf{Number} & \textbf{Total} \\
\hline
 & (Geometric) & 1:25 or Lower & \textbf{Gestation} (days) & \textbf{Partitions Less Than 270 days} & \textbf{Partitions More Than 270 days} & \textbf{Not Pregnant} & \textbf{Infected} & \\
\hline
Subcutaneous—5.0 ml. & 1:3387 & 5 & 3 & 264 & 7 & 6 & 1 & 8* & 3 & 6 & 14 \\
Intradermal—0.2 ml. & 1:3418 & 11 & 2 & 262 & 9 & 12 & 0 & 12 & 7 & 9 & 21 \\
Subcutaneous—0.2 ml. & 1:2016* & 3 & 2 & 276 & 1 & 3 & 1 & 3* & 1 & 2 & 5 \\
Nonvaccinated & & & 23 & 29 & 1 & 1 & 31* & 28 & 0 & 31 \\
\hline
\end{tabular}
\caption{Summary of Results}
\end{table}

\textit{s} = Results in first column based on six heifers, one of which died three months after vaccination; \textit{*} = Only evidence of infection was single isolations of \textit{Br. abortus} from the blood stream of one animal in each group.
vaccine or subcutaneously with 5 ml. of the same vaccine to an exposure dose of 15.6 × 10^6 virulent Br. abortus strain 2308 organisms is presented in table 2. Response of the control cattle in this experiment is shown in table 2A.

There was very little difference in the immunity to brucellosis induced in cattle by the inoculation of 5 ml. of strain 19 vaccine subcutaneously or 0.2 ml. of the same vaccine intradermally. This was demonstrated by percentage of Brucella isolations, retained placentas, and premature parturitions.

The incidence and persistence of bacteremia was exceedingly greater in the nonvaccinated than in the vaccinated animals.

A persistent bacteremia and repeated isolations of Br. abortus from the udder secretions of the nonpregnant control cow 2919 demonstrates the susceptibility of nonpregnant cattle that have not been vaccinated. It further justifies the classification of two nonpregnant vaccinated cattle in the preliminary experiment as having resisted exposure to brucellosis.

The incidence and persistence of bacteremia was exceedingly greater in the nonvaccinated than in the vaccinated animals.

The post-exposure agglutinin responses of cattle in experiments 1 and 2 were comparable except in the controls. Although the agglutinin titers of nonvaccinated cattle in experiment 2 were low in some animals at the time of parturition, a postparturient seroagglutination test revealed that the titers of these animals had increased to 1:1600 or higher.

There was no relationship between the degree of agglutinin response and the degree of immunity to brucellosis induced in cattle with strain 19 vaccine. Furthermore, the stage of pregnancy in cattle at the time they were exposed to virulent Br. abortus had no influence on the termination of pregnancy or resistance to the disease. A summary of the results of this investigation is presented in table 3.

Some of the information obtained in this investigation was used as part of a previous report by Manthei (6) in which nonpregnant cattle were not included. This was done for the purpose of clarity.

DISCUSSION

The data presented show that there is very little difference in the immunity and agglutinin response in cattle inoculated as yearlings with 5 ml. of strain 19 vaccine subcutaneously or 0.2 ml. of the same vaccine intradermally. These results are in agreement with those reported by McDiarmid (9) and indicate that the 0.2 ml. intradermal dose is as effective as the conventional 5 ml. subcutaneous dose of strain 19 organisms. However, the subcutaneous inoculation of 0.2 ml. of strain 19 vaccine in a small number of yearling heifers also produced an immunity to brucellosis equal to that produced by subcutaneous inoculation of 5 ml. of the same vaccine. The agglutinin response was not as great in animals vaccinated subcutaneously with the 0.2 ml. dose of strain 19 vaccine as in those vaccinated subcutaneously with the 5 ml. dose or intradermally with 0.2 ml. dose, but a higher percentage had titers below the diagnostic level of infection 18 months following vaccination.

Evidence presented in this report and by Campbell and Rodwell (1) indicates that the agglutinin response is less and agglutinin titers recede to lower levels in cattle when the dose of strain 19 vaccine is decreased and the method of administration remains the same. However, Haring and Traum (2) also presented evidence
showing that agglutinin titers behaved in the same manner with a decrease in age of cattle at the time of vaccination. This information emphasizes our need for more knowledge concerning the dose of strain 19 vaccine and method of vaccination that will produce the best results. It further emphasizes that cattle should be vaccinated at an age that will result in a serviceable immunity but not cause any interference with our present diagnostic tests.

In reducing the dosage of strain 19 vaccine to prevent interference with the sero-agglutination test, we should always be cognizant of the effect it may have on degree of resistance induced in cattle against brucellosis. The minimum dose of viable strain 19 organisms and method of administration that will produce a serviceable resistance in cattle to brucellosis and cause the least interference with present diagnostic procedures is unknown at this time. Until this information is available, routine inoculation of small doses of strain 19 vaccine may produce some undesirable results if any of the vaccines are low in viability. Investigations have demonstrated that the viability of liquid and reconstituted desiccated strain 19 vaccines is decreased when subjected to adverse environmental conditions.

Information on the resistance to brucellosis induced by intradermal inoculation of strain 19 vaccine in cattle at four to eight months of age has not been published. Consequently, comparisons cannot be made with the resistance induced in cattle vaccinated at the same age by the subcutaneous method or with results obtained under the conditions of the present investigation.

Although the number of vaccinated animals of each group that resisted brucellosis in this investigation is not encouraging, we have evidence to show that the conjunctival exposure doses of Br. abortus strain 2308 employed were excessive for vaccinated heifers during their first pregnancy. It is our opinion that a critical evaluation cannot be made of any immunizing agent until more is known about age susceptibility of cattle and the 50 per cent infective dose of a virulent Br. abortus exposure strain is established.

The demonstration of temporary bacteremia in cattle following exposure to virulent Br. abortus organisms as the only evidence of infection is difficult to interpret and evaluate. Routine culturing of blood has not been practiced by most investigators; therefore, the incidence and significance of temporary bacteremia in cattle exposed to brucellosis has not been determined. It will be necessary to establish a criterium for infection before we can adequately measure immunity of susceptibility.

It is evident from the information presented that inoculation of cattle over eight months of age with either 5 ml. of strain 19 vaccine subcutaneously or 0.2 ml. intradermally will interfere with diagnostic procedures used in the control and eradication of bovine brucellosis in this country.

SUMMARY

Forty-one dairy heifers were vaccinated between 12 and 15 months of age with Brucella abortus strain 19 vaccine. Twenty-one were inoculated with 0.2 ml. intradermally, 14 with 5 ml. subcutaneously, and six with 0.2 ml. subcutaneously. Part of the animals of each vaccinated group, except the last one, were in two different
RESPONSE IN CATTLE TO BRUCELLA ABORTUS VACCINATION 113

experiments. Vaccinated and nonvaccinated cattle in the first experiment were exposed to $26.1 \times 10^6$ viable organisms of virulent *Brucella abortus*, strain 2308, and those in the second experiment were exposed to $15.6 \times 10^6$ viable organisms of the same strain of *Brucella abortus*.

Maximal vaccinal titers occurred between the tenth and fourteenth or fifteenth days following vaccination, regardless of vaccinal dose or method of administration. Maximum agglutinin titers were similar in animals inoculated with 5 ml. and 0.2 ml. of strain 19 vaccine subcutaneously and intradermally, respectively; whereas they were considerably lower in animals inoculated with 0.2 ml. of vaccine subcutaneously.

The degree of post-vaccinal agglutinin response was not related to the degree of immunity to brucellosis in cattle vaccinated with strain 19.

Serum agglutinin titers of heifers vaccinated as yearlings with 5 ml. of vaccine subcutaneously and 0.2 ml. intradermally receded to approximately the same average level 78 weeks following vaccination. The percentage of vaccinated animals with titers below 1:100 at this time was highest in those inoculated with 0.2 ml. of vaccine subcutaneously followed by those inoculated with 0.2 ml. intradermally. The lowest percentage occurred in the animals receiving the 5 ml. dose subcutaneously.

The degree of immunity to brucellosis and termination of gestation were similar in vaccinated cattle regardless of the vaccinal dose or method of administration employed.

The relationship of vaccinal dose, method of vaccination, and age of cattle at time of vaccination to immunity and agglutinin response in cattle are discussed as well as standardization of exposure dose of virulent *Brucella abortus* and establishment of a criterion for infection to measure resistance to brucellosis in cattle.

REFERENCES

8. MANTHEI, C. A., MINGLE, C. K., AND CARTER, R. W., Duration of Immunity to


EVALUATION OF VACCINAL METHODS AND DOSES OF BRUCELLA 
ABORTUS STRAIN 19

C. A. MANTHEI, D.V.M.¹

There has been considerable controversy during the past ten years concerning the merits of various methods of administration and doses of strain 19 employed for the immunization of cattle against brucellosis. Much of the controversy is the result of not critically evaluating published information and drawing conclusions from opinions and limited experimental data. Unfortunately very little data have been published comparing the immunizing efficiency and recedence of agglutinin titers in cattle that have been inoculated by the various methods and doses of strain 19 vaccine. Most of the published information concerns a comparison of maximum agglutinin titers and opsonic activity, neither of which is accepted as an index of immunity to brucellosis in cattle. The principal objective of everyone interested in the use of immunizing agents for aiding in the control and eradication of bovine brucellosis should be to employ the vaccine, the dose of vaccine, and the method of administration that will provide a serviceable immunity and cause the least possible interference with diagnostic procedures.

This paper presents a comparison of local and systemic reactions, maximum agglutinin response, recedence of agglutinin titers, and immunity produced in animals of different ages by various doses of strain 19 vaccine inoculated by the subcutaneous, intradermal, and intracaudal routes.

EXPERIMENTAL DATA

Local reactions. The degree and persistence of local reactions vary considerably in animals of the same age but evidence will be presented showing that they are related to dose of strain 19 vaccine, site of inoculation, and method of administration. According to the experiences of Campbell and Rodwell (3) and Manthei, et al. (11), the degree and persistence of local reactions decrease with a decrease in dose of standard strain 19 vaccine regardless of method and site of inoculation employed.

Subcutaneous inoculation of 5 ml. of strain 19 vaccine in cattle usually produces a large diffuse or circumscribed swelling, depending on the site of inoculation. When inoculations are made in the subcutaneous tissue of the neck, brisket, or area immediately posterior to the axillary space, the swellings are frequently circumscribed and persist for three weeks or longer. We have found the upper one-third of the lateral surface of the shoulder to be the most desirable site for subcutaneous injection of vaccine. Post-vaccinal swellings in this area are usually diffuse and disappear within seven days as a result of constant massage from movement of the shoulder during exercise. Animals may show slight lameness in the foreleg involved but the condition is temporary.

Intradermal inoculation of 0.2 ml. of strain 19 vaccine in the caudal fold produces a circumscribed swelling followed by central necrosis and sloughing of tissue. This

¹ Pathological Division, Bureau of Animal Industry, Beltsville, Maryland.
type of local reaction was observed in each of the 69 cattle vaccinated in this manner by us (11, 16). Absence of central necrosis of tissue at the site of inoculation is a very good indication that the vaccine was not injected intradermally. The time required for local reactions produced by intradermal injection of vaccine in the caudal fold of cattle to completely disappear was from 20 to 30 days. There have not been any published reports on the effect of reduced doses of strain 19 inoculated intradermally in the caudal fold.

Intracaudal inoculation of 1 ml. of strain 19 vaccine produces a cylindrical swelling at the terminal portion of the tail where the vaccine is deposited. The distance from the tip of the tail where swelling occurs depends on the length of the needle employed. According to Campbell and Rodwell (3), the swelling is accompanied by a slight exudation followed by dry necrosis and sloughing of the terminal part of the tail in 20 per cent of the animals vaccinated by the intracaudal method. The severity of the reaction corresponded to the size of vaccinal dose. Similar local reactions were observed by Buddle (2).

**Systemic reactions.** Systemic reactions in vaccinated cattle vary with the individual. The cause for this variation is not clearly understood but it may be due to the difference in susceptibility to brucellosis observed in cattle selected at random.

The majority of animals inoculated with strain 19 vaccine have a rise in temperature during the immediate four day post-vaccinal period. Increases in temperatures are produced with 0.2, 1, and 5 ml. doses of strain 19 vaccines inoculated intradermally, intracaudally, and subcutaneously, respectively.

Temporary bacteremias have been demonstrated in adult cattle inoculated with strain 19 organisms by several investigators (1, 7).

Milk production decreases temporarily following vaccination of lactating cows. Campbell and Rodwell (3) reported that the mean loss of milk per cow in animals inoculated intracaudally with 1 ml. of strain 19 vaccine was 35 pounds (28 per cent) during the six-day post-vaccinal period. Buddle (2) reported an average loss of milk per cow during the seven-day post-vaccinal period was 4.9 per cent in cattle vaccinated subcutaneously, 10.5 per cent in those vaccinated intracaudally. Holman and McDiarmid (9) reported an average loss of 24 pounds of milk per cow during the nine-day post-vaccinal period. These cattle were inoculated with 5.0 ml. of strain 19 vaccine by the subcutaneous method. Research (16) conducted in cooperation with the Bureau of Dairy Industry showed that the average loss of milk per cow for the nine-day post-vaccinal period was 52.3 per cent of the production for a single day in cattle inoculated with 5 ml. of vaccine subcutaneously and 56.7 per cent in cattle inoculated with 0.2 ml. of the same vaccine intradermally. The average loss of milk was greatest in cattle that were at their peak of production. All of these investigators observed that the maximum loss in milk production occurred during the second and third days following vaccination. Furthermore, milk production of most cattle returned to normal within nine days following vaccination.

The incidence of abortions caused by vaccination of pregnant cattle with strain 19 is variable. Moore and Mitchell (14) reported no abortions following the inoculation of 68 pregnant cattle with 5 ml. of vaccine subcutaneously. Campbell and Rodwell (3) reported similar results from inoculating pregnant cattle with 1 ml. of
vaccine intracaudally. Results contrary to those previously presented were reported by Deem and Cross (5). In one herd, there were 26 premature and 31 normal calves born following the vaccination of pregnant cattle with strain 19 and in another herd there were four premature calves born following vaccination of 56 pregnant cattle. Only one premature calf from each herd was cultured and the Brucella abortus organisms isolated could not be differentiated from strain 19. In a preliminary report by the author (10), strain 19 caused one abortion in 76 pregnant cattle inoculated with 5 ml of vaccine subcutaneously and one abortion in 27 pregnant cattle inoculated with 0.2 ml of the same vaccine intradermally.

There are no reports of isolating strain 19 from the milk of lactating cows that were nonpregnant at the time of vaccination. In a report (10) where strain 19 was demonstrated in the udder at termination of gestation, the udder infection was transitory. This finding coincides with the results obtained by Mingle, Manthei and Jasmin (12) and Taylor and McDiarmid (15) on the stability of reduced virulence of Br. abortus strain 19.

Agglutinin response. The agglutinin response in cattle inoculated at different ages with various doses of strain 19 vaccine by the subcutaneous, intradermal, and intracaudal methods are presented in table 1. The terms negative, suspicious, and positive agglutinin titers used in tables 1 and 2 represent the type of reactions observed in various dilutions at and below the minimum diagnostic level of infection, regardless of the antigen employed. These terms are equivalent to the following reactions when the standard Brucella abortus antigen prepared by the Bureau of Animal Industry is employed: negative = no agglutination or less than 50 per cent agglutination in the 1:25 dilution of sera, suspicious = 50 to 100 per cent agglutination in the 1:25 and 1:50 dilutions, and positive = 50 to 100 per cent agglutination in the 1:100 or higher dilutions. Although the information obtained from the different references was not complete in all cases, some very pertinent information is presented.

The range of maximum agglutinin titers, which is not included in the table, varied considerably in vaccinated animals of each group. This variation was not associated with dose of vaccine, method of vaccination, and age of animals at the time of vaccination.

Maximum agglutinin titers of each group of vaccinated animals are expressed in the geometric mean where information was sufficient to make accurate calculations. The purpose of employing this procedure was to provide a more accurate measurement of the mean agglutinin response.

Mean agglutinin titers were directly related to the dose of strain 19 vaccine when it was administered by the same method. These titers were consistently higher in cattle inoculated by the intracaudal method than in those inoculated by the subcutaneous and intradermal methods. There was no significant difference in the mean agglutinin titers of cattle inoculated with 5 ml of strain 19 vaccine subcutaneously and those inoculated with 0.2 ml of the same vaccine intradermally.

The rapidity with which agglutinin titers of vaccinated animals recede is more closely related to the age of animals at the time of vaccination than it is to the dose or method of administration of vaccine. This is demonstrated in table 2 which is a summary of data showing the level of vaccinal titers one year following vaccination.
### TABLE 1
Comparison of Agglutinin Response Produced in Cattle by Various Vaccinal Methods and Doses

<table>
<thead>
<tr>
<th>REFERENCES</th>
<th>VACCINATION—STRAIN 19</th>
<th>MAXIMUM AGGLUTININ TITERS</th>
<th>RECEDENCE OF AGGLUTININ TITERS</th>
<th>Below Minimum Diagnostic Level of Infection (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Method</td>
<td>Dose (ml.)</td>
<td>Age of Cattle</td>
<td>Number of Cattle</td>
</tr>
<tr>
<td>Campbell (3) and Rodwell</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>Sexually</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>1.0</td>
<td>mature</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>0.4</td>
<td>heifers</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>0.2</td>
<td>and</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Intradermal</td>
<td>0.2</td>
<td>cows</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>1.0</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>0.2</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>0.04</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>McDermid (13)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>15-18 mos.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Intradermal</td>
<td>0.2</td>
<td>15-18 mos.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>1.0</td>
<td>15-18 mos.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>12-15 mos.</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>0.2</td>
<td>12-15 mos.</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Intradermal</td>
<td>0.2</td>
<td>12-15 mos.</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>1.0</td>
<td>12-14 mos.</td>
<td>26</td>
</tr>
<tr>
<td>Manthei, et al. (11)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>6 mos.</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>1.0</td>
<td>6 mos.</td>
<td>48</td>
</tr>
<tr>
<td>Buddle (2)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>7-8 mos.</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>1.0</td>
<td>7-8 mos.</td>
<td>32</td>
</tr>
<tr>
<td>Gregory (6)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>9-10 mos.</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Intracaudal</td>
<td>1.0</td>
<td>9-10 mos.</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>Intradermal</td>
<td>Subcutaneous</td>
<td>Intradermal</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------</td>
<td>-------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Cotton (4)</td>
<td>5.0</td>
<td>0.2</td>
<td>5.0</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>4-7 mos.</td>
<td>4-6 mos.</td>
<td>4-6 mos.</td>
<td>7-8 mos.</td>
</tr>
<tr>
<td></td>
<td>108</td>
<td>385</td>
<td>810</td>
<td>1,084</td>
</tr>
<tr>
<td></td>
<td>14 days</td>
<td>14 days</td>
<td>12 mos.</td>
<td>12 mos.</td>
</tr>
<tr>
<td></td>
<td>670*</td>
<td>980*</td>
<td>81.4</td>
<td>90.0</td>
</tr>
<tr>
<td></td>
<td>34 days</td>
<td>12 mos.</td>
<td>14.9</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100.0</td>
<td>3.7</td>
<td>96.3</td>
</tr>
<tr>
<td>B. A. I. (17)</td>
<td>5.0</td>
<td>0.2</td>
<td>5.0</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>6-8 mos.</td>
<td>6-8 mos.</td>
<td>9-16 mos.</td>
<td>9-16 mos.</td>
</tr>
<tr>
<td></td>
<td>273</td>
<td>442</td>
<td>432</td>
<td>442</td>
</tr>
<tr>
<td></td>
<td>18 mos.</td>
<td>18 mos.</td>
<td>18 mos.</td>
<td>18 mos.</td>
</tr>
<tr>
<td></td>
<td>78.1</td>
<td>82.9</td>
<td>57.0</td>
<td>65.2</td>
</tr>
<tr>
<td></td>
<td>20.1</td>
<td>14.7</td>
<td>39.3</td>
<td>30.7</td>
</tr>
</tbody>
</table>

* = Arithmetical mean based on end point dilution of 1:2000; #: Information not reported; Absence of Data = Insufficient detail of data in original reports.
Haring and Traum (8) also presented data showing that the age of animals at the time of vaccination has a marked influence on recession of post-vaccinal agglutinin titers. A careful review of agglutinin titers in calf-vaccinated cattle classified as suspicious shows that titers of 1:50 were in the majority in subcutaneously vaccinated cattle whereas titers of 1:25 were in the majority in intradermally vaccinated animals. In agglutinin titers classified as positive, the great majority were at or only one dilution above the minimum diagnostic level of infection.

Regardless of the unquestionable influence of age of cattle at the time of vaccination on recession of agglutinin titers, there is some evidence to indicate that vaccinal dose and method also have some influence on decline of titers. Although the report of Campbell and Rodwell (3) was not in sufficient detail to present the results on the post-vaccinal decline of agglutinin titers in tables 1 and 2, these investigators demonstrated graphically that the smaller the dose of vaccine injected either subcutaneously or intracaudally the lower were the agglutinin titers 100 to 200 days following vaccination. Furthermore, when they injected cattle with 0.2 ml. of strain 19 vaccine subcutaneously, intradermally, and intracaudally, the agglutinin titers in the subcutaneously vaccinated cattle dropped to a slightly lower level at 100 days following vaccination than those vaccinated by either of the other two methods. These results are similar to results of less extensive research by Manthei, et al. (11).

**Immunity response.** The immunity response in cattle vaccinated as calves and yearlings with various doses of strain 19 vaccine administered by the subcutaneous, intradermal, and intracaudal methods are presented in detail in table 3.

There was a considerable difference in the number of cattle that resisted brucellosis in the three experiments. This demonstration of differences in degree of immunity appears to be closely associated with the strains of *Br. abortus* used for exposure. In the work reported by Buddle (2), vaccinated and control cattle received exposure to infected cattle prior to conjunctival exposure to *Br. abortus* strain 544. The degree of exposure employed by McDiarmid (13) with the same

### Table 2

**Summary of Data on Recedence of Vaccinal Titers**

<table>
<thead>
<tr>
<th>Method</th>
<th>Dose (ml.)</th>
<th>Number of Cattle</th>
<th>Age of Cattle</th>
<th>Time after Vaccination</th>
<th>Negative (%)</th>
<th>Suspicious (%)</th>
<th>Positive (%)</th>
<th>Below Minimum Diagnostic Level of Infection (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcutaneous...</td>
<td>5.0</td>
<td>1,864</td>
<td>4-8 mos.</td>
<td>1 year</td>
<td>74.2</td>
<td>22.0</td>
<td>3.8</td>
<td>96.2</td>
</tr>
<tr>
<td>Intradermal...</td>
<td>0.2</td>
<td>1,967</td>
<td>4-8 mos.</td>
<td>1 year</td>
<td>87.2</td>
<td>11.8</td>
<td>1.0</td>
<td>99.0</td>
</tr>
<tr>
<td>Intracaudal...</td>
<td>1.0</td>
<td>32</td>
<td>4-8 mos.</td>
<td>1 year</td>
<td>66.6</td>
<td>24.0</td>
<td>9.4</td>
<td>90.6</td>
</tr>
<tr>
<td>Subcutaneous...</td>
<td>5.0</td>
<td>480</td>
<td>9-16 mos.</td>
<td>1 year</td>
<td>24.8</td>
<td>54.6</td>
<td>20.6</td>
<td>79.4</td>
</tr>
<tr>
<td>Intradermal...</td>
<td>0.2</td>
<td>463</td>
<td>9-16 mos.</td>
<td>1 year</td>
<td>29.6</td>
<td>53.8</td>
<td>16.6</td>
<td>83.4</td>
</tr>
<tr>
<td>Intracaudal...</td>
<td>1.0</td>
<td>35</td>
<td>9-16 mos.</td>
<td>1 year</td>
<td>28.5</td>
<td>54.3</td>
<td>17.2</td>
<td>82.8</td>
</tr>
</tbody>
</table>
### TABLE 3
Comparison of Immunity to Brucellosis Produced in Cattle by Various Vaccinal Methods and Doses

<table>
<thead>
<tr>
<th>REFERENCES</th>
<th>VACCINATION—STRAIN 19</th>
<th>EXPOSURE TO VIRULENT BR. ABORTUS</th>
<th>Response to Brucellosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>METHOD</td>
<td>DOSE (ML)</td>
<td>AGE OF ANIMALS</td>
</tr>
<tr>
<td>Buddle (2)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>6</td>
</tr>
<tr>
<td>Intracaudal</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McDiarmid (13)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>15-18</td>
</tr>
<tr>
<td>Intradermal</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intracaudal</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manthei, et al. (11)</td>
<td>Subcutaneous</td>
<td>5.0</td>
<td>12-15</td>
</tr>
<tr>
<td>Intradermal</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcutaneous</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcutaneous</td>
<td>5.0</td>
<td>12-15</td>
<td>Conjunctival</td>
</tr>
<tr>
<td>Intradermal</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

544 = Strain of virulent Br. abortus routinely used to challenge resistance to brucellosis in cattle in England; 2308 = Strain of virulent Br. abortus frequently used to challenge resistance to brucellosis in cattle in the United States; * = one nonpregnant animal in each group.
strain of virulent \textit{Br. abortus} appears to be suitable for evaluating induced resistance to brucellosis in cattle. Although the results reported by Manthei, Mingle and Carter (11) are not particularly encouraging, subsequent research has demonstrated that the exposure doses of the highly virulent strain 2308 employed were more than was necessary to infect 100 per cent of nonvaccinated heifers during their first pregnancy.

Regardless of this difference between experiments, there was no significant difference in the degree of immunity to brucellosis between animals inoculated with 5 ml. of strain 19 vaccine subcutaneously and those inoculated with 1 ml. and 0.2 ml. of the same vaccine intracaudally and intradermally, respectively. Furthermore, the immunity to brucellosis in a small number of animals inoculated subcutaneously with 0.2 ml. of vaccine was similar to that in the three groups of vaccinated cattle previously discussed. There were also marked differences in the degree of immunity to brucellosis in cattle vaccinated in the same manner. These differences were exhibited by persistence of bacteremia, condition of the calf at parturition, length of gestation period, degree of placentitis, and extent of infection. For example, the only evidence of infection in three cows included in the report of Manthei, \textit{et al.} (11), was a single isolation of \textit{Br. abortus} from the blood of each animal associated with a temporary rise in agglutinin titers. These three cattle apparently recovered from the disease prior to calving normally. Although the degree of immunity to brucellosis in vaccinated cattle of each group varied considerably, it was significantly higher than in corresponding groups of unvaccinated controls.

The data on immunity to brucellosis in cattle inoculated with various doses of strain 19 vaccine by three different methods of administration are summarized in table 4.

\textbf{TABLE 4}
\textit{Summary of Data on Immunity to Brucellosis}

<table>
<thead>
<tr>
<th>METHOD</th>
<th>Dose (ml.)</th>
<th>Number of Cattle</th>
<th>Infected (%)</th>
<th>Noninfected (%)</th>
<th>Live Calves (%)</th>
<th>Mean Gestation Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcutaneous</td>
<td>5.0</td>
<td>70</td>
<td>37</td>
<td>63</td>
<td>70</td>
<td>267 days</td>
</tr>
<tr>
<td>Intradermal</td>
<td>0.2</td>
<td>31</td>
<td>45</td>
<td>55</td>
<td>71</td>
<td>265 days</td>
</tr>
<tr>
<td>Intracaudal</td>
<td>1.0</td>
<td>52</td>
<td>38</td>
<td>62</td>
<td>60</td>
<td>264 days</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td>87</td>
<td>85</td>
<td>15</td>
<td>30</td>
<td>234 days</td>
</tr>
</tbody>
</table>

DISCUSSION

There is but one purpose in reviewing data on the controversial subject of vaccinal methods and doses relative to strain 19 and that is to present as many facts as possible to the livestock industry.

The type of local reactions observed in cattle following vaccination with strain 19 are related to method of vaccination and tissue injected but intensity and per-
sistence of these reactions are more closely related to dose of vaccine and site of inoculation.

Systemic reactions caused by the inoculation of strain 19 vaccine in cattle varies with the individual, regardless of age of the animal at the time of vaccination. Furthermore, there is no evidence to indicate that systemic reactions are related to sites of inoculation, methods of inoculation, and doses of strain 19 thus far employed. It has been demonstrated that the number of viable strain 19 organisms can be reduced to a point where they will not produce infection in guinea pigs. By analogy, it then would be possible to reduce the dose of strain 19 vaccine in cattle to the degree where no systemic reactions could be detected. What effect this reduced vaccinal dose would have on the production of immunity to brucellosis in cattle is not known because the biological processes involved in production of immunity are not clearly understood.

The data presented show there was no significant difference in the degree of immunity produced in cattle vaccinated as calves with 5 ml. of strain 19 vaccine subcutaneously and 1 ml. of the same vaccine intracaudally. Nothing has been published on the degree of immunity produced in cattle vaccinated as calves with 0.2 ml. of strain 19 vaccine intradermally; consequently no comparison can be made of the degree of immunity produced in calf-vaccinated cattle by each of the three vaccination procedures. However, there was very little difference in the degree of immunity to brucellosis in cattle vaccinated between 12 and 18 months of age with 5, 1, and 0.2 ml. of strain 19 vaccine inoculated by the subcutaneous, intracaudal, and intradermal methods, respectively. Furthermore, results obtained on a very limited number of cattle vaccinated at a similar age show that the degree of immunity produced with 0.2 ml. of strain 19 vaccine inoculated subcutaneously was equal to that produced with the same dose of vaccine inoculated intradermally. This finding emphasizes the scarcity of information on the minimum dose of strain 19 vaccine that will produce a serviceable immunity. Moreover, we do not know the relationship between the minimum dose of vaccine and method of vaccination to the degree of vaccinal immunity.

Agglutinin response was greater in cattle vaccinated by the intracaudal method than it was in cattle vaccinated by either the subcutaneous or intradermal methods when the dose of strain 19 vaccine was the same. Furthermore, there was no significant difference between maximum agglutinin response in cattle inoculated with 5 ml. of vaccine subcutaneously and 0.2 ml. intradermally; however, the response was less with both of these procedures than with 1 ml. of vaccine intracaudally. The significance of agglutinin response is questionable because it has not been demonstrated that agglutinin response is related to degree of immunity to brucellosis.

Recedence of vaccinal titers in cattle appears to be more closely related to age of the animal at the time of vaccination than to dose of vaccine or method of vaccination. A much higher percentage of agglutinin titers recede to negative as well as below the minimum diagnostic level of infection in cattle vaccinated between 4 and 8 months of age than in those vaccinated over 8 months of age. Consequently, vaccination of cattle over 8 months of age with strain 19 will make it impossible to accurately interpret the results obtained with our present diagnostic tests. The fact that the percentage of suspects was higher in the cattle inoculated as calves with
5 ml. of vaccine subcutaneously than in those inoculated at the same age with 0.2 ml. of vaccine intradermally proves very little concerning methods of vaccination because of the tremendous difference in dosage.

Before we can recommend one method of vaccination or one dose of vaccine as being superior to all others, it will be necessary to conduct research on various doses of vaccine inoculated by the same method as well as the same doses inoculated by various methods. Another consideration is the practicability of methods of vaccination, sites of inoculation, and doses of vaccine. It is necessary to apply any method of inoculation accurately, consequently the method of choice will depend on herd management conditions. The choice of site is important from the standpoint of local reactions and ease of operation and the dose of vaccine must be sufficiently large to insure accurate measurement. However, the final judgment on efficiency of the methods of vaccination and doses of vaccine must be on the degree of serviceability of the immunity produced and the degree of interference with our present diagnostic procedures.

The arbitrary dose of 5 ml. of strain 19 vaccine increases the chance of injecting an animal with a sufficient number of viable organisms to produce a serviceable immunity. Until more is known about the minimum dose of viable strain 19 organisms that will produce a serviceable immunity in cattle against brucellosis, caution should be exercised in reducing the vaccinal dose, regardless of the method of administration employed. This word of caution is based on the possibility of injecting vaccines that are nonviable or low in viability. Research has demonstrated that the viability of liquid or reconstituted dried strain 19 vaccines decreases when subjected to adverse environmental conditions. Therefore, utmost care should be taken with strain 19 vaccines to insure maximum viability at the time they are inoculated into cattle.

In concluding this discussion, it should be stated that we do not know the minimum dose of strain 19 vaccine or the most desirable method of vaccination that will provide a serviceable immunity in cattle against brucellosis and not interfere with interpretation of our present diagnostic procedures. Moreover, further research is needed or more facts must be published before recommendations can be made concerning reduced dosages of strain 19 and methods of vaccination.

REFERENCES


4. COTTON, COLUMBIA I.: An Intensive Study of Post-vaccination Responses in Groups of Calves Vaccinated Intracutanously and Subcutaneously with Brucella Abortus Vaccine, and II. A Comparative Study Over a Ten Year Period
of Intracutaneous versus Subcutaneous Vaccination of Calves with Strain 19 


A SUMMARY OF RESULTS OBTAINED IN OHIO IN COMPARATIVE TESTS OF HUDDLESON'S BRUCELLA MUCOID AND STRAIN 19 VACCINES


Wooster, Ohio

The objective of this report is to offer a brief summarization of the results obtained in a series of tests in which the protective values of Huddleson's Mucoid (M) and Strain 19 brucella vaccines were challenged by experimental exposure with a virulent strain of Brucella abortus.

A portion of the work herein considered has already been reported whereas the additional data have been obtained from other tests, the data of which are now in preparation for formal publication.

Since the general technics and procedures used in these tests have been similar and have already been reported, no attempt to review them in detail will be made at this time.

The development of an ideal vaccine for protection against Brucella abortus in cattle may be beyond the realm of actual accomplishment, nevertheless it should be the ultimate goal in this field of research.

A review of the early efforts to develop vaccines for protection of cattle against brucellosis would serve no worthwhile purpose at this time, other than to state that no outstanding success in the use of agents incapable of producing infection of the vaccinates was attained prior to the development of the Brucella Strain 19 vaccine by the United States Bureau of Animal Industry.

While field tests of a vaccine afford a coverage of relatively large numbers of animals which is highly desirable, however, such data are frequently criticized because no or insufficient nonvaccinated animals have been retained in the herds as controls.

It is generally recognized that experimental or so called controlled tests in which representative nonvaccinates are maintained, afford the more reliable data upon which evaluation of the vaccinal resistance may be based. It is possible to establish a degree of uniformity in the conduct of controlled tests which may offer favorable conditions for comparison of the results of different investigations. It is recognized that such tests may not represent the many variables met in various herds under conditions of natural exposure. Caution should therefore be exercised in arriving at definite conclusions as to the utility value of vaccines based upon data obtained from a limited number of experimental tests.

Privilege to conduct this work in Ohio was granted by Dr. H. G. Geyer, Division of Animal Industry, Ohio Department of Agriculture. Permission to obtain the vaccine from the Brucella laboratory, Michigan State College, East Lansing was granted by Dr. B. T. Simms, United States Bureau of Animal Industry.

All "M" vaccine used in the tests has been supplied by Dr. I. Forest Huddleson of the Brucella Laboratory, and represented current production lots that were being used in the State of Michigan. This vaccine is a suspension of one of the
RESULTS OF BRUCELLA MUCOID AND STRAIN 19 VACCINES

mucoid growth phases of Br. suis containing both living and dead organisms. The dose of the vaccine is established on the basis of the dry weight of the bacterial cells. The volume of the dose for any animal is 1 cc. and is injected subcutaneously in the region immediately posterior to the scapula. The vaccine may be used in calves six months or older and in either pregnant or non-pregnant adult cattle. Agglutinin response in negative noninfected animals may reach a low reaction titer which disappears in both the calf and adult vaccinates within 30 to 100 days.

Comparative tests of "M" and strain 19 vaccines have been made with both calf and adult vaccinated cattle. The animals selected for use in the experiments were obtained from Brucella free herds and were subjected to one or more agglutination tests at monthly intervals after assembly and prior to vaccine administration. A suitable number of animals in each trial were not vaccinated and served as controls upon possible unintentional exposure of the animals prior to their experimental challenge with virulent Br. abortus cultures. Until the time of exposure all animals in each experiment were maintained as a single herd and were subjected to routine monthly agglutination tests.

In all tests the animals were experimentally exposed by instillation into the conjunctival sac of a measured quantity of virulent viable Br. abortus organisms, one half of the total exposure dose being applied to each eye. In the tests the same strain of Br. abortus (S2308) was used as the infecting agent. This particular culture was obtained from the United States Bureau of Animal Industry and had been employed in several tests, whereby some data as to its virulence and the numerical quantity most suitable for vaccinal resistance challenge were available. Using this culture it had been reported that an exposure dose markedly exceeding 750,000 organisms would in some instances break the resistance of strain 19 vaccinates. Since strain 19 vaccine was being employed as a reference vaccine in our tests the use of an infecting challenge which would exceed the probable protective value of that vaccine appeared undesirable.

The evidence upon which the protective value of a Brucella vaccine is based may vary somewhat with the viewpoint of those concerned. In some instances the cattle owner will be satisfied if the abortion rate in his herd is reduced; his veterinarian may be interested in a reduced occurrence of positive agglutination reactions; while the research man will be most concerned in results of attempted recovery of the infecting agent from the aborted fetus or material collected from the dam, as indices of vaccinal value.

All three methods are susceptible to certain criticisms:

1) Not all Brucella-infected animals abort nor are all aborting cows necessarily infected with Br. abortus.

2) A positive agglutination test is not per se an infallible index of current infection since vaccinal titers, occasional irregularity in the occurrence of agglutinin titers, and in some instances a prolonged incubation period prior to agglutinin development, may be confusing to evaluation of agglutination tests.

3) Recovery of Br. abortus from the aborted fetus or material from the cow probably is the most critical and generally accepted evidence of infection; however, failures to recover the organism never carry the same weight of evidence as do positive recoveries, since in some instances the negative results may be due to
inadequate technics or the selection of unsuitable material for examination, rather than to an actual absence of the infecting agent.

Brucellosis experimentation involving cattle is both an expensive and time consuming research and the number of animals involved in a single test is usually limited. Since significance of the data obtained bears a close relationship to the number of animals involved, a single test offers but limited criteria from which conclusions may safely be drawn. However, a combination of the results obtained in repeated tests conducted under comparable conditions, increases the number of observations whereby at least probable trends may be predicated.

The number of animals and the per cent which were resistant to experimental Br. abortus exposure, as determined in three experimental groups of cattle by non-recovery of the organism from the aborted fetuses and/or vaginal swabs and colostral milk collected from the dams, are presented in Table I.

TABLE I
Results of Attempted Recovery of Br. abortus from Cattle following Experimental Exposures

<table>
<thead>
<tr>
<th>TEST</th>
<th>STRAIN 19 VACCINATES</th>
<th>&quot;M&quot; VACCINATES</th>
<th>NON-VACCINATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cattle</td>
<td>Resistant</td>
<td>%</td>
</tr>
<tr>
<td>A</td>
<td>100%</td>
<td>100%</td>
<td>76</td>
</tr>
<tr>
<td>B</td>
<td>80%</td>
<td>83.3%</td>
<td>76</td>
</tr>
<tr>
<td>C</td>
<td>83.3%</td>
<td>83.3%</td>
<td>76</td>
</tr>
<tr>
<td>Combined</td>
<td>90.9%</td>
<td>100%</td>
<td>76</td>
</tr>
</tbody>
</table>

* Numerator—Number resistant cattle; Denominator—Total cattle in group.

Test A. The cattle used in this test were agglutination negative beef cows 7–12 years old and were selected from a herd which had been maintained as a non-reactor group over a period of five years prior to use in this test.

Pregnancies were established in 25 cows 11 of which had received strain 19 and 8 "M" vaccines. Six were non-vaccinated controls.

Each of these cows had produced normal calves during the year. The vaccines were administered to the cows shortly after the calves had been weaned and breeding was initiated approximately two weeks later. The cows were subjected to experimental Br. abortus exposure when six to seven months in gestation and approximately nine months after vaccine administration. Each animal received 1,500,000 Br. abortus (2308) viable organisms as a divided dose instilled into each conjunctival sac.

Recovery of Br. abortus was undertaken with material collected at the time of calving. Brucella organisms were obtained from none of the strain 19 vaccinates; from one of the "M" vaccinates and from four of the control animals. The percentage of animals thus classified as resisting the experimental challenge was 100 per cent of the strain 19 vaccinates, 87.5 per cent of the "M" vaccinates and 33.3 per cent of the non-vaccinated controls.
RESULTS OF BRUCELLA MUCOID AND STRAIN 19 VACCINES

Test B. This test was made with Holstein heifers obtained from a single brucellosis-free accredited herd.

Pregnancies were established in 17 of the heifers; five were strain 19 vaccinates, six were "M" vaccinates and six were non-vaccinated controls. These heifers ranged from 8-15 months of age at the time of vaccination, averaging 9.6, 10.1 and 11.3 months respectively in the above groups.

The exposure challenge was the same as that in test A except that the total dose per animal consisted of 750,000 organisms. The exposure was made when the heifers were in their fourth to sixth months of gestation and approximately 16 months following vaccine administration.

The percentage of animals classed as resistant to exposure in this test was 80 per cent of strain 19 vaccinates, 50 per cent of "M" vaccinates and 16.7 per cent of the controls.

Test C. The 26 Holstein heifers used in this test were obtained from two Br. abortus free herds and ranged from four to 13 months (average 9 months) in age at the time of vaccine injections. Six received strain 19 vaccine and nine were given "M" vaccine. Eleven were retained as non-vaccinates.

The exposure challenge, similar to that indicated for Test B, was made during the 11th to 212th day (average five months for each group) of gestation and at approximately 15 months following vaccine administration.

The percentage of resistant animals in this test was 83.3 per cent of the strain 19 vaccinates, 22.2 per cent of the "M" vaccinates and 9.9 per cent of the non-vaccinates.

Combining the results of the three tests shows the average percentage rate of resistant animals as 90.9 per cent for the strain 19 vaccinates, 52.1 per cent for the "M" vaccinates and 17.3 per cent for the non-vaccinated controls.

Variations are noted in the percentage rates of resistant animals in the different tests whether they received strain 19, "M" vaccine or were non-vaccinated controls, however, the average percentage of the combined tests may offer some indication representative of the trend that might be anticipated were a larger number of animals subjected to similar conditions of experimentation.

While neither vaccine gave complete protection it is quite apparent, under conditions of these tests that strain 19 vaccine afforded a greater protective value than did the "M" vaccine.

However, there is a definite indication that "M" vaccine is not entirely devoid of protective value. Whether or not this degree of protection might offer a serviceable resistance in many herds under field conditions of exposure remains to be established.

Other available information indicates that a less marked reaction of the vaccinate occurs following injection of "M" than strain 19 vaccine. Neither vaccine produced a recognizable transmission of infection to other non-vaccinated animals in direct association with the vaccinates. Mucoid vaccine has been used with no apparent ill effect, irrespective of the stage of gestation at time of vaccination, and does not produce prolonged reactor titers in non-infected cattle regardless of the animals' age.

Considering the above information it would appear that "M" vaccine may find a field of utility, particularly in non-infected adult breeding animals and those
furnishing milk to areas that require this product to originate from agglutination negative animals, even though its protective value as demonstrated in these tests is below that of strain 19.

Whatever interpretation may be made of these results the fact still remains apparent, as has been frequently stated, that present vaccinal use can be accepted only as an adjunct to the problem of brucellosis control in cattle.
REPORT ON BRUCELLOSIS ERADICATION PROJECT

ASA WINTER, D.V.M.*

Washington, D.C.

This annual review of the trend in brucellosis thinking, and advancements in field operations for eradication of the disease, gives cause for continued optimism. The report presented at the 1951 meeting of the Association was, we believe, the most comprehensive and inspiring summary yet prepared, since it described a period of perhaps our greatest advancement in those developments which are paving the way to success of the brucellosis eradication program. We would like to think of this report as another chapter on a project which through gradual build-up of understanding and support by the people has now hit a progressive stride.

The increasing support from cooperating non-regulatory agencies, together with approval by the Brucellosis Committee of this Association of developments which may supplement our accepted practices and standards, are important factors in recent accomplishments.

In connection with cooperation of non-regulatory groups, it will be recalled that the 1951 report referred to a nationwide study then under way by Professor C. G. Bradt, Extension Animal Husbandman of Cornell University on Public Livestock Health Programs. That work has since been completed, and observations gained from this survey of 23 states have been summarized and presented in the interest of the national program.

It is interesting to note that among his observations the following statement by Professor Bradt, "In this study of public livestock health programs, brucellosis in cattle, swine, and goats is looked upon by most states as the number one problem." The report mentions overall progress in brucellosis eradication with the greatest advancement noted, however, in dairy sections. In connection with these observations Professor Bradt states, "As yet, beef cattlemen and dairymen do not see eye to eye on the kind of program they both can agree upon to promote in their state." This situation has been recognized by the Bureau as one which must be reconciled and we are glad to note that action was taken last year by the Brucellosis Committee of this Association recommending appointment of a sub-committee of ranchers and regulatory officials to draw up rules and regulations for application specifically to range and semirange areas as a means to an understanding solution of this matter.

From his observations on the problem of veterinary shortage, which included studies in several states where lay personnel is being used, Professor Bradt makes the following statement, "The use of properly trained laymen for vaccinating and bleeding, preferably under veterinary supervision, offers hopeful possibilities." Bureau records show that personnel of this type is now being employed in eight states, and with generally satisfactory results.

* Doctor Winter is assistant in charge of the Brucellosis and Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture.
Another observation deals with the participation of practicing veterinarians and refers to the rates of compensation which are indicated as "too low in some states". The Bureau has long championed the greater participation by accredited veterinarians if this program is to be extended to the limit of the demands and need. Without exception the greatest progress has been made in those states where this policy is recognized and practiced, with equitable rates of compensation agreed upon by the regulatory officials and the veterinary profession. Only recently the Bureau has been granted approval for cooperation with states through compensating participating accredited veterinarians on a per head, or per herd-per head basis, and each state has been circularized regarding its interest in such a plan.

With respect to calf vaccination, Professor Bradt, as an extension specialist from a state that has led in calf vaccination, and after discussing this also in the other states where vaccination predominates, voices the observation that calf vaccination should be viewed as a means to an end, and not the end or goal. We believe this attitude toward the use of vaccine is now general, i.e., vaccination is accepted as a valuable supplement to any program and may be considered when practiced alone, as a sound approach in certain areas to a more complete program, but not as an end procedure. In this connection it is interesting to note that calf vaccination has increased about 25 per cent during the past year and with seeming justification at this period in the program.

Along with this increase in vaccination, a healthy increase is recorded in blood testing. A summary of the year's work shows that nearly 2,000,000 additional blood tests were applied this year, with more than half of these conducted in the state of Wisconsin where a determined effort is being made to complete its brucellosis eradication project. Even eliminating this heavy expansion of activities in Wisconsin, however, there was still an increase of 16 per cent in the volume of blood testing throughout the remainder of the country. This increase was distributed throughout 26 states and Puerto Rico.

With this noted increase in calf vaccination and blood testing, the use also of the ABR test, which was adopted only this year as an official practice, has expanded rapidly and promises to overcome to a large extent the personnel shortage which has plagued the program for several years. Through the use of lay technicians for collection of milk samples, and with limited veterinary participation necessary for this work, 454,732 herds containing an estimated 8,585,416 animals have in this manner been screened for Brucella infection during the year. These represent roughly 1,000,000 more animals than were blood tested during the same period, thus more than doubling the total number of cattle on which determining tests for the presence of Brucella infection would have been possible without the benefit of this test. It is expected that the milk test will prove to be one of the greatest contributions toward making possible the fulfillment of our obligation in the field of brucellosis eradication.

One of the recommendations of the 1951 Brucellosis Committee, that greater tolerance should be granted certain degrees of titer in the case of animals vaccinated as calves, if they are members of a herd otherwise eligible for certification as free from brucellosis, has encouraged breeders and regulatory officials to extend calf vaccination wherever indicated without the former fear of jeopardizing herd status.

Statistical data on the brucellosis project are available for distribution here as in
former years, and additional copies of these reports may be obtained by writing the Bureau office in Washington. It will be noted from these data that there is an increase in blood reactors from the 3.1 per cent of a year ago to 4.2 per cent for this period. This reversal in trend results from the selective method of blood testing which was followed during the year in the state of Wisconsin. There, the ABR test was used on all herds as an initial screening process and only those which reacted to the ring test were subsequently blood tested. With reactors being confirmed in about 90 per cent of the ABR reactor herds, and with the large volume of work under way in that state, this practice was largely responsible for the impressive increase in infection rate reported this year. If, however, only regular testing conducted in the remaining states is considered, we find a reduction from the 3.1 per cent animal infection rate of last year to 2.7 per cent for the period of this report.

SUMMARY

The effects of organizational work at state and county levels and the vast amount of factual publicity given brucellosis and the program through the farm press, radio, television, extension service, and other media are demonstrated in the accomplishments of this past year. The additional calf vaccinations, 636,918 over those of the previous year—a 25 per cent increase, indicate the extent of interest in this field and reflect to some degree the recognition given this practice by the Brucellosis Committee through liberalizing regulations with respect to vaccinal titers.

Additional blood tests amounting to 1,850,491, a 32 per cent increase over a year ago, demonstrate an understanding of the limitation that must be placed on vaccination alone to eradicate brucellosis, and show, too, the effect of milk ordinances now operating, or proposed, on the tempo of programs in several states.

The acceptance of the ABR test in 18 states and Puerto Rico as a practical answer to the personnel and fiscal problems in meeting demands for brucellosis-free herds and areas supports the action of the 1951 Brucellosis Committee in approving this test as an official practice. Milk tests applied during the year revealed approximately 30 per cent of the herds as positive and held for further check with the blood serum test to determine the affected individuals. At the same time the remaining 70 per cent were identified as probably free from infection, and a fixed asset in our brucellosis campaign. The value of identifying and protecting our brucellosis-free herds, which country-wide outnumber the infected herds about four to one must be considered of equal importance to any phase of the program for eradication of brucellosis.

Willingness on the part of regulatory officials to evaluate and adapt to their own program needs all measures which are available for advancing the brucellosis project, and the continued support already demonstrated by interested non-regulatory groups will have an important influence on the future of the brucellosis program. There is strong evidence that public reaction will assure the conditions necessary for completion of this project.

SYNOPSIS OF PRINCIPAL INTEREST ITEMS

Study by impartial observer of livestock disease problems confirms brucellosis as the number one offender in most states.
Effort being made by Brucellosis Committee of the Association to have representations of range and semirange interests and regulatory officials develop plans acceptable to those particular areas.

Considered essential that services of the practicing veterinarian be enlisted in the brucellosis campaign, and that equitable rates of compensation be established in all areas. Federal Bureau of Animal Industry proposes cooperative support for plan which would compensate on per head, or per herd and head basis.

Twenty-five per cent increase in calf vaccinations and 32 per cent increase in blood testing during the year. State of Wisconsin accounted for approximately one-half of blood test increase.

ABR (milk ring test) officially accepted, and conducted on 454,732 herds.

Through use of the ABR test, and with increased blood testing during this period determinations were made for the presence of Brucella infection on nearly twice as many herds as was possible the year before with the blood test alone.

The rapid classification of all dairy herds for protection of that 70–80 per cent which are initially free from infection, while concentrating on the eradication of infection from the remainder is extremely important to the completion date of the program. The ABR test is our greatest aid for this purpose.
REPORT OF COMMITTEE ON BRUCELLOSIS


For over 30 years the United States Livestock Sanitary Association appointed a Committee on Brucellosis. Annually the Committee reported and gave its recommendations for brucellosis control and eradication. The efforts of these Committees were not in vain, as progress has been made in reducing the incidence of the disease on the national level. However, it also behooves the sanitary official to occasionally take inventory and evaluate the acceptance and effect of these rules and regulations.

It is evident that today there exists on the national level, a definite "brucellosis consciousness" among cattle, swine, and goat raisers. It is also evident that there also exists a more energetic feeling that "brucellosis must go" if more efficient livestock production is to be attained.

The uniform rules and regulations of recent years appear practical and sound. Their practicability is substantiated by three of our states being able to attain the "Modified Certified Brucellosis-free" status.

In the face of these factors, it would appear justifiable to utilize the now existing rules for longer periods of time and minimize the annual changes. All will agree that these annual changes were conscientiously and sincerely made in an effort to expedite the reduction of the incidence of the disease. However, these constant changes have likewise established confusion and some doubts in the minds of industry.

Now that the uniform rules appear both sound and practical, it does not seem justifiable to continue annual changes except as national progress may indicate.

In view of the foregoing, it is the recommendation of this Committee that this Association request the Chief of the Bureau of Animal Industry to cause to have re-written the uniform rules for certifying Brucellosis-free herds and areas and the uniform recommendations for State Legislation in simple outline-form.

In conjunction with the foregoing, it is reasonable to conclude that if brucellosis is to be completely controlled or eradicated, it is of utmost importance that the same serious consideration be given the disease in other species of livestock such as swine and goats. It has become evident that the swine producers of the nation are seriously interested in an efficient control program. This is further established by a recent release from the American Swine Records Association, whereby it was recommended a more vigorous program for the control of swine brucellosis be inaugurated on the state and national level.

In keeping with the recommendations of the report of the Committee on Brucellosis, of 1951, your Committee urges and strongly recommends that a special subcommittee on swine brucellosis be appointed and be made a part of the Committee
on Brucellosis. This Committee should include adequate representation of leaders of the swine industry. This Committee endorses the report of the Committee of 1949 on Swine Brucellosis.

Your Committee likewise feels and recommends that comparable interest and attention be given to the goat industry. It would appear that the problem is most significant, considering the presence of brucella melitensis in swine and cattle, as well as brucella suis infection in cattle.

STANDARD MILK AND HEALTH ORDINANCES

The intensified efforts for brucellosis control and eradication are ever more justifiable, especially for today's dairy industry. The present and future milk ordinances with specific references to the brucellosis status of the herd will continue to develop. The demands of the consumer will be met as public education continues to improve.

PRIORITY FOR FUNDS

As industry demands continue to mount for more efficient and extensive brucellosis control programs, it behooves the Legislatures of the several States to assume the responsibility in providing adequate funds that this end may be accomplished.

PROPOSED REVISION TO UNIFORM METHODS AND RULES FOR THE ESTABLISHMENT AND MAINTENANCE OF CERTIFIED BRUCELLOSIS-FREE HERDS OF CATTLE AND MODIFIED CERTIFIED AREAS

Section 20 (a-1) Add to read:

Range and semi-range areas may qualify for certification as Modified Brucellosis-free areas provided all herds are tested as outlined in the procedures approved by the United States Bureau of Animal Industry for Brucellosis eradication; provided further that all range and semi-range herds that have been following an official calfhood vaccination program for at least three (3) years may qualify on a test of all dairy cattle in the range or semi-range herds, all pure bred cattle, and at least 20 per cent of the range or semi-range cows over three (3) years of age and provided further that all animals tested are negative to the test for Brucellosis. Except cows officially vaccinated when calves which do not react in a dilution of more than an incomplete in 1 to 100. Should infection be disclosed in any of the animals required to be tested in the range or semi-range herds, said herds shall be handled as outlined in the procedures as approved by the United States Bureau of Animal Industry for the eradication of Brucellosis.

Section 20, Paragraph C.

Change what apparently is a typographical error of 3 per cent to 2 per cent so that the paragraph reads as follows:

If the test of an area as under 20 (a) results in more than 2 per cent reactors, or if a retest of infected herds as under 20 (b) does not qualify the area for certification, it shall be necessary to make a complete area retest.

Section 21, Add Paragraph 5 to read as follows:

At the expiration of the three (3) year period, range and semi-range areas may be re-certified for another three (3) year period when the results of a retest of 20 per cent of the representative herds as described in Section 20 (A-1) reflects a rate
of infection which does not exceed 1 per cent of the cattle or 5 per cent of the herds tested. The number of herds required for the retest shall be computed from the last area test and shall not include the same 20 per cent previously tested for this same purpose.

Delete Section 24 and insert the following as Section 24:

Reactors may be retained in a quarantined herd for a period not to exceed three (3) years from the date retention of reactors was started.

Add a new Section designated as 25 to read as follows:

The movement of official calfhood vaccinates over 30 months of age from otherwise clean herds is permitted, when those official calfhood vaccinates do not react to over 1 to 50. Provided the animal has three successive tests not less than 30 days apart without a rise in titre.
DISCUSSION OF THE REPORT OF THE COMMITTEE ON BRUCELLOSIS

PRESIDENT R. L. WEST: Thank you, Dr. Driver. This report will be referred to the Executive Committee. Is there any discussion of this report? We will take time to discuss the report if anyone here has questions or remarks.

SECRETARY R. A. HENDERSHOTT: I listened to this report but I didn't have any opportunity to study it. The hour is late, and it occurs to me that last year we spoke about accepting reports of this nature when there might be some controversy. Why would it not be wise to have a copy of the report before us to study for a period of time?

It seems to me that a good many were in favor of laying a report of this nature over as far as the activation is concerned, for a period of one year, so that we might have an opportunity, during the course of that year, to study the changes proposed. I don't feel I have had an opportunity nor am I competent, after hearing it once, to pass judgment on it one way or another. Personally, I would like to have an opportunity to study it for a while before I know whether I want to vote for it or not. I do think sometimes that we take reports of important disease projects of this nature, like reports on tuberculosis, and approve them rather rapidly without having an opportunity to thoroughly study them so as to know what the implications are, and what they contain, and then we find next year that we have made some errors in changing our procedures, and then we have to go back and rescind the action we have taken.

I don't know whether there is anything of a controversial nature in this report. One thing that caught my ear was permission in range and semi-range areas for animals to remain in the herd for three years. Were they vaccinates? I don't know what lies behind that. Also, the report says something about allowing animals vaccinated with Strain 19 to move out of herds with a 1 to 50 dilution reaction. We keep our suspect reactors at home, and an animal with a 1 to 50 reaction is a suspect in our State.

I think when you are vaccinating calves you have to expect and anticipate that you are going to have some of these animals. We don't want any more than we have. I certainly would not be encouraged to take animals, in interstate movement, with a history of calfhood vaccination exhibiting a 1 to 50 dilution reaction—I don't care where they come from.

If possible, I would like to be able to study this report a little and have some discussion on it before we accept it.

PRESIDENT R. L. WEST: Would you like to answer that, Dr. Driver?

DR. F. C. DRIVER: Mr. President, as you noticed in this report, it gives the people from our range states an opportunity to engage in an area brucellosis control and eradication program. I think if you consider this very seriously you should accept it, even though it isn't entirely what you may want. We want these western people to have an opportunity to do area work. This gives them that opportunity. It may not meet what you would like in every respect. We studied this matter very carefully. I believe a great majority of our Committee finally settled on that.

In all seriousness, when you start fooling with this thing and further discourage
the western people, you had better take that into consideration. Give them an opportunity to get started.

As far as holding reactors not in excess of three years is concerned, that does not apply to the western country any more than it does to us. We have that problem in our own State. In fact, I am the one who initiated it. It is very important to us, because we have people who will hold one cow, and I know of some now who have held cows since 1948. We are supposed to hold them only temporarily. We have to have some kind of regulation or something else to get those few people taken care of so that the cattle will have to move in a given length of time, in area states as well as other states.

We worked for two nights and very late last night on this report. We didn't have uniformity, I'll tell you. This was discussed pro and con. We really have had a time making up this report. I know there are differences of opinion, but maybe when you come to a final conclusion you will be about like us. You will finally pass it, although I don't know. Let's be careful about these western people, and let's give them a chance.

Dr. H. A. Milo: I thought I followed the report closely. I am wondering if I missed any change in the certification of the re-certification period—in other words, reverting back to the three-year certification that we had previously; then we adopted the two-year certification period. Has that been considered?

Dr. F. C. Driver: Yes, it has been considered, and has not been changed, except in the western range and semi-range areas. That applies only to them.
REPORT ON FEDERAL-STATE COOPERATIVE TUBERCULOSIS ERADICATION PROJECT

A. K. KUTTLER, D.V.M.¹

Research, though limited, is still being carried on in connection with bovine tuberculosis. Dr. Howard W. Johnson, who is assistant in charge of the Pathological Division of the Bureau of Animal Industry, has conducted experiments on the use of tuberculin intradermically in the cervical area and published information which will aid greatly in completing this important project. In 1950 a report on studies of tuberculin was made to this association by Doctor Johnson in collaboration with B. C. Swindle, L. A. Baisden, and R. R. Henley. In this experiment 60 cattle which had reacted to tuberculin injected in the caudal fold were studied. After repeated tests it was demonstrated that tuberculin used in the cervical area in known infected herds offers certain advantages over other methods.

The Association has adopted the use of tuberculin in the cervical area in known infected herds, and instructions have been issued accordingly to all Bureau of Animal Industry stations. This method has been used in 18 states. We regret that it will not be possible to tabulate information supplied from the states where tuberculin has been used in the cervical area; however, in each of the states where such tests have been made, lesion reactors have been disclosed which failed to react to injections in the caudal fold area. Excerpts from some of the reports follow:

"The cervical test disclosed reactors which would have been missed in the herd had the caudal and vulva tests been used alone."

"We are convinced that the cervical area is superior to the other sites for the following reasons: (a) reactions more pronounced; (b) owing to the more sensitive area, restraint of animals is imperative, consequently a more perfect injection is possible; (c) owner reactions more favorable; (d) the more sanitary field and technique has its advantages; and (3) this test may be used immediately following disclosure of infection."

"The records I have kept show that of the 22 reactors to the cervical test 17 showed lesions on postmortem examination and five reactors showed no visible lesions. Of the 17 that showed lesions, two did not react to either the caudal fold or vulva test, and 15 reacted to all three tests."

"As anticipated, the percentage of reactors showing no visible lesions is increased with the cervical test; however, we have also removed generalized cases that failed to show on the caudal test."

"So far, we have not failed in cleaning up a herd in a very limited time by the use of the cervical test and removing all reactors to the test."

"Before the cervical test was brought to our attention in 1947, I failed on several occasions to get reactions where the site of injection was the caudal fold and vulva. Sixty days later when the cervical injection was made in conjunction with the

¹ In charge of the Brucellosis and Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture.
caudal fold and vulva, reactions were observed in the cervical location while no reactions were present at the other sites. It is interesting to note that all five of the animals reacting to the cervical test only were generalized cases. Personally, I think the cervical test is our only means of identifying some of the generalized cases that failed to react to caudal fold and vulva injections. I do think, however, that the cervical test should be limited to herds that have a history of harboring tuberculous animals as proved by post-mortem inspection."

In a number of states, known tuberculous herds are not retested at proper intervals. There is no need to wait 60 to 90 days for retests when tuberculin is applied in the cervical area.

There is attached a tabulated report concerning present laws in the different states. You will note there are four which do not have laws authorizing state officials to require the test. In four states laws authorize quarantine of reactors only. In 29 states reaccreditation is done on a percentage basis. In 18 testing of all cattle in a given area instead of spot-testing is done. In approximately half of the states it is considered more difficult now to persuade owners to submit their herds to the test than when the project was begun.

Even at this late date laws should be improved where necessary so as to make it possible to complete this project at the earliest possible time. It has been suggested that the Council of State Governments, which is made up of legal representatives from each of the states, consider a uniform law which will assist in correcting problems still existing in some states.

For several years it has been the practice to require laboratory confirmation of infection for range cattle classed as tuberculous on postmortem meat inspection, before requiring the owner to present his herd for the test. This practice has been broadened to include dairy cattle in some states.

Most of you will recall the report made to the Association last year by Dr. C. L. Davis, in charge of the branch pathological laboratory of the Bureau of Animal Industry at Denver, Colo., in which he pointed out that almost half of the untested animals classed as tuberculous on regular postmortem inspection at federally inspected slaughtering establishments were actually not tuberculous. We know that approximately the same percentage of cattle classed as tuberculous as a result of the tuberculin test show no visible lesions when slaughtered. Our conclusions as a result of this information can prove helpful or detrimental, depending upon how we look at it and what we do about it. We can conclude, as too many have already done, that bovine tuberculosis has been eradicated and that we should turn our energies to other fields, or we can appreciate that almost 1,000 cattle were condemned on federal postmortem meat inspection last year as unfit for human consumption as a result of having generalized tuberculosis. This number of advanced cases could soon bring disaster to us if we fail to prosecute bovine tuberculosis eradication even more diligently than in the past, since it is reasonable to believe cattle in this country are more susceptible now than when the infection was more widespread.

We shall merit the acclaim for having eradicated bovine tuberculosis only when all suspicious lesions of tuberculosis at the abattoir or those cattle which show evidence of infection as a result of the tuberculin test are non-tuberculous. Rather
than assume a complaisant attitude, let us appreciate that more than half of the suspected tuberculous lesions at postmortem and those found as a result of the test are actually tuberculous.

A great deal of credit must be given to the Meat Inspection Division of the Bureau of Animal Industry for the assistance they have always rendered in locating centers of infection. During the past year almost as many infected herds were discovered in this way as were found by the tuberculin test. Meat Inspection has continued to improve its service along this line. The greatest obstacle in supplying information so that we may go back to the farm or ranch of origin is the fact that in many sections livestock are not so marked that they can be traced from slaughtering establishments to the point of origin. In those areas where regular testing and ear-tagging of all dairy cattle is practiced, and in practically all of the range areas, cattle are so marked that in most instances they can readily be traced to the farm or ranch of origin. In those areas where branding or regular ear-tagging is practiced, better protection is afforded from theft, and when we add to this advantage the assistance to be realized in the control and eradication of all livestock diseases, I believe we will soon appreciate the value of permanently marking all cattle before or at the time they leave the farm and provide suitable penalties for removing or effacing such marks. It is encouraging to note that at the last meeting of the secretaries, directors, and commissioners of agriculture they placed the marking of cattle and interstate movements by trucks on their agenda for study during the coming year.

Work is still in progress on the film strip showing the technique of tuberculin injections and typical reactions. It is felt this will be of value, particularly among the younger veterinarians who have not had the advantage of clinical tuberculosis such as was available near most of the veterinary colleges a few years ago.

There were 9,164,265 cattle tuberculin tested during the last fiscal year, which is more than have been tested for any year since 1943, with 0.11 per cent reactors, which is the lowest of record. Statistical tables for both brucellosis and tuberculosis have been prepared by the Bureau as usual and are available for all who would like to have them.

Due to personnel shortage and other difficulties, the avian-swine tuberculosis project which has been carried on for a number of years in the Corn Belt states has been curtailed to a considerable extent. It is generally agreed that we cannot test poultry and swine such as has been done and is being done with cattle, and that education is our best approach to the eradication of tuberculosis in these species. A motion picture on avian and swine tuberculosis is now being made which we hope will be of educational interest equal to the film, "The Triple Threat of Brucellosis." Dr. C. K. Mingle, who was technical advisor for "The Triple Threat," is also in charge of the technical aspects of the avian-swine tuberculosis film.

It has only recently been recognized that well-marked lesions of tuberculosis in cattle in this country may result from infection with the avian type of the disease. With this information before us, we can recognize a great need for continuing the campaign to eliminate avian and swine tuberculosis. Our most effective means of eradicating the disease in these animals is to continue to stress the marketing of poultry for slaughter after one laying year, which is also of considerable value in
controlling other diseases of poultry, and it has been demonstrated that a hen produces up to 30 per cent more eggs during the first year than in later laying years. In the case of breeding flocks, annual tuberculin testing should be practiced, with removal of all infected birds and thorough cleaning and disinfecting of premises.

SUMMARY

Tuberculosis in cattle has been reduced to the point that only one affected animal is now found in approximately 1,000 cattle tested. The goal of completing this project, which has meant so much from the standpoint of a more abundant and wholesome food supply, is in sight. However, attention is directed to the fact that even with the low percentage of affected animals, there were almost 1,000 carcasses condemned on federal meat inspection last year as unfit for human consumption. The fight to eliminate this dread disease, which can be transmitted from cattle to man, must not be eased until the job has been completed.

Studies are continually being made to improve methods of detecting the remaining infected herds. One valuable source of information is available through federal meat inspection. The greatest handicap to this method is failure on the part of owners of livestock to mark their animals at or before the time they are marketed so that they can readily be traced from the slaughtering establishment back to the farm or ranch of origin.

Tuberculosis is also a serious problem in poultry and swine in some areas. Nearly all affected swine have the avian type of the disease, and its eradication in poultry will solve the problem for both species. The disease can best be eliminated in poultry by the retention of hens for only one laying year, or, in the case of breeding flocks, by testing all birds, disposing of all reactors for slaughter, and maintaining good sanitation.
TUBERCULOSIS CONDEMNATIONS

Dr. J. R. Pickard¹

Chicago, Illinois

The subject of tuberculosis is one of the oldest on your program. While it does not occupy the spotlight that some of the current diseases now hold, its potential danger warrants continued effort.

The campaign against tuberculosis is an unparalleled conquest by the veterinary profession and the livestock industry. This presentation provides an opportunity not only to review the status of the disease, but points out the need for a renewed campaign, particularly in avian tuberculosis.

The biggest deterrent to the important work which still needs to be done on tuberculosis eradication is an attitude of indifference or apathy. So much publicity has been given to the practical elimination of bovine tuberculosis that it has resulted in a complacent feeling among many individuals. Many are inclined to feel that we have met the stage of irreducible minimum in the eradication of this disease.

In this presentation we would like to emphasize two points—the need of (1) an improved method of animal identification at time of slaughter, and (2) an intensified educational campaign to reduce swine condemnations by focusing more attention upon avian tuberculosis.

Chart §1 shows swine and cattle carcass retentions for tuberculosis from 1921 through 1952. In 1921, when the eradication program was launched, one out of eight hogs, or 12.4 per cent were retained. The peak of retentions at 15.2 per cent was reached in 1924 and since that date there has been a gradual decline through the years with an average of 4.4 per cent retained for 1952.

The second line represents the cattle retentions with 1.62 per cent or one out of 60 retained in 1921. The downward trend of this line to 0.026 per cent in 1952 is testimony to those of you—federal and state officials, veterinarians, health associations and allied groups—who are deserving of great credit for this successful campaign.

In passing, it might be pointed out that these lines indicate apparently no degree of parallelism between the incidence and eradication of tuberculosis in cattle and swine. While the hog is susceptible to all three types of tuberculosis, it has been established by research and the condemnation studies at slaughtering establishments that the majority of tubercular hogs are of the avian strain.

While the percentage of cattle carcass retentions—0.026 in 1952—gives us reason to be proud, certain words of caution should be uttered. This successful campaign resulting in such a low percentage of reactors should not be allowed to foster an attitude of complacency or indifference that is apparent with so many individuals and groups. The job will not be finished until complete eradication has been reached. This is evidenced by the soundness of the recommendations of the Committee on Tuberculosis.

¹ General Manager, Livestock Conservation, Inc.
Data compiled by the Meat Inspection Service shows 400 non-reactor cattle condemned for tuberculosis in the fiscal year ending last June 30th. Their records reveal 15 condemnations in Chicago area. Knowing that Drs. Kuttler, Seher and Mau have long advocated a better system of cattle identification, we inquired from Dr. O. W. Seher, Inspector in Charge, Meat Inspection Division, Chicago, Ill., how successful they were in tracing the ownership of these dangerous spreaders. He replied that they were successful in less than 50 per cent of the cases. On this basis, some eight unidentified herds in the Chicago area may be the seedbed for spreading the disease.

A TE 35 form is used for reporting slaughtered animals infected with tuberculosis. Here is an actual case that proves the need of proper animal identification. The information on this TE 35 form reads that the hide was removed before the lesions were found. The animal was a dairy cow eight to 10 years old, with extensive lesions. She was one of 78 cows in the lot representing purchases through 10 commission firms. An attempt to establish identity and trace ownership was without results.

Case #2 was a Hereford bull from a mixed lot of six bulls purchased from one of four commission firms. While there were no ear tags nor brand on the hide, Dr O. W. Seher and the bureau veterinarian in an adjacent state established identity. Results: 164 cattle tested; 155 were clean and nine reacted.
Case #3 was a Holstein cow bearing an Illinois ear tag which provided easy identification. Investigation of the herd revealed five reactors out of 14.

The proper identification of animals, that is, dairy cows and breeding bulls at the time of marketing would drastically reduce the cost of tuberculosis eradication. It would be an important adjunct or supplement to our field testing program.

Chart #2 shows percentage of swine carcasses retained for tuberculosis in various cities under federal meat inspection for the years 1922, 1932, 1942 and 1952. Some of the states with the highest percentage of infection showed a 40 per cent drop in retentions between 1922 and 1932, and a 30 per cent or more for the next 10-year period.

While this graph clearly illustrates progress in the downward trend of hog retentions, the current average retention is too high for any praise.

The next Chart #3 indicates at a glance that the incidence of hog tuberculosis is primarily a problem of the northcentral states. The difference in percentages among the states indicates a need for some states to give more attention to the problem. This percentage runs from one out of 12 hogs in the more acute areas to one out of 190 in Georgia. Unless a more vigorous eradication campaign is formulated by many of the states, increased condemnation loss in hogs due to tuberculosis will result.

Chart #4—Avian tuberculosis survey by veterinarians assigned to area projects in the states indicated for a one year period ending June, 1951.
Avian tuberculosis is primarily a disease of the older birds. In 119 pullet flocks tested, 14 per cent were infected, whereas 57 per cent of the hens were positive in 95 flocks tested. This table substantiates the importance of disposing of old hens, the maintenance of all-pullet flocks, and not permitting swine and chickens together.

In summarizing, progress can be made in bovine tuberculosis eradication by better systems of identifying emaciated cows and breeding bulls of all breeds. The tremendous annual monetary loss which continues to result from swine condemnations due to avian type of tubercle bacilli warrants more educational effort in eliminating avian tuberculosis.

**CHART 3**

*Excessive of reactors which were condemned or passed for cooking for tuberculosis.*

(Data: BAI - USDA)
AVIAN TUBERCULOSIS SURVEY
by Veterinarians Assigned to Area Projects

Data: BAI-USDA
July '50 - June '51

<table>
<thead>
<tr>
<th>Flocks tested</th>
<th>Pullets</th>
<th>Hens</th>
<th>Mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean flocks</td>
<td>119</td>
<td>95</td>
<td>218</td>
</tr>
<tr>
<td>p.c. Clean</td>
<td>103</td>
<td>41</td>
<td>127</td>
</tr>
</tbody>
</table>

Infected flocks | 16. | 54. | 91. |

p.c. Infected   | 14. | 57. | 42. |

REPORT OF COMMITTEE ON TUBERCULOSIS

JAMES W. CROUSE, Trenton, New Jersey, Chairman; L. L. BRECK, Frankfort, Kentucky; F. G. BUZZELL, Augusta, Maine; JOHN CANTY, Montpelier, Vermont; J. I. CURTIS, Salt Lake City, Utah; WARREN B. EARL, Reno, Nevada; ORLAN HALL, Ottawa, Ontario, Canada; I. G. HOWE, Albany, New York; H. W. JOHN- son, Beltsville, Maryland; A. G. PICKETT, Topeka, Kansas; F. L. SCHNEIDER, Albuquerque, New Mexico; ASA WINTERS, Washington, D. C.

PART I

Individual Accredited Herd Plan

1. (a) A tuberculosis-free accredited herd is one in which no reactors have been found on at least two annual tuberculin tests and physical examinations. Herds in which infection occurs shall be quarantined and must successfully pass at least two tuberculin tests and physical examinations—with the first to be given within 60 days, and the last between five and six months following the date infection was disclosed, in order to be released from quarantine. To qualify for accreditation or re-accredited the herd must pass another, or third test in not less than six months following release from quarantine. Such physical examinations and tuberculin tests shall be applied by a veterinarian regularly employed by the State or Federal Bureau of Animal Industry, or by an accredited veterinarian under the supervision of a veterinarian regularly employed by the State or Federal Bureau of Animal Industry.

(b) A herd with no evidence of recent infection in which reactors are disclosed as a result of the tuberculin test may be reaccredited following a 60 day negative retest if no visible lesions or skin lesions only are disclosed on post-mortem examination of the reactors found.

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

(1) The accredited veterinarian shall not conduct such tests until he has received written authorization from the proper cooperating State or Bureau officials.

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

2. (a) The official tuberculin test shall be the intradermic or the subcutaneous test. The intradermic injection shall be a measured amount of tuberculin, not less than 0.1 cc for routine testing—nor less than 0.2 cc for testing known infected herds, when intradermic injections are made in the caudal or cervical areas. The intradermic injection of tuberculin in the cervical area shall be made only in infected herds, and then only upon approval by State and Federal cooperating officials.

(b) State and Federal authorities may require that any herd in which infection has been found shall not become accredited unless the final or accrediting test has been made by a combination of tests listed under Paragraph (a) above.
(c) The veterinarian who applies the tuberculin test shall inform all cattle owners concerning tuberculosis of other domestic animals, including poultry and swine. Owners or caretakers shall also be informed of the possibility of cattle becoming sensitized as a result of exposure to people affected with tuberculosis.

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

4. No animal that has been designated as a reactor at any time shall be presented for retest.

5. Reactors to the tuberculin test shall be promptly removed from the farm and after their removal the infected premises shall be thoroughly cleaned and disinfected with a disinfectant approved by the United States Bureau of Animal Industry, and in a manner satisfactory to the cooperating State and Federal authorities. Full information is desired with respect to every factor that might have a bearing on the appearance of infection in the herd, such as: Past history of herd; water supply; light; ventilation; sanitation; management; manner of making additions to the herd (source, isolation pending retest, and retests); disposal of waste products; human infection; avian infection; Johne's disease, etc.

6. Herd owners are required to house, feed, and care for their cattle under such sanitary conditions as will tend to promote good health, and to follow such recommendations as are made by the cooperating State or Federal authorities.

7. Calves in accredited herds shall not be fed milk or other dairy products from other herds not fully accredited, or from unknown sources, unless such materials have been properly pasteurized.

8. (a) The herd owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the grade animal to be marked by a tag or other means satisfactory to the cooperating State and Federal authorities.

(b) Each herd owner is required to keep a record of all additions.

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

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

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

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

PART II

Modified Accredited Area Plan

13. The provisions of the individual accredited herd plan that relate to testing, removal of reactors, cleaning, disinfecting and sanitation shall apply to the modified accredited area plan. All infected herds shall be quarantined and tested as provided in paragraph 1.

14. Modified accredited areas that disclosed on the last test of all cattle (except as hereinafter provided in paragraph 19) not more than 0.2 per cent infection may be
reaccredited for a period of six years if a retest of ten or more per cent of the cattle in the said area discloses a degree of infection not exceeding 0.2 per cent, provided that in calculating the degree of infection all post-mortem meat inspection reports of tuberculosis and otherwise disclosed cases of tuberculosis accumulated in said area since the last test are included, and provided further that adequate State laws and regulations permitting effective quarantine and testing of infected herds as provided in paragraph 1 are enforced.

15. Modified accredited areas that disclosed on the last test of all cattle (except as hereinafter provided in paragraph 19) more than 0.2 per cent infection may be reaccredited for a period of six years if a retest of all cattle (except as hereinafter provided in paragraph 19) in said area discloses a degree of infection not exceeding 0.2 per cent, provided that in calculating the degree of infection all post-mortem meat inspection reports of tuberculosis or otherwise disclosed cases of tuberculosis accumulated in said area since the last accreditation test are included, and provided further than adequate State laws and regulations permitting effective quarantine and testing of all infected herds as provided in paragraph 1 are enforced.

16. Modified accredited areas that disclosed on the last test of all cattle (except as hereinafter provided in paragraph 19) more than 0.2 per cent infection may be reaccredited for a period of three years if a retest of twenty or more per cent of the cattle (except as hereinafter provided in paragraph 19) in said area discloses a degree of infection not exceeding 0.5 per cent, provided that in calculating the degree of infection all post-mortem meat inspection reports of tuberculosis or otherwise disclosed cases of tuberculosis accumulated in said area since the last accreditation test are included, and provided further that adequate State laws and regulations permitting effective quarantine and testing of all infected herds as provided in paragraph 1 are enforced.

17. If the retest of an area as provided for under either paragraph 14 or 15 discloses a degree of infection of more than 0.2 per cent but not more than 0.5 per cent the area may be reaccredited for a period of three years. Infected herds shall be quarantined and retested as provided in paragraph 1.

18. If the retest of an area as provided for under either paragraph 14, 15 or 16 discloses more than 0.5 per cent infection, accreditation shall be suspended until all cattle (except as hereinafter provided in paragraph 19) in the area have been retested, and the degree of infection reduced to not more than 0.5 per cent. Infected herds shall be quarantined and retested as provided in paragraph 1.

19. A county or area may be remodeled in the range or semi-range region upon compliance with paragraph (a) or (b) and other provisions in this section.

(a) When not less than ten per cent of the bulls, purebred breeding cattle, milk cows, and semi-range breeding females, with such other cattle as may be considered necessary by the State and Federal cooperating officials are tuberculin tested.

(b) When not less than ten per cent of the bulls, purebred breeding cattle, milk cows, barnyard cows, and home fed cattle are tuberculin tested, or properly identi-

It is not intended that reaccreditation tests as provided under paragraphs 14, 15, 16 should interfere with more frequent tests when State and Federal cooperating officials consider such additional testing necessary.
fied, 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 post-mortem reports, etc., including post-mortem inspection at packing plants of those branded cattle that are sold direct from the range for immediate slaughter, then all the cattle in that herd or associated with the diseased animal shall be immediately tuberculin tested in accordance with the provisions of the modified accredited area plan. The area may then be remodeled for a period of six years, if the total number of reactors and cattle found tuberculous upon post-mortem examination from the area is not more than 0.2 per cent of all the cattle tested in the area. 3

20. The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper livestock sanitary official of the State of destination.

21. Reactors found in herds where no visible lesions or skin lesions only are found, and where there is no history or other evidence of infection, will not be counted in determining the percentage of infection, as provided in Sections 13 to 19 inclusive, and may also be discounted in computing the area rate of infection used as the basis for testing requirements under paragraphs 14, 15 and 16. No visible lesion reactors will be counted when found in herds where any lesion reactors are found, or in herds where lesions of tuberculosis have been found on post-mortem meat inspection reports.

Your Committee is pleased to report that the records covering tuberculin testing for the past year show a further substantial reduction in the per cent of reacting animals.

We are concerned, however, with the number of herds still being disclosed both through testing and from meat inspection reports, as remaining foci of infection, and feel that it will be extremely difficult in many areas to expand testing sufficiently to, alone, provide for the complete eradication of this disease.

Your Committee recognizes the service being given by the Meat Inspection Division of the Bureau, and others, as a most valuable aid in accomplishing this goal; but the records show that better methods must be devised for the identification of animals consigned for slaughter if this service is to operate effectively.

It is recommended that careful study be given by this Association to the question of providing for such identification of animals moving for slaughter as will permit effective tracing to herds of origin. It is further recommended that legislation, where necessary, should be considered by each State in this endeavor.

The Committee recognizes the value of laboratory confirmation of tuberculous lesions as now provided in some areas, and recommends extension of this service where possible.

* These paragraphs were inadvertently omitted from the recommendations presented at Louisville, however, these particular paragraphs were not changed from the 1951 recommendations,
FOOT-AND-MOUTH DISEASE SASKATCHEWAN, CANADA

T. Childs, V.S., D.V.M.¹

Foot-and-mouth disease is a major disease of animals in most countries of the world. During the past year it has reached pandemic proportions in almost all European countries. In Holland, Belgium, France, and Western Germany, outbreaks have been counted by the tens and scores of thousands. In the light of such conditions, considered in conjunction with the great number of immigrants and visitors coming to Canada from those countries during the past year, many arriving by air transport within 24 hours after leaving their homelands, obviously, it is next to impossible to place effective barriers against the introduction of this disease on all avenues by which it may be introduced.

I believe you are all aware that we have now and have had for many years, effective barriers to introduction of the causative agent of this disease by the usual paths of transmission; that is, by diseased animals, contaminated meats and meat products and raw products of the soil. However, there are many other ways by which the virus may be introduced either innocently or maliciously. For instance; European immigrants have a predilection for bringing into Canada, often hidden in personal effects, meats and meat products in the raw or semi-raw state; such meats and meat products coming from an infected area, are decidedly dangerous. During the past year, and previously, our officers have discovered and confiscated many items of that nature—hidden in the interior of cushions or pillows, at the bottom of trunks holding personal effects, etc. There is also danger of the virus being carried on clothing and other personal effects, if the time between leaving infected premises and coming in contact with susceptible animals is short and the weather cold. Most immigrants are vaccinated against smallpox shortly before leaving their homelands. If from infected areas and the calf lymph used for the vaccination is contaminated, that vaccinate might be decidedly dangerous as a carrier.

To lessen the possibility of the virus being brought in on contaminated clothing and personal effects, since last March, all immigrants coming from countries where the disease is prevalent, are required to have clothing and personal effects disinfected before leaving their homelands. Parcels arriving by mail or otherwise, for such immigrants are subject to opening and examination of contents which, if of a dubious nature, are held for examination by a departmental veterinarian.

In considering the nature of the foot-and-mouth disease virus, such as its ability to retain its infectiousness for comparatively long periods of time outside the natural host, particularly in low temperatures and favourable hydrogen ion concentration, oxidation reduction potential, moisture, etc., together with opportunities for transmission afforded by massive movements of people from infected countries to Canada by the modern rapid means of transportation, it is not surprising the disease should eventually appear in Canada, in spite of the very efficient safeguards interposed against its introduction by the Health of Animals Branch, which has kept Canada

¹ Veterinary Director General, Ottawa, Ont., Canada.
free of this plague heretofore. Neither should anyone be surprised if, in spite of all these precautions, the disease again finds its way into Canada. In this connection, the possibility of the disease being again introduced into Canada by immigrants, regular trade channels, or by other means, has caused me much greater concern during the past five or six months than the possibility of the infection escaping from the areas formerly under quarantine in Saskatchewan.

As this paper is merely intended to furnish historical data, including an outline of methods and procedures followed in the successful containment of the Saskatchewan outbreak and its eradication, I am omitting a description of species susceptibility, symptomatology, course, sequelae, and other details. It is sufficient here to indicate the cause of foot-and-mouth disease is a virus, said to be 8 to 12 millimicrons in size.

There are reported to be six distinct immunologic types, three of which are known as A, O, and C, in the English speaking world. There are reported to be numerous sub-types or variants of these. In addition, there are three recently identified African types. Type A was identified by the Departmental laboratory as being responsible for the Saskatchewan outbreak, history of which, and procedures followed in dealing with same are here presented.

Prolonged and searching investigation as to the manner and means by which foot-and-mouth disease was introduced into Saskatchewan, indicates the virus was brought in either innocently or maliciously by an immigrant from Western Germany. This man, Willi Bruentzen, classed as a dairy helper and truck driver, left an infected farm in Western Germany on October 15, 1951, reached Regina, Saskatchewan, November 2. The afternoon of the same day, just 17 days after leaving infected premises in Western Germany, he reached the premises of Mr. L. T. Wass located some 30-odd miles northeast of Regina, being placed there by the immigration authorities as a farmhand or dairy helper. Livestock on the L. T. Wass premises at that time consisted of 38 dairy type cattle, a few swine, and a couple of horses.

Willi Bruentzen apparently was not satisfied with employment on the Wass farm. In any event, after observing and in some measure assisting with the work in connection with the cattle for a period of two days, he left this employment on the morning of November 5, proceeding by Provincial Service bus, from the village of McLean, Saskatchewan, which is a few miles distant from the L. T. Wass premises, to Winnipeg, Manitoba; thence to Pine Falls, Manitoba; thence after a few days' work in the woods at that point, to Port Arthur, Ontario. He was finally picked up during the month of March, at Vancouver, British Columbia. He was brought from Vancouver to Ottawa, questioned; clothing, person, and personal effects examined at the Animal Diseases Research Institute, Hull, P. Q., in an attempt to find virus. Results were negative, so, Willi Bruentzen was returned to Vancouver.

Although the vesicular disease affecting the L. T. Wass cattle was reported as of December 2, 1951, and diagnosed as vesicular stomatitis, quarantine imposed as of December 3, and animal differentiation tests commenced, the information concerning Willi Bruentzen was not uncovered at that time; neither was other very important information. It was not until February 18, 1952, when the disease had been recognized by Doctor Christie and me as foot-and-mouth disease, and the origin of infection sought, that intensive and very searching investigation brought to light
the information concerning Willi Bruentzen and other information almost equally important. On this date, February 18, 1952, at my request, the Royal Canadian Mounted Police commenced the search for Bruentzen. I am not entirely satisfied that Bruentzen is as innocent as would appear from the investigation made. It has been reported that on his arrival at Regina, he claimed to lack funds to pay his bus fare to place of employment, however, when he purchased his bus ticket from MacLean, Saskatchewan, to Winnipeg, Manitoba, some two or three days later, he was reported by the bus ticket vendor to be in possession of a sizable roll of currency. It is understood he received no money from Wass for his brief period of employment. His peregrinations after leaving the Wass premises appear to be somewhat unusual for a newly arrived immigrant. Certainly Willi Bruentzen is a gadabout. He would appear to be a prevaricator also.

From information now available, some of which was unearthed only recently, it would appear that Mr. L. T. Wass noticed his swine to be sick “about seven days before the cattle were seen to be sick”. However, he had stated they appeared to be but mildly sick, and very soon recovered, so he did not think their sickness could be associated with that of the cattle. However, on November 26, 1951, finding his cattle off feed and salivating, he called a local veterinary practitioner who, being ill, prescribed treatment according to symptoms described by Wass over the telephone. Treatment was in the form of a drench, believed to be epsom salts, intended to correct the supposed digestive trouble. Two neighbors assisted in medicating the cattle.

On November 30, 1951, his cattle not having shown the expected improvement, Mr. Wass telephoned the Provincial veterinarian at Regina. He, in turn, advised a local veterinary practitioner who visited the Wass premises on the night of December 1. Diagnosis was deferred and the condition reported to the Health of Animals Division veterinarians at Regina, Saskatchewan, two of whom accompanied the veterinary practitioner to the Wass premises on December 2. The condition was diagnosed as vesicular stomatitis, a condition with which both Divisional veterinarians were familiar.

The condition was reported by telegram to the Veterinary Director General, who issued instructions to quarantine the herd, keep it under observation, and inoculate horses by the tongue scarification method, with material secured from the lesions found in the cattle. This was done and results reported as negative, the inoculated horses being reported as showing lesions indicative of vesicular stomatitis. The disease apparently was very mild at this stage, no foot lesions being noticeable, nor other complications among these cattle; recovery apparently being quite rapid and complete. Quarantine was terminated as of December 8. No indication was found of disease in other herds in the vicinity at this time.

About December 10 or 12, cattle owned by the two neighbors who assisted in medicating the Wass cattle, were noticed to be off feed and showing evidence of salivation. Symptoms apparently quite mild, feet apparently not affected. These herds were placed under quarantine and observation, horses were inoculated with the same results as were obtained on the Wass premises. The condition seemed to clear up quite rapidly, recovery appeared to be complete, with very little physical deterioration. Quarantine was terminated a short time later.
December 18, a similar condition was noted among cattle in a feed lot on the premises of a packing plant in Regina. Symptoms apparently quite mild; no noticeable foot involvement. The affected animals were isolated and quarantined; they appeared to recover quite rapidly without serious loss of condition. When all symptoms had disappeared, with temperature and physical condition apparently normal, the animals were passed for slaughter. Postmortem examination revealed healed scars on tongues and oral mucous membranes, but apparently not more serious than could be expected following recovery from vesicular stomatitis. A few other similar cases were reported about this time, just outside and to the northwest of Regina. In these cases the condition was also described as mild, no noticeable foot lesions and quite rapid recovery. Nevertheless all herds in which the condition was found were promptly placed under quarantine and observation. It would appear that from the manner in which the disease manifested itself among the first herds infected, the virus must have been introduced in an attenuated form, as, animals infected later did exhibit a well marked malaise and well marked lesions— including foot involvement and quite severe lameness. Apparently after a few passages through susceptible animals, the virus recovered its normal destructiveness.

During the month of January 1952, the disease seemed to be abating or disappearing. No new cases were reported between January 4 and the last few days of that month. However, during the last few days of January, and during the early part of February, a number of new cases appeared on premises northwest of Regina. These outbreaks assumed a more serious form than previous cases. Definitely serious vesicular lesions were found, associated with well-marked malaise, serious loss of condition, with foot and udder involvement. At this time swine were noted to be involved.

The apparent worsening of the situation was reported by telegram or telephone to Ottawa. Meanwhile, being fairly sure we were dealing with a comparatively innocuous vesicular condition, I had decided to use up some of my long overdue statutory leave; accordingly, I commenced what was planned as one week’s statutory leave as from February 11 to 16, inclusive. However, on February 12, Dr. E. E. Carlson, Assistant District Veterinarian, Regina, Saskatchewan, communicated by telegram or telephone with Dr. O. Hall, who was in charge during my absence, indicating the situation appeared to be really serious, and requested assistance to verify or refute his suspicious. Doctor Hall immediately called me by telephone and advised me of Doctor Carlson’s message. I, in turn, suggested that Dr. C. A. Mitchell be asked to send one of his pathologists to Regina to conduct animal differentiation tests, and, if thought necessary, to secure and bring material to the Animal Diseases Research Institute, at Hull, P. Q., for laboratory examination. Doctor Mitchell was unable to spare a pathologist for the trip to Regina at this time, and suggested that material be collected and sent forward to the laboratory by (presumably) air express.

Dr. O. Hall directed Doctor Carlson to follow the procedure advised by Doctor Mitchell. Accordingly, material was collected by Doctor Carlson on February 13 and 14 and sent forward by air express on the evening of February 14. Learning of this procedure, on February 14, and fearing that in the remote possibility we actually were dealing with foot-and-mouth disease, our officers at Regina, and
perhaps the laboratory staff, would not appreciate the dangers of handling such material, and make an error of some sort that would allow the virus to escape, with disastrous consequences to the livestock industry of Eastern Canada, the danger of entrusting such possibly dangerous material to mail or express transportation was also considered. Accordingly, with the idea of avoiding such dangers, I sent a telegram to Dr. N. D. Christie, District Veterinarian, Regina, countermanding Doctor Hall’s instructions to Doctor Carlson concerning collection and forwarding material for laboratory examination. That telegram was dictated to a C.N.R. telegraphist over the telephone, and, largely owing to the upsetting nature of the situation at that time, I neglected to file a record of that telegram. An attempt was made to exploit that fact in a manner detrimental to me, when no copy of the telegram referred to could be found in our files at Ottawa.

My countermanding telegram to Dr. N. D. Christie did not reach him in time to prevent collection and sending forward of material for laboratory examination. However, assuming the telegram would be received in time to prevent shipment of the material, immediately on sending the telegram, I made preparations to proceed to Regina by plane at the earliest moment, investigate the situation and personally conduct animal differentiation tests, and either personally secure and bring material to the Department laboratory for examination, or entrust the conveyance of such material to Dr. K. F. Wells, whom I decided should accompany me to Regina. Meanwhile, having telephoned Regina to apprise the District Veterinarian of my intentions I learned from Doctor Carlson that my telegram countermanding Doctor Hall’s instructions concerning collection and forwarding of material for laboratory examination, was not received until after the material had been sent forward. Nevertheless, I decided to carry through my plan to proceed to Regina immediately plane reservation could be arranged. The Deputy Minister and the Director, Production Service, were apprised of the situation and its potentialities by me, and arrangements were made for funds necessary to purchase animals for differentiation tests. I secured plane reservations for Dr. K. F. Wells and myself for the night of February 16, and we arrived in Regina on the morning of February 17.

First-hand appraisal of the situation, consultation with Drs. N. D. Christie and E. E. Carlson, together with their description of the lesions found, examination of same and study of pattern of spread, convinced me we were confronted with an outbreak of foot-and-mouth disease, although there was not as yet any indication as to how the disease had been introduced. Accordingly, in order that all possible precautions might be taken to prevent further spread while my diagnosis was being verified or refuted by animal differentiation and laboratory tests, at about 11:30 p.m. standard mountain time on February 17, I filed a telegram to Ottawa indicating we were confronted at Regina with an outbreak of a serious vesicular disease, and ordering the official quarantining of six rural municipalities, which I thought at that time would include all infected and suspected of being infected premises. Investigations made on February 18, made it advisable to quarantine an additional three rural municipalities, and further investigations made on February 19, with extreme difficulty on account of deep snow and blizzard conditions, necessitated the inclusion of an additional two rural municipalities in the quarantined area. Later on, two small secondary outbreaks necessitated the inclusion of an additional
ten rural municipalities within the quarantined area. When we finally had the outbreak correctly pin-pointed, we had 42 premises under close individual quarantine as infected or suspected of being infected. These, in turn, were within an area of close quarantine comprising 21 rural municipalities. This area of close quarantine was in turn surrounded by a buffer area of modified quarantine comprising 41 rural municipalities. This method of containment was 100 per cent successful, as the results obtained most definitely indicate.

On February 18, preparations were made to deal with the outbreak as foot-and-mouth disease as follows:

1. The situation was discussed with Provincial Department of Agriculture officials, who were advised regarding the seriousness of the outbreak, my diagnosis, and the steps already taken for containment. However, these officials were cautioned not to make any statements regarding the nature of the disease; that would be announced officially when all tests were completed.

2. Advised transportation companies and others concerned regarding the steps taken, quarantine requirements etc., for dealing with a dangerous disease of animals. Requested observance of these requirements.

3. Instructed Dr. R. H. Lay, District Veterinarian, Winnipeg, Manitoba, to quarantine all packing plant stockyards, public stockyards and feedlots in Manitoba. To prohibit movement of foot-and-mouth disease susceptible animals from the province, and permit movement of such animals within the province only for immediate slaughter.

4. Instruct Dr. N. D. Christie, District Veterinarian, Regina, Saskatchewan, to quarantine all packing plant stockyards, public stockyards and feedlots within Saskatchewan. To prohibit movement of foot-and-mouth disease susceptible animals from the province, and permit movement of such animals within the province only for immediate slaughter.

5. Advised Dr. B. T. Simms, Chief, Bureau of Animal Industry, Washington, D. C., by telephone, concerning the situation at Regina, indicating the presence of serious vesicular disease, and inviting him to send up a specialist on vesicular diseases for consultation, and for the purpose of supplying Dr. B. T. Simms with first-hand information regarding the situation. Dr. M. R. Shahan, Director, Foot-and-Mouth Disease Research, United States Bureau of Animal Industry, arrived in Regina, on February 21, having been delayed approximately two days enroute by weather conditions. He was immediately supplied with disease-free animals and all assistance necessary to conduct animal differentiation tests, which, as of February 23, verified my earlier diagnosis. Doctor Shahan came to Ottawa on February 24 and secured first-hand information concerning results of laboratory tests of material secured from infected animals at Regina, February 13 and 14. These tests also verified the earlier diagnosis. Doctor Shahan returned to Regina, February 26 and remained there for a period of ten days or two weeks, assisting and advising our officers in control and eradication work. He was replaced by Dr. F. J. Mulhern, foot-and-mouth disease eradication specialist, United States Bureau of Animal Industry, Washington, D. C., who remained at Regina and vicinity until about the middle of May. Their assistance and advice to our officers during that time was invaluable.
6. Arranged for expansion of Divisional office space, equipment and inter-office communications at Regina; summoned by wire, the first of Divisional veterinary reinforcements for duty at Regina. These were augmented later as rapidly as transportation facilities could be arranged.

7. Instructions sent out to all district veterinarians to trace and inspect all susceptible animals moved intra, or inter-provincially originating in the three Prairie Provinces during the period November 1, 1951, to February 18, 1952; the same procedure to apply to all shipments of meats from packing plants in Regina during the same period.

8. Packing plants in Regina placed under quarantine and all operations discontinued with the slaughter of the small amount of livestock on hand as of February 18. All district veterinarians, packing plant managements and veterinarians in charge of packing plants in Canada, alerted to the danger of any of the Regina packing plants’ employees being employed at other packing plants without thorough cleansing and disinfection of clothing, personal effects, etc.

9. Arrangements made to secure extra supplies of protective clothing for veterinarians and their assistants to be employed on control and eradication work; rubber boots, coats, gloves, hats, coveralls, etc. Supplies of disinfectants—sodium hydroxide, (lye) and sodium carbonate, with power equipment to handle same. The securing of a suitable building to set up a central disinfection station to take care of trucks and other vehicles leaving the quarantined area. Similar arrangements for taking care of milk and cream cans at receiving stations within the quarantined area, which included the City of Regina.

10. As radical measures of control and eradication with respect to foot-and-mouth disease are mandatory in Canada, we were faced with the problem of disposing of the carcasses of animals involved. This proved to be a difficult problem. The terrain in the Regina district is fairly level, with clay or “gumbo” subsoil to a great depth. This freezes during the winter to a depth of five or six feet. In the light of these conditions, the excavation of burial pits for slaughtered animals appeared to be an impossibility. The feasibility of various other methods of disposal was explored, such as, excavating by means of explosives, cremation of carcasses by using flamethrowers, or passing carcasses through cooking tanks in the infected packing plants. None of these methods proved feasible. The difficulty was finally solved by Dr. L. B. Thomson, Director, Prairie Farm Rehabilitation Association, who assembled extra heavy excavating equipment, and by applying much extra power, was able to break through the five or six feet of frozen clay. Burial pits were ready and the first animals slaughtered and buried on February 29.

11. Two young cattle and two young swine and a horse were secured from outside the infected area, placed in isolation under guard and injected with material harvested from infected animals for animal differential tests; time of injections being 6 p.m., February 18.

12. On February 18 all available veterinarians of the Division at Regina were set to work on intensive investigations throughout the district to ascertain, if possible, the extent of the infection. This investigatory work, carried on under very bitter weather conditions and over almost impassable roads, indicated the infection had been spread further afield than was first thought. This necessitated the inclusion
of an additional two rural municipalities within the area of close quarantine, bringing the total number at that time to 11. Later on, to deal with the small secondary outbreaks at Ormiston and Weyburn, it was necessary to place an additional ten rural municipalities under close quarantine, in order to have the area of close quarantine arranged in a single block, although infection was actually confined to five rural municipalities.

13. Included in the investigatory work allotted to divisional veterinarians at Regina, February 18, was visiting and re-quarantining those premises on which the disease had appeared earlier, and which were quarantined at that time on a diagnosis of vesicular stomatitis and released from quarantine later when the animals involved appeared to have recovered. Until this date, February 18, 1952, the origin of the infection, and the manner or means by which it had been introduced, had not been found or suspected. Our veterinarians were instructed to question all owners involved, as to their movements, purchase or acquisition of additional livestock, merchandise from abroad, visitors, hired help, etc., during the month of November 1951, and earlier. At this time the information concerning the immigrant Willi Bruentzen and his brief employment on the L. T. Wass premises came to light. Several other very important items of information were learned, which, when the disease was first reported as vesicular stomatitis on the L. T. Wass premises, were not apparently considered as being associated with the introduction and spread of the disease, and consequently, the veterinarian who reported the condition, established quarantine, and conducted animal differentiation tests on the L. T. Wass premises, was not supplied with this vital information.

Investigatory work conducted by divisional veterinarians on February 18 and 19 brought to light the information concerning the immigrant Willi Bruentzen, his brief stay on the Wass premises and his departure for Winnipeg, Manitoba. My thought on receiving this information was; this man is probably a saboteur and has sown the infection in the Winnipeg dairy herds. Dr. R. H. Lay, District Veterinarian, Winnipeg, was promptly alerted by telephone and requested to get every available divisional veterinarian on inspection of the dairy herds in the vicinity of Winnipeg, meanwhile having his men keep a sharp look out for Willi Bruentzen. At the same time the Royal Canadian Mounted Police were requested by me to trace and pick him up.

Information secured from L. T. Wass and other sources February 18 and 19, and later, indicates that foot-and-mouth disease in a mild form was present for some considerable time previous to November 26, 1951, on which date Wass called his veterinarian, Doctor Richards of Indian Head, Saskatchewan, in connection with the condition of his cattle. It has since been established that sometime previous to November 26, 1951, his swine were sick, appeared to have the same condition as the cattle exhibited later, but the swine recovered very quickly, and he thought no more about it at the time.

Further information brought to light on February 18 and 19 indicates that L. T. Wass did on November 22, 1951, convey a number of calves from his premises to the Burns & Co. Ltd., packing plant at Regina, and sold the calves to that firm for immediate slaughter. While at the Burns & Co. Ltd., premises L. T. Wass walked through a feedlot looking at the cattle therein. Further, that on November 26, the
day Wass called his veterinarian in connection with the condition of his cattle, a
farmhand employed by L. T. Wass, left that employment and proceeded directly
to employment on one of the largest dairy farms in the vicinity. About ten days
later a vesicular condition was noticed by the owner of this herd among his cattle.
This condition was not reported, the owner did not consider it as being serious;
animals apparently were not seriously affected and, according to the owner, made a
rapid recovery. This foci of infection was not uncovered until February 19, 1952.
However, there is no doubt the disease, carried from the L. T. Wass premises
November 26, 1951, had been smouldering on these premises for approximately
2½ months, during which time it was spread to many other herds in the vicinity,
and by sale of infected calves, to a couple of herds some 20 miles distant.

From the foregoing it will be seen that infection was carried from the L. T. Wass
premises to the premises of two neighbors, who assisted Wass in medicating his
affected cattle, and by Wass himself to the Burns & Co., Ltd., packing plant and
feedlots in Regina—the latter ten days and the former one week before the condi-
tion of the Wass cattle was brought to the attention of divisional veterinarians.
The infection had also been implanted in the large dairy herd mentioned above, by
the former Wass employee, about one week before quarantine of the Wass herd
and premises was established.

The facts are: The infection had been carried from the Wass premises to at least
six or seven other premises, including a packing plant, packing plant feedlots, and
the largest dairy herd in the vicinity, one week to ten days before the condition
was reported on the Wass premises. By that time, December 2, 1951, the most
damaging spread had already taken place, and the pattern of things to come had
been established. However, the quarantines established on all premises where the
disease was found and diagnosed as vesicular stomatitis, had the effect of preventing
further spread from those premises. We have no evidence the disease was spread
from an infected premise after quarantine was established, either before or after
the true nature of the disease was established. This quarantine of each infected
premises, as from December 3, 1951, indicates why it was possible, under terribly
difficult weather and road conditions, to successfully contain the outbreak, within
the areas originally placed under quarantine, and thus pave the way for the rapid
eradication of the disease.

PROCEDURES BY WHICH THE DISEASE WAS CONTAINED AND ERADICATED

1. By quarantine established on individual infected premises as from December
3, 1951, and in most cases maintained until all quarantines and restrictions were
removed as of August 19, 1952, on which date Canada was declared free of foot-
and-mouth disease. In all 42 premises were so quarantined.

2. By area quarantine within which all infected and suspected of being infected
premises were located. The infection was found in but five municipalities, but it was
necessary, as a precautionary measure, to include a further 16 municipalities; by
doing so, the area of quarantine was established in one block.

3. Buffer area of modified quarantine; This comprised 41 municipalities surround-
ing the area of close quarantine. In the buffer area, movement of livestock, livestock
products, etc., within that area, was possible under permit.
Quarantine requirements were enforced on a 24 hour basis by the Royal Canadian Mounted Police.

Slaughter of all animals known at that time to be infected, or suspected of being infected or exposed, was commenced on February 29, 1952, and completed on March 13, including one herd which had been held an extra five days for special tests. With the exception of this herd, all animals involved were disposed of by March 9 just ten days after eradication operations commenced. Disposal was as follows: The animals were driven into burial pits approximately 11 ft. deep; there killed by rifle fire by the Royal Canadian Mounted Police. The carcasses were then slashed to check gas formation, covered with lime and buried under approximately 8 ft. of earth.

Immediately the animals were removed from infected premises, disinfecting crews moved in to make a preliminary clean-up. All loose litter, straw, hay, feedstuffs, etc., were collected and burned. The barns, stables and surroundings including manure piles, were then drenched with lye solution driven by powerful pumping equipment. It was necessary to have the water used in this work heated at Regina and rushed in tanks to premises where used. This procedure was expected to take care of surface virus, which we believe it did. The real clean up was deferred until warm weather (about April 1) disposed of the snow and ice, thawed frozen manure, etc. Then any loose virus might be present was exposed and vulnerable to disinfection procedures—which were as follows: Collection and burning of all litter and rubbish which could not be dealt with during the preliminary clean up. Removal and burning of all wooden flooring, feed boxes, troughs, decayed timbers, etc., which could not be disinfected. Thorough cleaning of interiors of all buildings, shaving several inches of soil off yards with bulldozers, burying all manure piles and drenching interiors and exteriors of all buildings with lye solution, also all fence posts, etc. Yards were drenched with lye solution and covered with lime. All farm equipment, including machinery, was washed with sodium carbonate solution. The dogs and cats, if any, were also subjected to washing. Meanwhile, all quarantine restrictions were fully maintained.

The infected packing plant and packing plant feed lots were dealt with as follows: All fresh and frozen meats, meat products, offal, bonemeal, feeds, feedstuffs, hay and straw, were destroyed by deep burial, burning, or passing through the plant cooking tanks or melters. Before attempting to clean the interior of the plant, the entire interior, starting at the top, was drenched with lye solution driven as a spray from powerful pumps. The work of cleaning was then deferred for 24 hours, after which the interior was thoroughly scrubbed and hosed down, then again treated to a most thorough drenching with lye solution. Following which the plant was kept out of operation for several weeks. Feed lots, yards, pens, corrals and all outbuildings were given similar treatment.

In all cases, the work of cleansing and disinfection was done by Departmental employees under the direct and constant supervision of selected Departmental veterinarians.

During the latter part of April a small secondary outbreak occurred in the vicinity of Ormiston, Saskatchewan. This outbreak was due to infected meat originating in the infected packing plant before same was placed under quarantine.
Bones from which the meat had been removed were thrown outdoors and carried by the farm dog to the livestock barn, where susceptible animals made contact. The animals involved were quickly disposed of by radical measures, the entire operation, including cleansing and disinfection of premises, being completed within 48 hours.

Another secondary outbreak occurred in the vicinity of Weyburn, Saskatchewan, during the last two days of April and first days of May. Eight herds, including six exposed, were involved here. However, these were dealt with very promptly and the entire operation completed as of May 3. Source of infection was the same as the other secondary outbreak. Since that time there has been no further indication of disease. Other procedures of a precautionary nature included farm to farm inspections by veterinarians, of all susceptible animals within the quarantined areas. These inspections were made as frequently as possible.

At the peak of the campaign we had no less than 70 Departmental veterinarians and several veterinary practitioners engaged in this work together with supervising cleansing and disinfection procedures, issuing permits (after inspection) for movement of livestock, etc., within the buffer area, answering sick calls far and wide, for which every form of transport available was pressed into service, including snowplanes, Army jeeps, halftracks, power trucks, and for long distance calls, airplanes. At this stage, on account of the panicky feeling generated in stockowners from listening to the uproar concerning this outbreak, if an animal sneezed or looked sideways, the owner would generally report at least suspicions of foot-and-mouth disease. There were scores and scores of such calls from all parts of the country; all required attention, on the very remote chance there might be something serious. However, our officers always reported findings negative.

Please note here: The outbreak was stopped in its tracks as of February 18, 1952, when all essential steps were taken to contain and eradicate this disease. All animals involved had been disposed of and premises given a preliminary cleansing and disinfection exactly 24 days after that date. That would have been the end of the outbreak, except for the contaminated meats which left the packing plant before quarantine was imposed, and although all retail outlets were checked by our officers, among some 1,600 such outlets, in only two cases did contaminated meat escape. These two slips caused the Ormiston and Weyburn outbreaks, which were very quickly squelched. The time taken to eradicate both the main outbreak, and the two secondary outbreaks, as from February 18 until May 3 was exactly 75 days, in spite of almost impossible weather and road conditions and the impossibility of getting down to the business of a thorough cleanup of loose virus until the advent of warm weather, with which we were favored as from April 1.

Altogether 42 premises were involved; infection was found on a total of 29 premises; 13 premises were classed as exposed and treated as though infected. The number of animals and products destroyed, and for which the owners received fair and just, if not generous, compensation is as follows: cattle, 1,343; swine, 293; sheep, 97; goats, 1; fowl, 2,372; eggs, 15,828.

Thirty days or more following cleansing and disinfection of premises involved, susceptible animals, consisting of not less than two young cattle and two young swine, brought from a distance outside the danger area, were placed on each premise,
after being given a close physical examination, and being tested negative to tuberculin, also passively immunized against clostridia. These animals were kept under control on the premises by special fencing, fed off the ground at various parts of the premises, and kept under continuous observation by Departmental veterinarians working in pairs. These animals were kept on the premises at least 30 days, when, if the owner of the premises was ready to restock, he was permitted to do so, his new animals being treated as test animals for another 30 days. If he was not in the position to restock, our test animals were left on the premises for another 30 days or until the owner could restock, whichever occurred soonest. All our test animals remained healthy, and being Departmental property, were, at the end of the test period, slaughtered under Departmental veterinary supervision, being subjected to very special ante and post mortem inspection. No evidence of disease was found. As you know, all quarantines were discontinued and Canada declared free of foot-and-mouth disease as of August 19, 1952.

The outbreak of foot-and-mouth disease in Saskatchewan was entirely unexpected. The scene of the outbreak, situated about midcontinent, seemed a most unlikely place for the disease to appear; particularly as our records did not indicate any imported livestock, livestock products or other materials likely to carry the disease had been brought into that district during the previous year. The very mild nature of the disease when it first appeared, simulating vesicular stomatitis, together with no information regarding a possible source of infection; the knowledge that vesicular stomatitis had appeared in western Canada previously; the fact that the veterinarians who examined the first animals involved were familiar with vesicular stomatitis and diagnosed the condition as such; and the probable misinterpretation of the animal differentiation tests, put my officers and me temporarily off our guard. Hence the delay in taking more vigorous action to make certain of the true nature of the disease. Certain it is that if the information concerning Willi Bruentzen had been forthcoming with the first report of the condition, I would most certainly have made a personal and immediate investigation, and brought every known test into action, though it is very doubtful if any live virus would have been found in the herds first detected, owing to the lapse of time between vesiculation and the reporting of the disease. That could have been a contretemps which might have supported further the initial diagnosis of vesicular stomatitis, and might have had truly disastrous results.

However, all this aside, the most damaging spread of the disease had already occurred as at December 2 or 3 with pattern of spread well established. Earlier correct diagnosis in conjunction with the radical measures put into operation as of February 18, 1952, might have prevented the disease reaching a few of the less important herds, and would certainly have lessened the danger of the disease being spread by contaminated meats. However, earlier and correct diagnosis would not have altered the general economic picture. The United States embargo against Canadian livestock and livestock products and other materials, would have been put into effect just that much sooner. Further, the disease certainly could not have been more than contained, it could not have been completely eradicated until the advent of warm weather.

You may be assured my officers and I had our hands quite full as from February
18 containing and eradicating the outbreak, with an inadequate and largely inexperienced staff, tracing and inspecting possibly diseased animals, tracing and dealing with meats that might be contaminated, investigating reports of disease received from all parts of the country, and a multitude of other matters spilled into our laps on account of this outbreak. However, as though this was not enough in addition to our regular duties, we were hampered and harassed almost beyond endurance, by the press demanding interviews, news items, photographs, etc. There was also intrusion by telephone at all hours of the day and night, a spate of letters offering remedies, preventives, and services from almost all countries outside the Iron Curtain. Much of what was published was not correct, was out of context and garbled.

Much rubbish was published as facts before the real story was available. Almost all such was highly critical, and dealing with water already over the dam. No one except our own Departmental officials seemed to be even mildly interested in what was actually being done. Added to the foregoing, we had just really come to grips with the outbreak, when the subject was introduced into the House of Commons, touching off a lengthy debate which finally brought about an investigation by the Agricultural Committee. This investigation extended over approximately two months, and caused much additional work assembling reports, securing and editing information in answer to questions asked in the House concerning the outbreak. However, I accept the responsibility for the handling of the outbreak from start to finish. The results are evident to all.

The much overdone publicity, general uproar, and criticism loosed on us when we were already staggering under a terrific load of work and responsibility was rather discouraging. However, we have, of course, learned a great deal from this outbreak. One lesson is, that foot-and-mouth disease is not nearly so formidable a foe as is generally thought. It can be whipped quite readily if it is possible to follow a very rigid policy of containment and eradication based on thoroughness in all phases of the work. Another lesson is that the actual work of eradicating the disease is much less wearing and harassing than being exposed concurrently to a spate of adverse publicity and criticism such as was loosed during the critical period of this outbreak. I might well paraphrase a very famous saying of Churchill's as follows:

Never was so much said and written by so many of a subject of which they knew so little. It is so very easy to sound off where no responsibility is involved. I did find it truly amazing, the number of foot-and-mouth disease experts (self proclaimed) who appeared almost overnight.

SUMMARY

The probable source of infection is indicated with an outline of measures taken to eradicate the disease, including methods employed in disposing of animals involved.

Controlling the movement of livestock, people and products likely to carry infection. Quarantine procedures, disinfecting stations, procedures in cleansing and disinfecting infected premises, including infected packing plants. Also procedures followed in the use of test animals following cleansing and disinfection of premises involved.
FOOT-AND-MOUTH DISEASE CONTROL AND ERADICATION
MEASURES IN CANADA

K. F. WELLS, V.S., D.V.M.¹

The ever changing livestock industry necessitates changing ideas and methods in disease control; nevertheless, in a disease such as foot-and-mouth, where complete and rapid eradication is the goal, the principles remain constant. These principles, the destruction and burial of all infected and contact livestock, thorough cleaning and disinfection of all infected premises with adequate investigation and quarantine measures to insure against possible spread, are universally accepted, but a great deal of variation can exist in the application of these principles. It is with this in mind that the following description of the Saskatchewan foot-and-mouth control operations are briefly outlined.

Canada was declared to be infected with foot-and-mouth disease on February 25, 1952. A total of 42 premises in the Regina area of the Province of Saskatchewan were involved, 29 of which were infected, with 13 being contact premises. In the program of complete eradication, a total of 1,343 cattle, 294 swine and 97 sheep were destroyed.

The problem of destruction and burial of livestock was found to be one of mechanics. The original operations were during severe winter weather and considerable difficulty was experienced in digging through 5½ feet of frost to prepare the burial pits. After trying various methods to break through the frost, including surface burning with oil and dynamiting, the best approach to the problem was found to be the use of rippers or rooters. The use of these rooters broke the frozen earth into pieces small enough to be handled by scrapers. Dynamite, on the other hand, blew up large chunks of frozen gumbo too big to be handled by a scraper or buldozer.

Butchers from the local packing plants were hired to slash the carcasses. Lime was liberally used and all carcasses were buried at least eight feet below the surface in an attempt to prevent odor problems. With the coming of spring weather, all pits were again worked over with buldozers to pack them down and fill in any cracks. Pit odors were not experienced at any time.

Officers of the Royal Canadian Mounted Police handled the shooting of the livestock. Destruction by a police body has obvious advantages. They are trained marksmen; they have the equipment; and most valuable of all, the presence and participation of a recognized and respected police organization adds prestige to the program.

There were three standards of quarantine used in the control of foot-and-mouth disease in the Province of Saskatchewan:

1. Individual quarantines were placed on infected or contact premises where livestock were destroyed and buried. This was the most severe quarantine.

2. A general quarantine was imposed on 21 contiguous rural municipalities in the Province. These 21 rural municipalities either had infected or contact premises

¹ Chief Veterinarian, Health of Animals Division, Department of Agriculture, Ottawa, Ont., Canada.
within them, or were in between rural municipalities which had infected or contact premises. These 21 quarantined rural municipalities comprised what was known as the Infected Zone, or more generally referred to as the Quarantined Area.

3. A general quarantine was imposed on 41 rural municipalities surrounding the quarantine area. This general quarantine was less severe than that imposed on the Quarantine Area. These 41 rural municipalities comprised what was generally referred to as the Buffer Zone. While there were no infected or contact premises within this Buffer Zone, a modified general quarantine was maintained in order to have the livestock surrounding the quarantine area under semicontrol in case there was a jump of infection. In addition, whenever or wherever a strict quarantine line is drawn there are bound to be border problems and situations arise which must be dealt with as exceptions to general quarantine. The establishment and maintenance of a buffer area quarantine permitted the handling of these exceptional problems while still maintaining sufficient livestock control to protect against the spread of disease.

Generally speaking, these three quarantines gradually lessening in severity, provided a necessary gradual dequarantine system where livestock control for disease eradication purposes goes from absolute control, where disease is present, to a minimum control where it was felt there was little or no danger of disease breaking out.

The particulars of the three quarantines are as follows:

1. *Infected or Contact Premises Quarantines.* This quarantine provided that livestock and livestock products could not leave the premises. It also provided that the owner of the premises, his family and all other persons on the premises must not leave without permission from a veterinary inspector. This provision controlling human movement was in effect only until all livestock had been buried and the premises satisfactorily cleansed and disinfected.

A lay inspector of the Department was placed at the gate of the premises to enforce this quarantine and to assure that all official personnel entering or leaving the premises were thoroughly disinfected before leaving.

Before the cleaning and disinfecting gang left the premises, the owner's car or truck, etc., and all work shoes were disinfected.

During the period of quarantine, arrangements were made by the Department for the delivery of all needed groceries, implement repair parts, gasoline and children's school books.

This strict human quarantine was not applied on the infected and contact premises during the severe winter weather as the general movement of the people was considerably less and all livestock in the area was housed. In addition, of course, it was not possible to fully complete cleaning and disinfection of all farm premises during the winter weather.

Following the destruction and burial of all livestock and the cleaning and disinfection of the premises, the quarantine was still maintained on the farm premises in order that livestock could not be taken on to the farm until the Department was satisfied foot-and-mouth no longer existed on the premises.

2. *The Quarantine Area.* The quarantine on the general infected area provided that livestock and livestock products, including meats, grain and other animal feed,
could not be moved or transported without a permit from a veterinarian of the Health of Animals Division. It also provided that all livestock and products noted above, including meats, could not be moved out of or into the quarantine area.

This quarantine was enforced by instructions to the railways and truckers, also frequent warnings by press and radio. The Royal Canadian Mounted Police were the actual enforcement officers. They established a special squad of eight officers who were on constant patrol, and in addition all R.C.M.P. detachments in the area are alerted to the regulations, making a total force of approximately 65 R.C.M.P. officers on control work.

Permits for the movement of all controlled livestock and other products, which are essential to the economy of the area, were granted where such movement did not endanger the disease eradication program, and in some cases only after essential disinfection procedures had been followed.

Free movement of milk and cream from farm premises within the quarantine zone to dairies within the quarantine zone was permitted. All trucks carrying such milk to the city of Regina had to pass through the Department's central cleaning and disinfection station in Regina after each trip from the country. Outward movement of milk and cream from the quarantine zone was prohibited. Adequate daily disinfection of all milk and cream cans was enforced.

The issuance of any permits was directly contingent on whether or not there was active foot-and-mouth infection in the area concerned. For example, when foot-and-mouth was established in the Ormiston and Weyburn areas, all permits in those areas were immediately suspended. The movement of cattle to pasture was immediately stopped and permits for such movement were not again issued until sufficient time, following the handling of the infected premises had elapsed, to assure that the area was sufficiently safe to allow such movement.

The through movement of livestock by rail was permitted providing such stock was not unloaded for feed and water in the quarantine area.

Following a careful study of the disease potential, as presented in individual cases, where undue hardship was being worked by the general quarantine, exceptions to the above general rules were permitted.

3. The Buffer Area. The quarantine placed on the Buffer Zone or area was more moderate than that on the quarantine area and was designed to control the movement only of livestock and their products with the exception of meats and milk.

It should, however, be pointed out that any movement permitted without a permit was only movement within the actual buffer area. All movements from the buffer area to the quarantine area or the free area were prohibited.

Livestock within the buffer area was allowed to be moved without permit for slaughter within the buffer area.

Livestock within the buffer area being moved for any purpose other than slaughter was subject to permit. Permits were granted, following inspection, for movement to pasture or for legitimate sale of purebred bulls or for the sale of suckling pigs.

Permits were issued for the movement of swine for slaughter from the Buffer Zone to the quarantine zone. However, this was subject to existence of a shortage of slaughter swine in the quarantine area.
FOOT-AND-MOUTH DISEASE IN CANADA

The free movement of milk and cream within the buffer zone only or by permit into the metropolitan quarantine area was allowed.

The free movement of hay, straw, cereal grains and concentrate feed was permitted within the buffer zone and such movement from the buffer to quarantine zone was allowed on permit.

Livestock, livestock product and agricultural product control in disease eradication was, of course, an essential. It was, however, just as essential to permit all possible movement needed to sustain the population in the area, providing the needs of disease eradication were first met.

This permit system was the only manner in which needed control and essential movement could be satisfactorily merged. However, the value of the permit system went far beyond this, in that it provided a record of all movement of animals or things which could carry infection. If infection were to break out in any new place within the area of our present operations, we had at our fingertips a written record of all livestock and livestock product movements, which might have been a factor in the further spread of disease. While the memory of the owners was of value, a written record going back over three months is of extreme value.

For this reason the cumbersome and time-consuming permit system could not be replaced.

There were no specific problems in the cleaning and disinfection field of the program, with the exception that some of the stables were in very poor condition and in these cases where an assessment showed that it would cost more to satisfactorily clean and disinfect than to replace a building, the buildings were burned.

All wooden floors were removed and burned.
All lumber, such as stall partitions, mangers, etc., which was removed, was burned.

Following the general clean-up, bulldozers were used to level off the barnyard and clean up all debris so that the premises were left clean and tidy.

All lumber removed from buildings was measured in board feet and the owner was compensated for an equal number of board feet of new lumber at the Regina retail price.

The Department took no part in rebuilding the stables. This was considered the owner's responsibility in view of receiving new lumber for old.

Large manure piles were a problem. Where it was not feasible to bury them, they were burned over if possible, then soaked with lye solution and covered by bulldozers with two feet of earth scraped up from surrounding fields.

The only disinfectant agents used were 2 per cent sodium hydroxide and 4 per cent sodium carbonate. Lime was used on barn yards.

Following cleaning and disinfection, a period of at least 30 days was allowed to elapse before test animals were placed on the premises. Snow fences were used to confine test animals to the barnyard and farm buildings. Quarantined premises were left vacant until all were ready for test animals and then animals were bought in distant points and placed on all premises on the same day. This made it easier to set up proper inspection, feeding and control. Test animals were maintained on infected and contact premises for 60 days.
One phase of special interest was the maintenance of livestock prices in the quarantine area. As the general quarantine on the infected area prohibited the outward and inward movement of livestock and livestock products, including all meats, with the exception of canned meats, it would have been possible for livestock buyers to depress the price of livestock in the area. This could have been done as there was a surplus of cattle in the quarantine area. Realizing that this restricted livestock market was a direct responsibility of the Departmental regulations, the Department accepted the responsibility of making certain that livestock prices were not depressed by buyers who might take advantage of the situation. It was also realized that if the price of livestock within the area dropped to below outside prices there might be an incentive for illegally moving livestock out of the area.

To handle this situation, all packing company officials and small slaughter house operators were brought together. The situation was clearly explained to them and as their market in the quarantine zone was protected by the prohibition on inward movement of all livestock and meats, they agreed to pay a set price for all the livestock purchased. The agreed price was approximately 2 cents above the outside market price.

All livestock producers had to have a permit before cattle could be shipped for slaughter and the packing plant or slaughter house of consignment had to be named on the permit so that if any individual sought to pay less than the agreed livestock price, permits would not have been issued for livestock consigned for slaughter to that individual or firm. It is worth mentioning that in no case were producers paid less than the agreed price.

As all buying of livestock had to be done by telephone, buyers not being allowed to visit the farms, and the stockyards being closed, a system of government grading and payment on government grade basis was instituted. This system not only protected the producer in getting a fair price for his livestock, but also protected the packing company from having to pay excessive prices for livestock of poor quality. Once a beast was delivered to the packinghouse or slaughter house premises, it had to be slaughtered; there was no return to the farm, and as the animals were not seen by the buyer beforehand, the system of payment on government grade was well accepted by all parties.

Grading and payment basis was handled by grading officials of the Federal Department of Agriculture Marketing Services.

One could go on describing various phases of the work, such as construction of cement vats for the disinfecting of all livestock hides in the area, the handling of animal feeds, such as rabbit carcasses, the fumigation of rabbit pelts which had been stored in hide cellars before being shipped for fur felts, the disinfection of race horses' feet and legs when they were leaving the local race meet, and last but not least, the tracing and destruction of all meats originating from an infected packing plant previous to its closing, but all of these merely add up to the fact that an outbreak of foot-and-mouth disease presents a very complex problem.

Control and eradication procedures were successful and on August 19, 1952, 170 days after the official declaration of infection, the Rt. Hon. J. G. Gardiner, Minister of Agriculture, was able to declare Canada free of foot-and-mouth disease.
In closing, I would like to pay tribute to the three Bureau of Animal Industry veterinarians, Doctors Shahan, Mulhern and Shigley, who were with us in Regina during various phases of the operation. It is gratifying to have experienced the fine cooperation which exists between our countries.

Statement of Expenditure Re Foot and Mouth Disease from Date of Discovery to September 30, 1962

Administration
Salaries of Temporaries ........................................ $ 25,178.87
Wages .............................................................. 103,998.37
Travel ............................................................... 157,640.81
Acquisition of Equipment ................................. 15,695.89
Supplies (Includes purchase of live stock for test purposes) .. 52,204.18
Freight and Express ........................................ 2,947.56
Telephones, Telegrams and Postage ......................... 2,811.19
Rental of Equipment ........................................ 47,320.39
Repairs and Upkeep of Equipment ........................... 2,392.47
Miscellaneous .................................................. 934.09
$411,123.82

Compensation
Animals, Poultry eggs destroyed ........................... $369,698.04
Other things .................................................... 109,828.33
479,526.37

$890,650.19

Note—includes administration expenditures by Regina Treasury Office to September 23, only.
REPORT OF THE COMMITTEE ON FOOT AND MOUTH DISEASE

M. S. SHAHAN, Washington, D. C., Chairman; A. K. CARR, Sacramento, California; D. A. DAVIDSON, Fort Worth, Texas; R. J. HIGHT, Phoenix, Arizona; C. E. KORD, Nashville, Tennessee; HARRY MCDANIEL, Dover, Delaware; ALBERT K. MITCHELL, Albert, New Mexico

At the last meeting of the Association one year ago, the main interest of this committee was the Mexican campaign, which was reviewed with high hopes. These hopes have materialized, and the Republic of Mexico was announced as having at last been freed of foot-and-mouth disease on September 1, 1952.

Thus, after a hard fight lasting almost six years, resumption of imports of cattle from the Republic is possible. The Association may be proud of its support of this international effort without parallel in the history of animal disease control. Your Committee recommends that the Association also support the newly organized Mexican-United States Commission for the Prevention of Foot-and-Mouth Disease, which is maintaining a small inspection and diagnostic service in central Mexico.

The 55th meeting of the Association last year at Kansas City had scarcely been adjourned when what now appears to have been the first cases of foot-and-mouth disease occurred in the Dominion of Canada. The disease, which was at first atypical and slow-spreading, was not officially recognized for three months. The announcement, which necessitated prohibition of importations of Canadian animals and meats into the United States, was cause for much concern on the part of livestock sanitary officials in both countries. It was feared that the disease would spread widely in the Dominion and might invade the United States. The effects of delays in diagnosis in the 1914-15 and 1924 epizootics in the United States were recalled with apprehension. It is gratifying to learn that the last known infection in Canada was eliminated in May, and at this time there is every reason to believe that the eradication efforts will be rewarded. The Canadian Ministry of Agriculture announced completion of eradication in August.

The epizootic of foot-and-mouth disease that was developing in Germany and adjoining countries during last year's meeting eventually became one of the most serious of all time, becoming even more damaging in some countries than the 1937-39 plague. In Great Britain some 72,000 animals have been slaughtered in the present campaign. The spread of the disease seems now to have been slowed down materially, even though it did extend to the Channel Islands and into Scotland. Ireland and Finland successfully avoided the infection. Norway reports no further outbreaks of the disease after slaughtering four affected herds. The first cases in Germany, where the epizootic started, were attributed to type O virus. Soon thereafter, however, a variant of type A appeared, and this, after sweeping the country and spreading into France, Belgium, Holland, Denmark, Norway and Sweden, was followed in several countries by type C virus, which previously had not been identified in western Europe for years.

In Britain the severity of the epizootic led to repeated challenges of the traditional
FOOT-AND-MOUTH DISEASE

national policy of eradication. It is a credit to the steadfastness and solidarity of the British veterinary officials that compromise was avoided. Elsewhere in Europe, demands for vaccine far exceeded the supply and the practice of vaccination fell into disrepute in many quarters.

Professor Gaston Ramon, secretary of the International Office of Epizootics, pointed out in a statement before the French Academy of Sciences, on August 4, 1952, that: “at the present stage of our knowledge, vaccination against foot-and-mouth disease can serve as a complement only. In the manner in which it is practiced it may, at best, procure a relatively small degree of immunity of short duration, which may be unexpectedly annulled by a new type of virus.”

This Committee would be remiss if it failed to reemphasize that the surest, quickest and cheapest method of eradicating foot-and-mouth disease, if it should occur in the United States, would unquestionably be the tried and proved “stamping-out” procedure. Vaccination appeals to the imagination as an easier way out, but the fact remains that presently available vaccines have been shown to be of value only as auxiliary eradication weapons when circumstances make it necessary to supplement the long accepted procedures of inspection, quarantine, slaughter and disinfection.

Although the United States has been free of foot-and-mouth disease for more than 23 years, we cannot afford to relax our diligence in enforcement of legal and regulatory restrictions or alertness in detection if the disease should appear again.

The current epizootic of vesicular exanthema (VE) is a special threat in this connection, since any outbreak of vesicular disease in swine that seems to be VE may actually be foot-and-mouth disease. Any laxity in diagnosis might easily fail to lift the disguise. All regulatory officials, practicing veterinarians and livestock producers, are urged to be constantly on the lookout for indications of foot-and-mouth disease or others of the dangerous diseases that have so long been successfully avoided or controlled.

Vesicular exanthema must be vigorously attacked and eradicated if the swine industry is to avoid a serious continuing handicap. Until the individual states recognize, accept and discharge their responsibilities in this undertaking, the disease will continue to complicate the problems of prevention and diagnosis of foot-and-mouth disease. Without doubt, one of the most effective actions to be undertaken by the states is prohibition of the feeding to swine of uncooked or otherwise unprocessed garbage.

The appropriation of funds by the Congress for construction of a laboratory for research on foot-and-mouth and other dangerous diseases deserves special mention. The law requires that the establishment be on an entirely government controlled, coastal island, which has been designated after compliance with an additional requirement for public hearings in the vicinity. Plum Island, in Long Island Sound, New York, which is the site of Fort Terry, recently reactivated by the U. S. Army, is to be the location. Final plans for the facilities are now being developed, and it is expected that construction will be completed some time in 1954, although some research may be initiated in advance of that time. Your Committee regards this project as one of the most progressive developments of our time. We wish to point
out, however, that the operation of the laboratory will require considerable annual outlays in appropriated funds for a worthwhile, continuing program. This Association should be unstinting in its support.

Mr. Chairman, this report is approved by all the Committee members except Mr. Duval Davidson of Texas. We recommend approval of the report by the Executive Committee of the Association, and the subsequent transmittal of copies to the members of the Agriculture and Appropriations Committees of the United States Senate and House of Representatives.
OUR NEWER KNOWLEDGE OF BOVINE HYPERKERATOSIS
(X-DISEASE)¹

A. M. LEE, D.V.M., M.S.²

For the past ten years many research workers believed X-disease, or hyperkeratosis, of cattle, was an infectious disease caused by a virus. One purpose of this paper is to present the present status of the research accomplished and in progress by the various state agricultural experiment stations, veterinary colleges, U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, and the U. S. Bureau of Animal Industry on X-disease, or hyperkeratosis, of cattle. Another purpose is to apply this knowledge to the following: (1) as complete a description of the disease as is now possible; (2) the prevention and control of the disease; (3) emphasize the more outstanding experimental work done on the cause which has resulted in the production of the disease; and (4) some equally important and outstanding work done which has failed to produce the disease.

In 1941 a new and peculiar disease of cattle was first seen and reported in New York State. This was a distinct entity that had not been reported previously. A very good description of the symptoms, lesions, and histopathology was published but the cause was not known. The disease was called X-disease, or hyperkeratosis. It now appears probable that in 1941 a herd was found in Illinois in which cattle were affected with the same condition. A Michigan publication in 1949 reported a herd was found in that state in 1940 which had cattle affected with X-disease, or hyperkeratosis. During the next few years affected herds were found in scattered areas of New York, as well as in several other states. By 1946 the disease had been officially diagnosed and reported to the Bureau from ten states, and in 1947 the Bureau had information that the disease existed in 27 states. In six or seven of these it had attracted the attention of livestock men and state livestock sanitary officials as a disease of economic importance which was becoming alarming due to damage done in some herds in widely scattered areas of various counties and states.

The disease had become of enough importance in 1948 that the Chief of the Bureau of Animal Industry called a conference on the disease at Washington in July. Representatives from 16 states attended and included state livestock sanitary officials, and research workers from veterinary colleges and state agricultural experiment stations. It was the consensus of these representatives that immediate action should be undertaken to obtain definite information on the disease by survey and research. The Bureau of Animal Industry inaugurated a survey to investigate the extent of the disease, its causative factors, methods of control, and to suggest such pilot experiments as could be carried out by collaborating states. Results of the survey indicated that a number of factors may have been involved in the causa-

¹ A contribution from the project entitled "X-Disease, or Hyperkeratosis of Cattle," a cooperative study participated in by 17 agricultural experiment stations and the Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture. (Doctor Lee is National Coordinator of this research project.)

² Pathological Division, Bureau of Animal Industry, Washington, D. C.
tion of the disease. It also showed that there was urgent need for research into the possible factors concerned in order to obtain information needed for formulating control measures. The survey showed that this research need would require a broad program covering a wide field, developed on a national basis, which would utilize the facilities available at the federal and various state institutions, as well as some of the farms and animals in the states where the condition was prevalent.

When it appeared probable that funds would be allocated to the Bureau for this new proposed project on X-disease, or hyperkeratosis, of cattle starting July 1, 1949, the Bureau contacted the administrative regional advisers in animal diseases from the four regions. Through these advisers the Bureau called a meeting of those interested in research on the disease. The agricultural experiment station directors were notified by the adviser of their respective region. Each station director was invited to send a duly authorized representative, who should bring a report on the prevalence and importance of the disease in his state, a state project for proposed research, and financial statement showing the amount of supporting state funds. This meeting was held at Chicago, June 20-21, 1949. The purpose of the conference was to plan research on X-disease, or hyperkeratosis, of cattle on a national or interregional basis, and organize the regional technical committees and a national technical committee. Official representatives were present from 18 state agricultural experiment stations, the Office of Experiment Stations, and the Bureau of Animal Industry. A temporary national or interregional technical committee was selected which included two persons from each of the four regions of the United States, a representative from the Office of Experiment Stations, one from the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, and one from the Bureau of Animal Industry. Reports on the disease and project proposals, with supporting state budgets and requests for funds were presented by the various representatives to the general group. This group referred the projects and budget requests to the national technical committee for recommendations and priority ratings. The committee’s recommendations back to the group were approved and from them the allotments of funds were made by the Bureau of Animal Industry.

The fund-participating line projects were located at Cornell University, Georgia Coastal Plain Experiment Station, Nebraska University, Pennsylvania State College, Tennessee University, and Texas A. and M. College. Some other stations which had done preliminary work, or expected to work on this disease, were also made cooperating ones. These were Alabama, Colorado, Illinois, Indiana, Michigan, New Jersey, and Virginia. The states of Connecticut, Kansas, Montana, and North Dakota signified a desire to be included in the cooperating group for possible later work on the disease. A round robin memorandum of understanding was later signed by the directors of these 17 state agricultural experiment stations, the Chief of the Bureau of Animal Industry, the Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering, the Chief of the Office of Experiment Stations, and the Agricultural Research Administration. The objects of the project were to study the pathology, symptoms, cause, treatment, and the relationship of chemicals, including minor elements of soils and plants; and to develop effective methods for the differential diagnosis, prevention, and control of X-disease, or hyperkeratosis, of cattle.

In order to make the proper approach to such a systematic study of a disease, there must be a survey period and a controlled experimental period. In any con-
Fig. 1.—Acute case of bovine hyperkeratosis. Note depression, lacrimation, and loss of flesh.

Fig. 2.—Acute case of bovine hyperkeratosis. Note early lesions on the muzzle.


trolled experiment you must have a hypothesis. During the first few years the work by most states has been largely of a survey nature and there has been no hypothesis. There has been no principle or theory assumed or taken for granted as a basis for reasoning or investigation to explain certain phenomena connected with the disease. It has been necessary to go into the field because the disease had not been produced experimentally. It was agreed at the start that Georgia, Tennessee, and Texas would concentrate on studies on the infectious phase. New York would determine the possible role of certain chemicals as etiological agents in bovine hyperkeratosis. The U. S. Bureau of Plant Industry, Soils and Agricultural Engineering would work

Fig. 3.—Bovine hyperkeratosis with proliferations on the muzzle. Skin hyperkeratosis also present\(^5\).

Fig. 4.—Bovine hyperkeratosis with wartlike lesions and an ulcer. Skin hyperkeratosis also present. Courtesy of Dr. Carl Olson, Jr.

Fig. 5.—Bovine hyperkeratosis with wartlike lesions on the dental pad.
on the relationship of soils and plant life as possible causes. Pennsylvania would work on the interrelations between nutrition, microbial flora of the rumen and bovine hyperkeratosis. Nebraska, with a large state owned herd of 160 head, of

Fig. 6.—Bovine hyperkeratosis with salivation. Note there is little loss of hair but skin hyperkeratosis which was quite extensive was evident on palpation. Courtesy of Dr. Carl Olson, Jr.

Fig. 7.—Bovine hyperkeratosis with advanced skin hyperkeratosis and watery nasal discharge.
which about 80 head were then affected, would study the course, symptoms, and pathology of the disease and combine attempts to reproduce the disease by contact, by inoculations, and with their various pelleted feeds. The other cooperating states

Fig. 8.—A severely affected Jersey with skin hyperkeratosis of the body and legs, and showing lacrimation and a watery nasal discharge.

Fig. 9.—Bovine hyperkeratosis in a four-year-old cow. Courtesy of Dr. F. H. Melvin.

would make surveys, collect and feed or test the suspected materials obtained, and attempt to demonstrate an infectious agent when opportunities were offered and their funds permitted.

As promising leads were established the program was to be intensified in some states, and emphasis was to be shifted in others. If it became desirable there was to
be developed correlated research programs in other states. It was also agreed that the Bureau of Animal Industry would not do any research work but would coordinate the program. It was the opinion the Bureau should maintain close supervision of all phases of the work in order to obtain the best possible research results from a well integrated cooperation.

The total losses attributed to bovine hyperkeratosis in the United States are impossible to determine and have only been unreliably estimated at between $2,000,000 and $4,000,000 annually since 1948. Considering the total number of cattle and the many cattle owners in this country, the total losses and total number of herds affected probably have not been extensive. Nevertheless the situation is a very serious one for individual farmers, ranchers, and dairymen whose herds are affected, and it is becoming more prevalent. The disease is being diagnosed often by Bureau field men and follow-up examinations confirm most diagnoses as do the meat inspection reports if the cattle are sent for slaughter. But fewer reports are coming to the Bureau from veterinary practitioners and livestock owners that the disease has been found in a herd than were received several years ago.

The disease definitely exists, or has existed in 35 states. There have been no cases to our knowledge in nine states. There are four states in which the disease has been suspected in a herd or two. No cases have been diagnosed in California, Oregon, Washington, or Nevada. Recently the disease has been suspected in one herd in Idaho, one in Montana, and one in South Dakota. Few, if any cases have been found in North Dakota. Two affected herds have been diagnosed in Arizona. Marsh (37) of Montana received reports from officials in the western states in 1950. The disease was first diagnosed in Utah in 1948 and occurred in four counties in that year. New Mexico has had sporadic cases reported with quite general distribution in the state. Wyoming reported 17 herds affected with bovine hyperkeratosis between April 1948 and February 1950, with deaths of 58 cattle. Jensen (37) of Colorado reported a number of herds were affected in that state in 1945 and that the number increased through 1948. There have also been no cases of the disease diagnosed to our knowledge in Maine, New Hampshire, Massachusetts, Rhode Island, or Delaware.

It is impossible to obtain much information on the prevalence and importance of this disease with any degree of accuracy because regulations do not require reporting of the disease. Gibbons, Lee, Johnson, and Robinson (8) in the report on a survey in some of the southeastern States give the following data: Twenty-six herds which had losses from bovine hyperkeratosis were surveyed in 20 counties in five states; namely, Alabama, Georgia, Tennessee, Florida, and Virginia. These herds contained 4,120 cattle of which 1,295, or 31 per cent had become affected with the disease. There were 759, or 59 per cent of the affected animals which died. The estimated total financial loss in the 26 herds was $110,860., or an average of more than $4,200. per herd. This was exclusive of the loss caused by the disease in planned breeding programs and future calf crops. Mortality was greatest in young calves and in those under six months 75 to 80 per cent died. In older calves it was from 50 to 60 per cent. In adult cattle the mortality was from 10 to 35 per cent. The greatest incidence of the disease was seen in the winter months but both acute and chronic cases were seen in all seasons of the year.
Harshfield (16) as chairman of a special committee of the AVMA, found that out of 43 states reporting to the committee, 31 recognized the disease and 30 states had experienced outbreaks in 1948. In 1949 this committee found it had been reported in several new and widely separated areas. Washko (36) of Indiana reported in 1949 that the disease had been recognized in 13 herds in one of which the owner lost 180 cattle out of a herd of 400 head. Huffman, Duncan, Webster, Judd, Killham, and Thorp (17) of Michigan reported in 1949 that the disease had been found in 22 herds in 18 counties, and that it was first seen in Michigan in 1940. Olson (31) of Nebraska, in a recent publication stated that the disease was found on about 30 Nebraska farms during 1949–50. Schmidt (37) of Texas reported, in 1950, that the disease had been found in 53 counties in Texas. Sikes (39) of Tennessee, reported 41 herds had become affected in 1950 which had not previously had the disease. Sikes (33) also reported in August 1952, that more than 3,000 cattle had died or had to be slaughtered because of bovine hyperkeratosis. He reported it was conservatively estimated that the total value of the cattle which have died from this disease in Tennessee is over $1,000,000. Link (18) of Illinois reported in August 1952, that a survey was under way in Illinois and that 35 farms had been visited on which bovine hyperkeratosis had been found. Link (36) had previously reported two herds affected in Illinois in 1947, and 12 herds in 1948.

The importance of the disease in a State has often varied immensely from year to year. Some states which have many affected herds one year will have only a few herds the next year. Other states with few or no affected herds one year will find a large number the following year. For example, in Wisconsin the disease was of no importance in 1950, there having been only a few herds in which cases appeared. Hall (13) of Wisconsin reported that bovine hyperkeratosis had been found in 16 counties in Wisconsin between January 1, 1952 and April 15, 1952. The Wisconsin Livestock Sanitary Division, through its Chief, Dr. H. J. O'Connell, announced that the accredited veterinarians of that state reported 1,085 affected cattle in June 1952 from 268 premises. The reports from the same source for July 1952 were 272 affected cattle on 65 premises. Veterinarians in a number of other States have reported affected herds. Wagener (41) of Germany reported he had again found affected herds in Germany since his return from this country in 1951, four affected herds having been found. The disease has recently been reported in Morocco by Martin and Hinterman (19).

Sippel (34) of the Georgia Coastal Plain Experiment Station did extensive work for several years attempting to find an infectious agent as the causative factor. Approximately 100 materials were screened which included most of the tissues, secretions, and excretions from acute and chronic field cases of the disease. Calves were given close contact exposure to cases of the disease. Cultural work on chick embryos was negative for any evidence of an infectious agent as the cause. Sikes (33, 37, 39) of the Tennessee station also did extensive work for several years on the infectious phase. This consisted of inoculations and frequent swabbings of calves with a variety of tissues and secretions from acute cases. He also made close contact exposures of nonaffected calves with the affected ones. Olson (27, 28) of Nebraska conducted controlled experiments with large numbers of calves attempting to transmit the disease by close contact with selected field cases represent-
ing various clinical manifestations of the disease but was unable to develop any cases by this means or by animal inoculations.

Attempts to determine if the disease could be transmitted by contact and by inoculation of calves with large amounts of blood from acute as well as chronic cases of bovine hyperkeratosis have been made by Schmidt (37) of the Texas station. This work did not produce the disease. Other research workers who have obtained negative results in attempts to find an infectious agent as the cause of bovine hyperkeratosis include Link (37) of Illinois, Washko (37) of Indiana, Jensen (37) of Colorado, Cole (37) of Ohio, Elder (37) of Missouri, Ryff (37) of Wyoming, and Roderick (37) of Kansas. Earlier work in attempts to determine if an infectious agent was the cause of bovine hyperkeratosis had previously been made by Olafson (11) of New York and by Gibbons (6) of Alabama. Hagan (11, 12), in reports for the college for 1942 to 1946, stated that numerous attempts at transmission by various methods over a period of four years at the New York State Veterinary College had failed to demonstrate an infectious agent as the cause of the disease.

Bortree and Nertney (4) of the Pennsylvania station made an extensive study of the microflora and microfauna of the rumen of both experimentally produced cases of bovine hyperkeratosis and field cases of the disease. There did not appear to be any significant differences between the predominating microorganisms of the affected animals and their controls.

Many chemical tests, using both qualitative tests and spectographic methods, have been run by Robinson and Specht (37–39) of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering. The materials tested have included suspected soils, plant life, and livestock feeds. Numerous and varied animal tissues of affected cattle have also been tested by these workers. Their attention was especially directed to such elements as molybdenum, vanadium, gallium, and thallium. The results showed that no inorganic chemical appeared to be a factor in the production of bovine hyperkeratosis. They also tested some suspected livestock feeds such as the Nebraska pellets for total organic chlorine and found no increase over control samples. The Bureau of Plant Industry, Soils, and Agricultural Engineering discontinued as a cooperating agency on this disease on their own request in 1951. Bear (37) of the New Jersey station worked on the possibility of zinc deficiency being a factor in the production of the disease. Gibbons, Shoffeitt, and Fosse (10) showed that cases in Alabama had not been produced by DDT.

Olafson, McEntee, Rickard, and Hansel (26) of Cornell have done extensive work on feeding chemical compounds to calves and testing the blood plasma for vitamin A and carotene. They have also done some work on tests for cholinesterase following some chemical feedings. They fed calves a few inorganic chemicals including a thallium salt. They fed calves 14 organic chemicals and organic chemical compounds associated with the production of a bovine hyperkeratosis-producing processed concentrate which included three petroleum products. Following Bell's report of finding the hyperkeratosis factor in a lubricant, they tested 19 lubricants sold in the area. Each was fed to a calf in total amounts of 1 pound or more. None of the lubricants or other compounds or chemicals referred to above in the Cornell work produced bovine hyperkeratosis. In earlier work before bovine hyperkeratosis had been produced with a highly chlorinated naphthalene, Olafson had fed alpha-
chloronaphthalene and found it did not produce this disease. Miller, Bortree, and Shook (21) of the Pennsylvania station fed calves a rancid cooking fat, and other calves a number of chemicals including naphthalene and pentachlorophenol, but did not produce bovine hyperkeratosis.

The attention of some workers was given early to attempts at experimental production of the disease with feed which animals were receiving where cases of the disease were found. Olson and Cook (27) of Nebraska studied a severe loss from bovine hyperkeratosis which took place in Nebraska in calves being wintered on pellets and hay. Control calves on the same prairie hay remained well. There were 150 calves receiving pellets of which 130 developed bovine hyperkeratosis and 47 died. Olson and Cook (28) proved there was a toxic substance in these pellets which produced bovine hyperkeratosis when eaten by calves. Olafson and McEntee (25) of Cornell found by numerous feeding trials that a suspected processed concentrate proved to be an active and rapid cause of the disease. McEntee, Hansel, and Olafson (20) later found that the ether extract of the processed concentrate produced bovine hyperkeratosis when fed to calves. The ether extract residue and the phenolic and neutral steroid fractions did not produce the disease. In these preliminary fractionation studies the active principle was contained in the free fatty acid fraction of the ether extract. Later Hansel, McEntee and Olafson (14, 26) found the active principle was not a fatty acid but was in the non-saponifiable fraction of the ether extract.

Miller, Bortree, and Shook (21) of the Pennsylvania station worked with a suspected timothy hay being fed when bovine hyperkeratosis developed in a herd. They took this hay to another area and proved that it contained a toxic principle which produced bovine hyperkeratosis. These workers also produced the disease with an ether extract of the Nebraska pellets obtained from Olson and with an ether extract of the processed concentrate obtained from Olafson. Miller, Bortree, and Shook (22) also produced it by feeding a different batch of a processed concentrate of the same type as was originally fed and tested at Cornell. This feed was produced later than the original processed concentrate.

Sippel (35) of Georgia fed this same type of processed concentrate but made in Savannah and found it did not produce bovine hyperkeratosis. Sippel (35) also produced the condition by feeding a different pelleted feed than the Nebraska pellets. These had been very strongly suspected as producers of many field cases of the disease in another area than Georgia.

Link (18) of Illinois fed pellets suspected of causing bovine hyperkeratosis in 31 Illinois herds in 1952. He found they produced bovine hyperkeratosis. Olafson and McEntee (25, 26) of Cornell found acute bovine hyperkeratosis followed by definite skin hyperkeratosis developed in one calf which had received no feed except its mother's milk. This cow had a mild form from long feeding of a bovine hyperkeratosis-producing processed concentrate.

Olson (30) of Nebraska found bovine hyperkeratosis developed in several calves which received milk from an affected cow. The work indicates that milk was a principal cause. Olson reported there was some evidence that the toxic material was biological in nature and that the history of the animals suggests there may be some hereditary tendency for this condition.
Prior to any experimental production of the disease in this country, Dr. H. W. Schoening, In Charge of the Pathological Division, U. S. Bureau of Animal Industry, at a conference in Europe learned of a possible X-disease-producing substance and made arrangements with German scientists to obtain some of these materials. He also made arrangements with the Economic Cooperation Administration for Dr. Kurt Wagener of the Hannover Veterinary College, Hannover, Germany, to come to the United States and survey affected herds in cooperation with the Bureau and the collaborators in the state agricultural experiment stations. Dr. Wagener also compared X-disease here with the disease he had encountered and experimentally produced in Germany. Wood which had been treated in Germany with a particular tank car lot of German wood preservative was brought to this country, constructed into a pen by Olafson (39) of Cornell, and calves were placed in the pen. These developed hyperkeratosis of the skin but no systemic effects and control calves on the same feed in an adjoining pen and cared for by the same attendant remained healthy. This same preservative was brought to this country, painted on other wood to which calves had contact, sprayed on calves, and fed to calves.

The experiment was planned and arranged by a committee consisting of Thorp, Olafson, Miller, Sikes, Schoening and Lee. Most of the work was done at Cornell under the direction of Olafson, but some of it was done at Penn State by Miller and Bortree. The animals were observed by the entire research group which attended the hyperkeratosis conference at Cornell, July 30–31, 1951. The disease was produced by all these methods with this German wood preservative which never has been sold in this country. Wagener (40) later published the work done in Germany with this same wood preservative. At the time the particular batch of German wood preservative was obtained the Bureau was informed that the regular commercial German wood preservative sold in Germany did not produce hyperkeratosis as compounded and neither did the various separate compounds used in its formula. On June 27, 1950, the Bureau was informed that this formula consisted of 79 parts chloronaphthalene, 1.5 parts p-oxydiphenyl, 4.5 parts perchlorkresol, and 15 parts Steinkohlenteerol (or creosote oil) as was announced by the Bureau to the collaborators concerned at that time. This information was later furnished to all the research workers on this disease in the Proceedings of the conference held on hyperkeratosis at Chicago in November 1950. Olafson (26) fed alpha-chloronaphthalene and it did not produce bovine hyperkeratosis. In August 1951 Danckworts (41) of Germany reported the German wood preservative contained 80–90 per cent of alpha-chloronaphthalene and also contained chlorinated cresol and naphthalene, and that the hyperkeratosis-producing wood preservative contained about two and a half times as much naphthalene as the regular commercial product. The tank car which was used to haul the one batch of hyperkeratotis-producing German wood preservative had previously been loaded with chloronaphthalene, alkylphenols, and crude cresols according to information received by the Bureau from the German authorities on May 29, 1951. In his survey work in this country, Wagener particularly directed attention to petroleum products, coal tar products, roofing paper, and wood preservatives as possible substances which should be tested when the history indicated they might contain the toxic agent. A number of such materials suspected
by field survey were fed to calves by Sippel (39) of Georgia, Schmidt (39) of Texas, Washko (39) of Indiana, Sugg and Gibbons (39) of Alabama, and others with negative results. Link (18) of the Illinois station found calves in one herd had eaten an asphalt roofing paper prior to developing bovine hyperkeratosis. He was able to produce bovine hyperkeratosis by grinding and feeding this particular asphalt roofing paper.

Washko, Green, and Donham (43) of Indiana produced bovine hyperkeratosis in four calves placed on a farm where the disease had previously occurred naturally. No cattle had been on the farm for the previous four months. The animals received no feed other than pasture and block salt.

Bell (1) of Virginia was the first to produce bovine hyperkeratosis with a petroleum product. This was being used as a chassis lubricant on trucks and farm machinery. He observed the calves were licking this lubricant from the springs of trucks to which they had access. He produced the disease by oral administration of the lubricant obtained at the farm, and with a new sample obtained from a dealer who sold the lubricant to the farmer. Bell (2) later worked in cooperation with the Sinclair Refining Company which manufactured the lubricant, and the Sinclair Research Laboratories, Incorporated. The lubricant with which Bell produced bovine hyperkeratosis was Sinclair Opaline Chassis Lubricant. Bell proved, with the help of the Sinclair people, that the substance in the original lubricant which produced bovine hyperkeratosis was a chemical additive. Bell then found by tests with calves that this chemical additive was a highly chlorinated naphthalene compound which had been used as an extreme pressure agent in the manufacture of the lubricant. In one of a number of cases produced by Bell with this lubricant, the calf received a total of less than 0.5 gm. of the highly chlorinated naphthalene administered in 15 gms. of grease during a period of seven days. As a result of this cooperative study the Sinclair Refining Company has ceased to use the highly chlorinated naphthalene as a chemical additive in the manufacture of Opaline Chassis Lubricant.

Sikes and Bridges (32) of the Tennessee station produced typical acute bovine hyperkeratosis with later pronounced hyperkeratosis of the skin and death with a highly chlorinated naphthalene compound which was called a pentachloronaphthalene. The lesions were typical of those seen in many field cases.

Olafson, Hansel, and McEntee (26) proved by fractionation and subsequent ultraviolet and infrared absorption tests that the toxic principle in the German wood preservative which produced bovine hyperkeratosis was a chloronaphthalene with a chlorine content slightly above what trichloronaphthalene contains. They also found a second compound, possibly trichlorobenzene.

The same findings of one cause being highly chlorinated naphthalene compounds, by these three stations, each working independently of the knowledge of the work on chlorinated naphthalene by the other two, increase the importance and value of the work. Olafson (26) later confirmed Sikes' work with pentachloronaphthalene by producing bovine hyperkeratosis with a highly chlorinated naphthalene compound. Sikes (33) later confirmed Bell's findings on lubricants by producing bovine hyperkeratosis by oral administration of a grease made by another company. He also produced marked hyperkeratosis of the skin by applying crank case oil to the
back of a calf once each week for eight weeks. In an earlier publication Harshfield and Rehfield (15) determined that a chronic dermatosis of cattle in South Dakota was due to oil applications. There was no systemic disturbance and no deaths reported. No symptoms other than those on the skin were noted. The condition produced by Harshfield was not bovine hyperkeratosis. Sippel (35) found Sinclair Opaline Chassis Lubricant was strongly incriminated in a field outbreak in Georgia during the time Bell was working on it at Virginia. He wrote to the company and learned that this was the same product with which Bell had produced the disease.

After bovine hyperkeratosis had been produced experimentally with the German wood preservative in this country, Bureau officials conferred with Dr. Paul Steiner, Pathology Department, College of Medicine, University of Chicago, and briefed him on the disease. Doctor Steiner is a member of the National Cancer Advisory Board. He suggested the oral administration of known cancerogenic agents to calves and also topical application to calves in the search for the finding the cause of bovine hyperkeratosis. Through Doctor Steiner and Dr. William Hueper, Chief of the Cancerogenic Section of the National Cancer Institute, two products were obtained for use. These were a special clarified slurry oil and a bunker C fuel. Both had been found to produce hyperkeratosis, papillomas, and carcinomas by topical application to mice. The clarified slurry oil had the higher cancer-producing ability. Sippel (35) of the Georgia Coastal Plain Experiment station administered each of these internally to calves over a period of time and made topical application of each to other calves periodically. He produced definite thickening of the skin with some hyperkeratosis of the skin, in a calf which received topical applications of the clarified slurry oil. If cases like this were seen in a herd, they would be confused by many with bovine hyperkeratosis. Olafson (26) of Cornell also fed both of these same products to calves without producing the disease.

Huffman, Duncan, Webster, Judd, Killham, and Thorp (17) of the Michigan station found that blood plasma ascorbic acid values in field cases of bovine hyperkeratosis were high. Miller, Bortree, and Shook (21) found high blood plasma ascorbic acid in experimentally produced cases to warrant the confirming of Huffman, et al, findings. This indicates that high plasma ascorbic acid is characteristic in X-disease.

Hansel, McEntee, and Olafson (14) found plasma vitamin A levels decreased rapidly after the substance which produces bovine hyperkeratosis is fed, and precedes the other symptoms. Plasma vitamin A levels went as low as 1.3 micrograms per 100 ml. When large doses of carotene were fed plasma carotene increased but plasma vitamin A did not. This suggests that the hyperkeratosis factor exerts an anti-vitamin A effect in part at least by interfering with the conversion of carotene into vitamin A. Olafson and McEntee (25) found the bovine hyperkeratosis-producing concentrate produced pronounced keratinization in bovine male and female reproductive organs. The normal epithelial lining of the ducts of the testes and the accessory sex glands of the male and Gartner's ducts of the endometrium of the female were replaced by stratified epithelium which had keratinized.

Olson, Cook, and Brouse (29) of Nebraska made extensive experimental studies on the reproductive ability of 94 heifers which had recovered from bovine hyperkeratosis. They found no permanent damage of the female reproductive tract as a
primary result of this disease. The recovered heifers were able to produce calves—each of the 94 heifers producing a calf. No unusual abnormality of estrus, length of gestation, or birth could be correlated with the previous symptoms of bovine hyperkeratosis.

Carll, Forgacs, and Herring (5) of the War Department's Chemical Corps laboratory at Camp Detrick, Maryland, reported on work on the role of microorganisms in a bovine hyperkeratosis-producing processed concentrate. They isolated an Aspergillus fungi from this concentrate. When this is grown on a similar processed concentrate which has been sterilized, it is toxic for cattle. Symptoms to date have been too acute, with death of the calves too early for them to develop hyperkeratosis of the skin. At this time it is premature to assess the relationship of this toxic-producing fungi found in the bovine hyperkeratosis-producing processed concentrate to the cause of bovine hyperkeratosis from eating certain livestock feeds. No cause of this disease in any livestock feed has been determined.

The experimental production of bovine hyperkeratosis has made it possible to learn more definite information about the symptoms and lesions. These have been well described by Olafson, (24) Olson, (27, 28) Gibbons, (6, 7, 8, 9) Morrill and Link, (23) Sikes, (33) and others. Some additional information on symptoms and lesions are being found from time to time as more experimental cases are produced and studied. Bovine hyperkeratosis is characterized by a gradually developing accumulation of hard, keratinous material which makes the skin thick, hard, inelastic, and wrinkled. The deep fissures and bold folds formed in the skin become so inelastic and hard that they are not reducible by stretching with the hands. There is often thinning, to complete loss, of hair of the affected skin. The regions of the skin most commonly affected are the sides of the neck, the shoulders, and withers. Other regions where the skin may also be affected are the inner surface of the thigh, the outer surface of the udder and scrotum, the convex surface of the ear, the dewlap, and the sides. In extreme chronic cases almost all the skin of the body may be affected and sometimes the skin of the legs.

If over a period of time sufficient bovine hyperkeratosis-producing material is taken in with the feed, or is given orally in capsules, or is administered by the stomach tube, or is placed directly in the rumen through a rumen fistula tube, there develop systemic symptoms before skin changes appear. The most common ones include listlessness, depression, excessive secretion of tears which often keep the hair wet below the eyes, drooling of saliva, a watery discharge from the nose, and loss of flesh. A rapid drop in plasma vitamin A often to very low levels has been found by some of the workers. There also often develops loss of condition, emaciation, a variable appetite, intermittent diarrhea, a dry scurfy skin, and raised proliferated areas, or wart-like lesions in the mouth. These are often found on the floor of the mouth, on the dental pad, hard palate, lips, tongue, gums, and on the inside of the cheeks. They have also been found on the muzzle, the margins of the nostrils, and in rare cases on the mucosa of the oesophagus. If the calf survives the systemic effects and does not die from secondary bacterial infection, pneumonia, or enteritis, the typical skin hyperkeratosis slowly develops, providing a total of enough of the toxic material is received.

The experimentally produced cases and the field cases commonly show cystic
swellings on the mucosa of the gall bladder, hepatic duct, cystic duct, common bile duct, and the large bile ducts. These experimentally produced cases and the field cases also commonly have proliferations of the small bile ducts of the liver, degeneration and fibrosis of the liver, dilation of the tubules of the kidneys, ulcers in the mucosa of the abomasum, and ulcers in the mouth. Additional symptoms and lesions have been found in experimentally produced cases and field cases in herds affected with bovine hyperkeratosis but further work is required before their exact relationship to bovine hyperkeratosis, as well as their importance economically can be properly evaluated. A few herds severely affected with bovine hyperkeratosis, and not affected with brucellosis, have had numerous abortions and stillborn calves, and considerable trouble from metritis, mastitis, and greatly reduced milk secretion. There have been two experimentally produced cases of bovine hyperkeratosis in cows by Sikes (33) in which abortion took place following administration of the toxic agent and the milk flow was greatly reduced and the cow was soon dry.

The symptoms and lesions shown will vary immensely according to the amount of the toxic substance the animal ingests or contacts, and the period of time elapsing while the toxic substance is being ingested or contacted. The concentration of the toxic substance in the feed eaten or in the compound with which the animal comes in contact will also cause variation in the symptoms and lesions. There are probably other factors not yet understood such as age, individual variations, ration the animal is receiving, and the medium or vehicle in which the toxic principle is suspended which may affect the form the disease takes. Calves and young cattle are more commonly affected but adults develop the disease.

From topical applications, or local skin applications, of known bovine hyperkeratosis-producing substances in diluted form to cattle, the research indicates that little or none of the systemic effects are produced. Typical hyperkeratosis of the skin develops and it is definite and very characteristic. Systemic effects do develop however when these same substances are fed or put in the rumen in other calves in proper amounts over a period of time. The skin hyperkeratosis will develop from this internal administration or feeding but it appears to require six weeks to two months or longer in most instances. Some calves during this time may develop secondary infections such as ulcers, abscesses, enteritis, and pneumonia, and die before that time. In the experimental production of the disease with a known bovine hyperkeratosis producing chemical such as highly chlorinated naphthalene, and with known bovine hyperkeratosis-producing livestock feeds and lubricants, calves and young cattle have died with the acute form of the disease before skin lesions appeared. It was then necessary to reduce the dose administered and increase the duration of the administration to get a production of definite skin hyperkeratosis.

There is also clinical evidence that in some herds more calves die from acute bovine hyperkeratosis than live to develop skin hyperkeratosis. The most recent extensive losses of this type on which work has been done have been in Wisconsin. The Wisconsin station also became one of those cooperating with the other stations and the Bureau of Animal Industry on this project when the disease became so prevalent last winter in that state. The University of Wisconsin and the Wisconsin State Department of Agriculture made a survey on the disease in that state. Dr.
Paul Phillips and Dr. H. J. O'Connell supervised the work, and a preliminary investigation was made. They found X-disease had been a serious ailment of cattle in Wisconsin during the winter of 1951-1952 and spring of 1952 and was one on which much research study was needed. In a press release August 1952 the University of Wisconsin reported the preliminary investigations had been completed. They found that in X-disease a factor or factors interferes with normal uses of vitamin A. In an experiment conducted they made use of a mixture of pelleted feeds gathered from several farms in southern Wisconsin and with these they developed the disease in several animals. They found that the blood vitamin A drops in X-disease to critically low levels and that the administration of vitamin A causes temporary improvement only. They reported that vitamin A only retards the progress of the disease and does not prevent its fatal termination regardless of the amount of vitamin A given. This is in agreement with the findings of Hansel, McEntee, and Olafson (14) of Cornell. There have also been other workers who have reported on testing plasma for vitamin A and on the use of vitamin A therapy in the treatment of bovine hyperkeratosis. Some work on this has been done by Olafson (24) of Cornell, by Gibbons (9) of Alabama, by Olson (27) of Nebraska, and by Webster, Duncan, Huffman, and Thorp (44) of Michigan, and others. All these trials have shown that vitamin A is not of much practical value in the treatment of affected animals. A number of other therapeutic agents including various sulfa drugs, antibiotics, and ointments have been used and results reported by Gibbons, (9) Olafson, (24) Olson, (27) and others on field cases of the disease without much value having been shown for any therapy tried. Bell (3) of Virginia has made some good suggestions to cattlemen regarding what they may do to prevent or reduce losses from bovine hyperkeratosis. He suggests these three steps: (1) Have an early diagnosis made on animals with symptoms so as to know as soon as possible if the disease is present; (2) remove possible sources of the toxic material to reduce losses; (3) do not unnecessarily expose cattle to compounds which might contain the bovine hyperkeratosis-producing substance. As Bell also states it can be seen that specific recommendations must wait until there is more information about the toxic agents. Once this knowledge is available it may be possible to remove those agents from materials to which cattle may be exposed as was done in the case of the lubricant or to keep cattle away from these materials.

Nothing has been found that has any value if animals with bovine hyperkeratosis continue to obtain the toxic factor or factors which produce the disease. If the toxic factors or factors are removed while the appetite remains and before pneumonia or other secondary infections develop, many animals will recover with good animal husbandry practices. Field cases of the disease have not been seen or reported in other species of animals in this country. Wagener (42) found some lacrimation and loss of hair in cats and dogs in Germany which had contact with wood treated with the hyperkeratosis-producing German wood preservative. Olafson and McEntee (25) killed sheep with the hyperkeratosis-producing processed concentrate, and obtained suspicious symptoms with it in guinea pigs and dogs (26).

The production of apparently the same disease with highly chlorinated naphthalenes may bring about the obtaining of more information on the toxic effects of this substance on domestic animals, both from the standpoint of ingestion and local
applications. Much is already known about its toxicity for humans and laboratory animals. However, it has not been proved what causes bovine hyperkeratosis in some livestock feeds. This may be a different disease, or a different organic toxicology or there may be a biological factor involved. Much has been learned about X-disease or bovine hyperkeratosis the past few years but there is definite need for additional research.

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REPORT OF COMMITTEE ON INFECTIOUS DISEASES OF CATTLE


Your Committee has considered its broad assignment and developed a non-standard report. The Committee of the preceding year obtained certain information concerning opinions on the relative importance of various infectious diseases of cattle. This year, six of the more important or more currently discussed diseases were selected and each assigned to a member of the committee for preparation of a concise review. This is intended to cover the present situation, diagnosis, control and recommendation.

CALF DIPHTHERIA (REPORT BY DOCTOR SAUTTER)

The term calf diphtheria is applied to an infection of the mouth, tongue, larynx and pharynx of calves and to a lesser extent older cattle. The disease is caused by Actinomyces necrophorus but certain bacteria and viruses have been incriminated. The name calf diphtheria is a misnomer, but is so firmly entrenched in the literature that it seems unwise to attempt different terminology in the absence of definitive research.

History. Calf diphtheria was first reported in 1876 by Dammann who believed it to be identical with diphtheria in man. Loefler in 1884 isolated and described the cause of human diphtheria. The two conditions have since been recognized as two unrelated diseases.

Etiology. The organism Actinomyces necrophorus, which is thought to be the cause of calf diphtheria, has numerous synonyms which have been given it by various investigators.

The organism is believed to be a normal inhabitant of the intestines of swine and probably of other animals. March and Tunnicliff¹ were able to demonstrate the organism in the soil ten months after infected sheep had pastured upon it but they were unable to demonstrate it after a second ten-month period. The organism probably does not multiply in the soil but is able to survive for an extensive period over quite rigorous climatic conditions.

Actinomyces necrophorus is not easily cultivated on artificial media. Media containing cooked meat or brain have been most successful.

Other microorganisms are apparently associated with A. necrophorus in the lesions of calf diphtheria, as shown by Ryff and Lee². These investigators isolated enterococci, pyogenetic streptococci, staphylococci, micrococcii, and corynebacteria together with saprophytic bacteria from the lesions of naturally occurring cases of calf diphtheria. Ryff and Lee caused lesions in rabbits' lips by injecting A. necrophorus together with other potential pathogens. When this organism was passed through animals and the amount of inoculum increased, the lesion was produced in
rabbit lips. Certain staphylococci and corynebacteria alone were able to produce the lesion but not with regularity. These data suggest possible relationships or trigger mechanisms which should be further investigated.

The organism is believed not to penetrate unbroken skin and mucous membrane but does gain entrance through breaks in the surface tissues. Teething in calves and feed containing coarse material such as awns, beards, and thistles are thought to be significant.

Transmission. The disease appears more often in animals maintained around barns and corrals. This is believed to be due to infection through contaminated surroundings. The disease spreads in a herd quite readily but not from one herd to another. The condition occurs with greater frequency in the winter months and less often in cattle on summer range; however, there are exceptions. Likewise the condition occurs with greater frequency in cattle housed in unsanitary surroundings but serious outbreaks occur under well managed sanitary situations.

Symptoms and Lesions. Some of the symptoms are inappetence, languor and slight elevation in temperature. Swelling occurs around the affected parts which are generally the mouth and throat. A toxin is produced which has a systemic effect on the animal. The lesion produced is mainly fibrinonecrotic. Membranes are yellow, have a disagreeable odor and in many instances the superficial portion sloughs leaving a raw ulcerated surface. Histologically there is an abundance of neutrophils and mononuclear cells in the area.

Prophylaxis and Therapy. According to what is known about A. necrophorus and its behavior in causing disease it seems wise to continue advising sanitation and good management.

The sulfa drugs have been used quite successfully in treatment of various diseases thought to be caused by A. necrophorus. Foot rot in cattle is one of the most outstanding.

Hayes and Wright in Montana recently described an outbreak of diphtheria involving 2,785 of a total of 4,095 calves and feeder cattle. Typical lesions were present in 66 per cent of treated animals. Complete recovery was reported in 99 per cent of the animals treated. Of the smaller number failing to respond, retreatment brought about complete recovery. The dose of sulfamethazine was 3/4 to 1 1/2 gr. per pound of body weight for two days.

Coccidiosis of Cattle (Report by Doctor Cunkelman)

Coccidia of cattle are parasites of the intestinal epithelium and often cause marked destruction of that membrane with sloughing, hemorrhage, symptoms of acute enteritis and diarrhea. The infection is harbored by practically all the adult cattle and a resistant form of the organism known as an oocyst escapes in the feces to be picked up under favorable conditions and reinfect the former host or other animals of the same species. Reinfection with the same species of coccidia may not cause clinical symptoms because of a resistant state due to the earlier infection but the animal serves as a carrier until reinfection ceases and the organisms are eliminated.

According to Morgan and Hawkins, 12 species of coccidia are infective to cattle, namely Eimeria zurnii, E. bovis, E. ellipsodalis, E. bukidnonensis, E. cylindrica,
E. canadensis, E. auburnensis, E. subspherica, E. alabamensis, E. brasiensis, E. iledefonsii, and E. Wyomingensis. Boughton states that E. zumii, E. bovis and E. ellipsoidalis are of greater economic importance than the others.

Davis and Bowman state that coccidiosis in cattle causes far more damage than most people realize. A veterinary committee on parasitology (Swales et al., 1948) in a report to the American Veterinary Medical Association, listed coccidiosis as the third most important parasitic disease of cattle. Simms, Boughton and Porter (1942) found coccidiosis to be one of the important factors in persistent diarrhea of calves from one to three months of age. Davis and Bowman note that many treatises on diseases of calves fail to list coccidiosis as a cause of scours.

It is interesting to note that in 35 replies to a questionnaire on this disease sent out recently by the writer, not a single respondent believed that the disease was on the increase in his area. In one state (Florida) it was said that the disease is diagnosed more often than formerly but this was attributed to a better appreciation of the problem and more accurate diagnostic procedures rather than an increase in the disease.

In general, the husbandry practices of an area are indicative of the incidence of coccidiosis. The disease is most apt to occur when young animals are crowded into small areas and proper sanitation is not observed. The disease is seldom seen in cattle grazing in adequate pasture areas or in confined cattle when sanitation is optimum. Feeding practices which permit contamination of feed with feces greatly increases the probability of an outbreak. Range calves and yearlings placed in filthy feedlots often suffer acute attacks of the disease. The practice of feeding hay on the ground to cattle just placed in a feedlot often results in an outbreak.

A contaminated water supply not uncommonly is incriminated in acute outbreaks. Shallow ponds and muddy water holes below overflowing tanks and troughs are dangerous in this respect, particularly if the infection has previously been encountered on the premises.

Much less common but very severe outbreaks of the disease are found under conditions of sanitation which cannot be criticized. These typically occur in high class dairy barns and where either beef or dairy cattle are being fitted for show. These attacks are usually limited to one or a very few animals of the group and are believed to be precipitated by intensive feeding practices.

The symptoms of acute coccidiosis are very much the same in all classes of cattle. Diarrhea is universally present and some degree of blood staining is characteristic. This may vary from none to cases where the passage consists almost entirely of a mass of mucus, sloughed epithelial structure and blood clots. Due to the irritation, straining may be severe. Some cases do not show any blood in the discharges but there is a very watery diarrhea. Badly soiled tail and hind quarters are characteristic. Inappetence, dehydration and a rapidly progressive weakness suggesting early death are common. The clinical picture in subacute cases is much the same although of lesser severity.

The diagnosis is confirmed by the finding of large numbers of oocysts upon microscopic examination of the bowel discharges. Experienced clinicians readily recognize acute outbreaks by the symptoms, but microscopic confirmation is always desirable.
The correction of husbandry practices to prevent spread of infection and reinfection is basic in handling an outbreak. Medications are directed at eliminating the specific infection and for protecting and promoting repair of the injured membranes. The sulfonamides, particularly sulfaquinoxaline, sulfamethazine, or sulfamerazine, are useful in combating the infection. Bismuth in oil, tannic acid and copper sulphate, catechu, and powdered charcoal are used for their effect on the membranes. Enemas of a solution of sulfaquinoxaline are used in cases of rectal coccidiosis in mature animals.

Good nursing and supportive therapy of blood transfusions, dextrose injections and stimulants are of marked value.

**BOVINE LEPTOSPIROSIS (REPORT BY DOCTOR RODERICK)**

The problem of leptospirosis is an intriguing one. Certain aspects of the disease, the hemoglobinemia, the hemoglobinuria, the icterus, the abortions and the sharp drop in milk production in dairy cattle affected with the disease are significant. Some of these features in young beef cattle are not so obvious, however.

Certain aspects of the pathogenesis and epidemiology of the disease still remain puzzling and there is need of further basic fundamental work. Unquestionably, this problem is of considerable significance on some farms in widely scattered areas. A rather high morbidity with considerable mortality was observed in cattle which undoubtedly were affected with this symptom complex in Kansas, Oklahoma and contiguous territory as early as 1941. It is logical to conclude that there are a varying number of inapparent subclinical cases as well as surviving carrier animals. Favorable field reports from the use of penicillin and aureomycin lend encouragement for the use of antibiotics in the treatment of clinical cases.

A logical program for the prevention of the spread of the infection is contingent on further information on the means of spread and the pathogenesis of the disease. There is need of further field studies to correlate the preliminary serological observations with the characteristic symptoms and pathological findings. A successful means of immunization, if attainable, will be a distinct accomplishment in the control of the disease.

**LISTERIOSIS (REPORT BY DOCTOR OLSON)**

Listeriosis was first recognized in 1926 as an infection among laboratory rabbits and guinea pigs in England. The following year it was found as an infection in the gerbille, a rodent of South Africa. In 1931 it was found as an infection in sheep of Australia. During the years from 1935 to 1940, a number of reports indicated this infection was occurring among chickens, sheep and cattle in the states of New Jersey, Connecticut, New York, Iowa and Illinois. The natural infection has also been found in horses, goats, swine, foxes, ferrets, raccoons, and man. Olafson (5) reported 25 outbreaks in sheep, 13 in cattle and two in goats during a ten-year period in the vicinity of Ithaca, New York. He suspected silage was associated with the outbreaks but did observe the disease where silage was not fed to animals.

Graham et al. (1) reported observations on seven outbreaks of the disease in sheep and eight outbreaks in cattle. The mortality varied from about three to thirty percent of the herds or flocks. Three of the outbreaks in sheep and three of the out-
breaks in cattle were associated with the feeding of silage to the herds. Jensen and Mackey (4) obtained information on seven outbreaks in sheep and 32 in cattle during two feeding seasons in Colorado. In large groups of animals from 3 to 15 per cent of sheep were affected and from 0.03 to 7.5 per cent of cattle. Gray, Stafseth and Thorp (2) reported that of 52 cases coming to their attention during a four-year period in Michigan, 29 occurred in sheep and 23 involved cattle.

Relatively few outbreaks have been reported among chickens. In the chicken, as well as in laboratory animals and some of the wild rodents, the disease seems to be of a generalized character whereas in cattle and sheep it appears primarily as an encephalitis, localized in the brain stem. A few cases have been reported in swine where the infection may be secondary. Listeriosis of sheep and cattle occurs more often during the winter months from December to March than at other times of the year. In these large animals the symptoms are those of an encephalitis with an elevation of temperature. Common symptoms are stupor, drooping of an ear, paralysis of the jaw, imbalance of ocular muscles and sometimes a keratitis. Animals that go down often prefer to lie on one side.

The mode of transmission is not known. A reservoir of the infection or contamination of the soil might be suspected since the disease tends to recur on the same premises from year to year. Various therapeutic agents have been tried. So far, none has been outstandingly successful. Laboratory tests with streptomycin (3) were not encouraging. Penicillin, chloromycetin, and streptomycin had very little in vitro effect on the Listeria organism whereas terramycin and aureomycin had more effect (6).

Aureomycin seemed to give some promise in laboratory trials but a cow with listeriosis and treated with aureomycin died (6).

Listeriosis may be a more common infection among domestic animals than is realized. Veterinarians in practice must be aware of the possibility of this infection. Until one becomes familiar with the disease, isolation of the organism by a laboratory is required for diagnosis. A sound approach for the control of the disease is not known and must await the results of studies on mode of spread and pathogenesis of the infection. As judged from the current literature, four agricultural experiment stations (Michigan, Colorado, North Dakota and Nebraska) have active programs of research. Occasional cases of listeriosis are being recognized in man. These are usually infections of infants which seem to be a generalized type. The Listeria organism must be regarded as capable of causing disease in a wide variety of animals. It is also widely scattered geographically. It may be an opportunist in its character of causing disease. The circumstances and factors leading to its opportunities for infection may be the avenues for effective control of the disease.

BOVINE MASTITIS (REPORT BY DOCTOR MURPHY)

Bovine mastitis is one of the large economic problems of dairy cattle; it is a disease familiar in some degree to everyone associated with such livestock, yet each one's knowledge and thoughts differ more than is probably the case with any other major disease.

Until 1940, research on the disease was building a picture having three broad parts; (1) Streptococcus agalactiae was shown to be the main cause of the chronic
form, and was shown to be probably eradicable from herds through proper application of cultural tests and elimination. (II) Injuries and abuses of various kinds were shown to have an important place in the disease, in that injuries usually result in a more acute mastitis caused by organisms other than Str. agalactiae. (III) This part has never been adequately clarified, but it consists of chronic and acute mastitis not due to gross injuries and not due to Str. agalactiae.

The advent of the "treatment era" with its penicillin so highly effective against Str. agalactiae, should have added great impetus to the attack on part I of the picture; it should have greatly alleviated damage under part II; and the research potential should have been turned to part III. Oddly enough, part I has received no great impetus and appears to have been largely forgotten, part II has in fact been greatly alleviated except that no real advances have been made in preventing injuries, and part III is as much of a mystery as ever since the research potential has been devoted almost entirely to the wild search for new and more effective treatments. In spite of some gains, it is doubtful whether any real progress has been made during the last ten years, even though millions of doses of therapeutic mixtures have been applied to the inside of countless numbers of udders.

In the last ten years, programs for the control of mastitis have been started in several states. Here again, the confusion that exists regarding this disease becomes manifest, as such programs can be divided into three categories. One extreme is represented by the control program that is based almost entirely on preaching "correct" herd management, with little or no attention being paid to bacteriological knowledge. The other extreme is represented by the program based on our best knowledge and has concentrated on the eradication of Str. agalactiae. This group has probably profited most by the true value of antibiotic treatment. The middle group is composed of the program that pays some attention to all aspects, but risks the danger of not paying enough attention to our knowledge of Str. agalactiae. Without exception, none of the concerted programs has set aside sufficient money to properly add to our knowledge of the lesser-known aspects of the disease.

Obviously, the main thing that is lacking is a satisfactory agreement on what the proper approach should be. There has been a notable lack of any leadership on the part of our national agencies, such as the American Veterinary Medical Association, The United States Livestock Sanitary Association, the Federal Bureau of Animal Industry, and possibly the American Dairy Science Association. As long as there is not a strong national leadership it is only natural that the various states will continue to meet the problem as they happen to see it. The longer this continues, the more difficult will be the final resolution of the matter.

VIBRIOSIS (REPORT BY DOCTOR HOPSON)

The status of bovine vibriosis is very uncertain in the state of New York. Since 1949 when a herd infected with this disease was first noted, the Bureau of Animal Industry of the state of New York has attempted to work out satisfactory tests and methods of control.

Not much has been done on vibriosis since the original work of Dr. Theobald Smith 20 years ago. Reports from the New York Bureau of Animal Industry state that antigen used by Dr. W. M. Plastridge, Storrs Experiment Station, Connecticut
and Dr. W. M. Thomson of their own laboratories contained variant strains and changed in sensitivity soon after preparation. As a result, tests showed up to 100 per cent infection in most herds. Because of the high rate of infection, it was observed that something was wrong. In the spring of 1951, the state Bureau of Animal Industry worked out a plan with Cornell University whereby the institution would assume the responsibilities for working out methods for detecting the disease and its control. Dr. Herbert L. Gilman, professor of veterinary bacteriology, reports as follows:

"About five years ago the profession and livestock raisers were very much concerned about the widespread nature of the disease as diagnosed by the agglutination test. We have never felt the test to be of any great value as a diagnostic agent and were never in favor of more than an occasional experimental test to establish the presence of the disease in the herd. At first it was thought to be primarily a disease causing abortion, whereas now we find it to be associated with delayed conception and sterility.

"The disease seems to be widespread throughout this as well as other states, but we can never be sure how serious and how widespread it is because of the lack of value of blood tests and the fact that recovery of the organism seems to be the only sure means of diagnosis.

"Various means to control the disease have been advised, such as a three-month period of sexual rest, systemic treatment with penicillin, and the injection of streptomycin in the uterus at the time of estrum. These all seem to give reasonably good results. We are by no means certain as to the infectious power of the organism. We are not certain that the organism alone can do damage. It may be an opportunist and operate only in the presence of some other agent such as a virus. Is our treatment effective because it kills vibrio or merely because it kills the other organisms that might also be associated with the disease?

"We at Cornell are at present engaged in pursuing the problem from several angles. The following are some phases that we are now undertaking:

(1) Will the semen extendors as now constituted, containing antibiotics, kill vibrio and therefore prevent the spread of the disease by artificial insemination? If not, what antibiotics, and in what concentrations, will do the job?

(2) Attempt to reproduce the disease artificially and to learn something of the nature of the disease and better methods of diagnosis.

(3) The extent to which the bull disseminates the disease. In this work we are culturing samples of semen in an attempt to recover the organism.

(4) Better means to diagnose the disease by use of the blood test, through culture of infected material and the detection of antibodies in uterine mucus."

It will be noted that the need for additional research is stressed with four of the six diseases reviewed. Encouragement for good research on problems of animal disease must be forthcoming or we shall continue to have unnecessary losses. The encouragement must be in the form of readily available funds for research laboratories in order that they may conduct the work and also to attract personnel to do this type of work. At present relatively few graduates from veterinary colleges (trained for clinical practice) enter into the additional training required to develop them into good research workers. Without the additional training, research tends
to become a gesture and does not delve into the basic aspects of the problem. The significant advances must, of necessity, come from increased basic knowledge.

REFERENCES

Calf Diphtheria


References read but not cited


Coccidiosis

6. Personal communications with thirty-five states.

Listeriosis

A brief history of the development of hog cholera vaccines is appropriate. Hog cholera first appeared in this country in Ohio in 1833 and soon spread throughout the nation. The disease reigned unchecked until 1908 when the serum and virus method of vaccination was developed by U.S. Bureau of Animal Industry workers. This was truly an epoch in the history of the swine industry for without a method of protecting hogs against cholera swine raising could not have developed to the extent that it has today. When it became obvious that the use of virus in the serum and virus method would necessitate living with the disease, efforts were begun to find another method of immunizing pigs. These efforts were culminated successfully in 1933 when Boynton’s (1) tissue vaccine (BTV) was developed, followed shortly by the introduction of crystal violet vaccine (2) (CVV). Since the date of the development of the inactivated vaccines it has been possible to eradicate cholera in this country. The idea of eradicating hog cholera had never occurred to most laymen and was referred to only occasionally by veterinarians (3), (4). However, through the efforts of certain veterinarians and some farm magazine publicity the idea began to grow and reached the point where, in 1950, a committee was appointed by the United States Livestock Sanitary Association to investigate the possibility and formulate means by which hog cholera could be eradicated from the United States.

While BTV and crystal violet vaccine could immunize pigs against cholera for approximately one year, they had certain serious drawbacks, namely, they required two to three weeks to develop an immunity and they could not be used in exposed pigs as the simultaneous use of these products with serum did not result in sufficient immunity. Compared with the extremely durable immunity engendered by serum and virus, these vaccines produced a relatively weak immunity although it would withstand the usual type of field exposure.

Attempts were made to use these products simultaneously with serum and Boynton (5) reported some success along this line. However, Edgington (6) and Sippel and Boyer (7) were unable to confirm these results. The latter workers also attempted to immunize pigs with crystal violet vaccine and serum. The vaccine was given intravenously and the serum subcutaneously. These tests also failed. Bureau workers (8) were unsuccessful with serum and CVV given subcutaneously.

In 1946 two articles appeared in the same number of a journal (9), (10) announcing the successful modification of the hog cholera virus. As a result four modified hog cholera vaccines of two general types are now on the market. A fifth and possibly more are in the process of development.

1 Contribution of the Department of Animal Diseases, Georgia Coastal Plain Experiment Station. Published with the approval of the Resident Director as Journal Series Paper No. 5.

2 Department of Animal Diseases, Georgia Coastal Plain Experiment Station, Tifton, Ga.
Vaccine Trial

In selecting a vaccine to use on our Station pigs, it was decided that one which could be used with serum would probably be safer; accordingly MLV (Ft. Dodge) and serum was chosen. A small scale immunity trial with the facilities at hand was conducted.

Pigs were vaccinated two weeks before weaning, at weaning and two weeks after weaning. Pigs of each age group were given MLV and serum or MLV alone. Daily white blood cell counts and temperature readings were taken on pigs in each group. Only one pig out of six developed a leucopenia following the use of MLV and serum. This pig was vaccinated at weaning. Biester and Schwarte (11) reported temperature recordings on five pigs that received MLV and serum. Three out of five of their animals developed temperatures over 104.

Table I summarizes the results of challenge of the vaccinated pigs with hog cholera virus 30 days and six months after vaccination.

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<thead>
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<th>Vaccinated with MLV + Serum*</th>
<th>Died</th>
<th>Visible Reaction-Recovered</th>
<th>Immune</th>
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<td>%</td>
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<tr>
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<tr>
<td>Vaccinated 2 weeks after weaning</td>
<td>0</td>
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*1 died pneumonia-enteritis, 1 of cholera.

None of our control pigs confined to eight foot square concrete floored pens with the MLV and serum vaccinated animals developed a leucopenia and all contracted cholera and died when challenged. The reverse was true of the controls with pigs given MLV alone. These control pigs all developed a drop in the white blood cell count after vaccination of their pen mates and, when challenged, all were immune. Table I summarizes the results of challenge of the vaccinated pigs with hog cholera virus 30 days and six months after vaccination.

New Vaccine Troubles

At this meeting last year manufacturers of the new vaccines reported on the results of their field trials (12), (13), (14). These tests looked very good indeed. Certainly the use of a modified, antigenic vaccine is theoretically sound. It was hoped these products would be the ideal immunizing agents and produce an immediate, solid, long lasting immunity without danger of over-reactions or spread of cholera to other susceptible pigs. The agitation for the eradication of hog cholera plus adequate accounts of the new products in the farm journals set the stage for
an insistent demand for the new products by the swine raisers and their wide acceptance by the profession. As a result over eleven million doses of hog cholera vaccines were sold during the 12 months preceding July 1952. Most of these were probably the modified virus types.

As was to be expected, trouble cases developed, and during the first five months

<table>
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<th>NO. PIGS</th>
<th>VACCINE</th>
<th>NO. SICK</th>
<th>NO. DEAD</th>
<th>PER CENT OF DROVE</th>
<th>TIME OF ONSET AFTER TREATMENT</th>
<th>W.B.C.'S</th>
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<tr>
<td>51</td>
<td>Rovac</td>
<td>6</td>
<td>5</td>
<td>21.5</td>
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<td>—</td>
<td>Rovac</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>10-12 days</td>
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<td>1</td>
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<td>56</td>
<td>MLV</td>
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<td>—</td>
<td>20</td>
<td>25.0</td>
<td>21 days</td>
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Number of cases of trouble in modified virus vaccine treated pigs in which history was not complete, pigs were sick at time of treatment, were sales barn-treated or were ill too soon after treatment or for some other reason vaccines could not be definitely involved in the trouble.

Rovac 13
MLV and serum 6

of 1952 we received 32 groups of hogs previously vaccinated with one of the new vaccines on which a diagnosis of hog cholera was made based on the history, symptoms, lesions, and a low white blood cell count. This is only a very small fraction of the trouble cases involving the new vaccines that occurred in our section.

Table two lists 13 cases where the reason for the trouble was not apparent. In addition there were 19 cases where the history was not complete, there were sick pigs at the time of treatment, the pigs were sales barn treated without the use of serum, were ill too soon after treatment, or for some other reason there was reason-
able doubt that the failure of immunity to develop involved the vaccines. In the 13 cases where vaccine failure appeared to be a possibility, there were five instances where the trouble appeared during the so-called reaction period, four to 14 days following vaccination. (Aitken (15), (16) has called attention to this type of reaction). In the other eight cases the trouble developed 21 to 120 days after vaccination. An average of 32.1 per cent of the pigs in the droves having trouble in the "reaction period" were involved whereas 29.1 per cent of the pigs in droves affected after immunity normally has developed became sick or died. As these figures were obtained during the course of the trouble, they undoubtedly became higher as the condition ran its course.

The reason for the trouble in the cases listed in table two was not apparent. These pigs were healthy at the time of vaccination as nearly as could be determined. It will be noted that 76.9 per cent of the trouble cases involved vaccines with which serum was not used. As we do not know the relative amounts of the "serum" or "no serum" vaccines used in our area we cannot say if this is a real or only an apparent balance in favor of the vaccines with which serum is used. Judging by the experiences of practitioners who have used both types, one would suspect that it is real. Biester and Schwarte (11) reported "over-reaction" trouble with both types of vaccines. As all pigs presented for vaccination do not meet the health standards the manufacturers of biological products and practitioners prefer, certainly a dose of serum given to these pigs along with whichever vaccine is used will help them withstand any potential "over-reaction." It was gratifying to learn that now all manufacturers of the modified vaccines either require that serum be used with their products or indicate that it can be used with them if desired.

In an attempt to better understand some of the over-reactions that took place in pigs from apparently healthy droves, we inoculated susceptible pigs with spleen material from animals from the droves in question. No reaction was observed in the inoculated pigs. However, when these pigs were challenged with virulent virus, they were immune. Biester and Schwarte (11) reported the same experience. While this does not explain the trouble in the original pig it tends to indicate that modified virus was in its spleen and possibly caused the over-reaction.

The "over-reaction" of apparently healthy pigs raises the question of varying degrees of susceptibility of different groups of pigs to the modified viruses. The question of susceptibility has been touched on by Mitchell and Gwatkin (17). These occurrences also raise the question in one's mind, depending on one's point of view, as to (1) if the hogs were really healthy, or (2) if the vaccines are sufficiently attenuated for use in the field on all healthy pigs, or (3) if variants of the hog cholera virus are playing a part in the troubles. Biester and Schwarte's (11) experiments suggest that the new vaccines will not protect against all variants. With the new vaccines, as with all biological products, some failures to immunize for reasons unexplainable at present must be expected. It is hoped that further experience and research will furnish the answers.

Demand for the new vaccines ran high among veterinarians and swine raisers in our section prior to and at the time they were released for use by the public. At one time during the late fall 1951, and early spring 1952 vaccination season, the majority of veterinarians had changed to the use of one of the newer vaccines. There
EXPERIENCES WITH HOG CHOLERA VACCINES

has now been a partial retreat to serum and virus. This has been due to "over-reactions" in vaccinated pigs and some apparent failures to immunize. A more recent development has been the appearance of cholera in pigs treated in the spring with a new vaccine after these pigs had been exposed to early fall pigs vaccinated with serum and virus.

DISCUSSION

A resume of the occurrences referred to in this paper suggests that if practitioners will bear in mind that in the new vaccines they are still using live viruses and will use them with the same care they use serum and virulent virus, fewer trouble cases will result. Apparently the new vaccines have been used on droves where the practitioner has been afraid to use serum and virus. This is indicated by the almost uniformly good results in experimental pigs in contrast to the trouble cases in less carefully selected animals. This practice has posed a severe challenge to the effectiveness of the new products. Possibly there has been a subconscious tendency to place these products in the category of the inactivated vaccines (BTV, CVV) rather than in the group with serum and virus. Some practitioners have apparently experienced trouble in spite of careful selection of pigs for vaccination. These relatively few cases indicate that there is still much to be learned about the new vaccines and hog cholera in general.

Although it is not clear whether or not the new products will prevent the spread of cholera to unvaccinated pigs under all circumstances, it will probably be accepted without challenge that the modified viruses are not as infectious or as invasive as fully virulent hog cholera virus. This fact gives the new vaccines a definite advantage over serum and virulent virus and will allow them to be used in the fight to eradicate hog cholera that was initiated by this organization. It should be emphasized that while the new products are modified viruses they have not been modified to the point of innocuity. The same care should be taken in their use as regards the health and condition of the hogs to be treated as is taken with serum and virulent virus. The "over-reaction" experiences of the past year may indicate that further attenuation of the viruses is desirable if it can be had without the sacrifice of the required amount of antigenicity. The apparent failures to immunize may indicate the desirability of attempts to widen the protective spectrum of the vaccines by the inclusion of more than one strain of modified virus in the vaccine.

It is obvious that rather than finding the answer to the hog cholera problem we have found many more questions. This is a healthy sign indicative of progress.

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GARBAGE FEEDING CONTROL IN CANADA

ORLAN HALL, V.S., D.V.M.¹

In dealing with this subject, it is interesting to review the evidence which prompted the institution of legislation for control of feeding of collected garbage to swine. As far back as 1903, it was suspected that the feeding of uncooked city garbage was responsible for outbreaks of hog cholera in Canada and, in order that you may have some information with regard to the early information which was collected, I quote a portion of a report, dated March 31, 1912, to the then veterinary director general, the late Dr. J. G. Rutherford, by the late Dr. A. E. Moore, who was at that time chief travelling inspector for Canada:

"I have the honor to inform you that in accordance with your request, I have prepared a brief report with reference to outbreaks of hog cholera which I have dealt with, the origin of which is undoubtedly the feeding of uncooked city garbage and hotel swill.

"The first outbreak of this kind that came to my notice occurred at Sudbury, Ont., in June 1903. Four premises were involved, 85 hogs died and 14 contacts were killed. Two of the owners were hotel men, feeding the swill from their own houses, the third owner a woman feeding swill collected around the town, and the other was a butcher who bought a lot of hogs from this woman. There was absolutely no other source of infection traceable. All the other hogs in the community were healthy and no outside hogs had been recently introduced into these herds.

"In November 1903, there was an isolated outbreak in a herd at Collingwood, Ont.; no source of infection could be traced, but the owner was feeding the refuse from the packing house. At this time there was more or less hog cholera scattered throughout Western Ontario, and it is quite possible that infected hogs may have been sent to the Collingwood packinghouse.

"In August and September 1908, another outbreak occurred at Sudbury and Copper Cliff, starting on two farms where owners were feeding slaughterhouse refuse and hotel swill. At first it was suspected that the disease was brought from near Wallaceburg, Ont., but a careful investigation was made on the premises where the hogs originated at Wallaceburg and no trace of hog cholera was found.

"In August 1908, hog cholera occurred on a farm at Toronto. Some 400 hogs died and 717 sick and contacts were slaughtered. The manager informed me that he had not bought a hog for nearly a year, and then only some boars from a farm where hog cholera had never been known to exist. No other hogs had come in contact with his since then.

"The owner fed his swine on hotel refuse. On examining this refuse I found it contained nearly every conceivable thing, such as uncooked pork rinds, ham and sausage, poultry bones and bacon, chicken and other fowl viscera, beef refuse, mutton and veal refuse, besides all kinds of vegetables and slops.

"I am at a loss to know the origin of this outbreak unless it came through contaminated food.

¹ Assistant Veterinary Director General, Ottawa, Ont., Canada.
"In December 1908, another outbreak occurred near Toronto, where 73 hogs died. No other source of infection could be attributed except from feeding the uncooked city swill.

"In January 1909, two more outbreaks occurred near Toronto. No source of infection could be discovered and both parties were feeding uncooked hotel swill. These two premises were several miles apart and there was no communication between them.

"In September 1909, quite a serious outbreak of hog cholera occurred at Ottawa. Fifteen premises were involved, 170 sick and contact hogs killed and 54 died. In every instance garbage-fed hogs were the victims; absolutely no other source of infection could be found. Farmers’ hogs in the same neighbourhood, which were never fed garbage, remained healthy.

"Later, in September of 1909, I was called to Toronto to investigate an outbreak of hog cholera at Weston, 365 hogs being involved. There were no contacts or recent importations. The hogs were fed on uncooked hotel garbage from Toronto.

"I carefully examined the garbage in both the Toronto and Ottawa outbreaks and I found a great many uncooked portions of pork, such as rinds from bacon and ham, sausages, spoiled pork chops, roasts and portions of ham and shoulders. I found in Toronto whole strings of raw, sour, mouldy sausages. The owner informed me that it was a frequent occurrence to find a bushel basket full in their garbage collection.

"In August an outbreak occurred at Sault Ste. Marie, and was principally dealt with by Inspector Perdue. I visited Sault Ste. Marie in September and I found, as did Doctor Perdue, that the outbreak was entirely among swill-fed hogs, and those in contact with them. No other source of infection could be found. Farmers' hogs in this neighbourhood not fed on garbage, remained healthy. The disease was found on twelve premises, 95 hogs died and 260 killed.

"Last September I visited Winnipeg, Man., on account of hogs dying of hog cholera near that city. In company with Inspectors McGilvray and Macintosh I made a careful investigation, and in every case found that uncooked garbage-fed hogs were the ones affected. There was absolutely no other source of infection that could be found.

"Three outbreaks occurred a little later at Helen Mines, Ont. At first it was thought that the disease might have been taken there from Sault Ste. Marie. This might have been true in one case, but the other two of these outbreaks were, as far as I could determine, not in contact at all with the Sault Ste. Marie hogs, but were fed on the swill from the railroad construction and mining camps.

"In October of this year quite a serious outbreak of hog cholera occurred at Fort William and Port Arthur. This outbreak, as well as those at Winnipeg, Sault Ste. Marie and Kenora, was confined wholly to hogs fed on uncooked garbage. The disease started almost simultaneously on all the different premises in this district. There was absolutely no communication nor exchange of hogs among these people and they were scattered in all directions.

"About the last of August or first of September the butchers of Fort William and Port Arthur ran very short of local pork (Canadian) and large shipments were rushed in from the Winnipeg packinghouses. It was from three to six weeks after
this, as far as I can learn, that the first hogs began dying near Port Arthur. I was told by the buyers that these shipments consisted largely of United States pork.

"I made a very careful investigation of the whole district in company with Inspector Fraser, with the result that 622 hogs were killed on 24 premises, valued at $5,500. Four hundred and seventy-five hogs died previous to our visit. The garbage-fed hogs in this district all developed the disease, with the exception of one lot. This lot was fed only a small quantity of garbage, which was obtained from a restaurant where only Canadian pork was used.

"I made an inspection of a large number of hogs not fed on garbage near Fort William and Port Arthur, but no evidence of hog cholera could be found. These premises at the Fort William and Port Arthur outbreaks are quite widely separate. All the garbage-fed hogs became sick about the same time, most of them the same week, and there was no communication between these different places.

"You will notice that all the western outbreaks of hog cholera occurred quite close together, the one at Sault Ste. Marie started in August, at Winnipeg in September, at Kenora and Fort William, the first part of October.

"It is interesting to note that immediately previous to these outbreaks a large quantity of outside pork was shipped into these towns by the Winnipeg packers, who all handle large quantities of United States pork.

"In conclusion, I wish to say that in my dealing with hotel swill-fed hogs, I have found the most repulsive conditions. The premises, with the exception of a very few, I found in a most unsanitary condition, many of them were indescribably filthy, and the stench almost unbearable, millions of flies swarmed around, rats, dogs and crows feeding off the decomposing garbage; in fact, everything reeking in filth.

"I believe that this material should not be allowed to be fed except under strict supervision, not alone from the serious danger of spreading the hog cholera infection, but also from a sanitary standpoint."

Doctor Rutherford in commenting stated that he was convinced that a thoughtful and unprejudiced perusal of the report would lead one with an open mind to the conclusion that the prevalence of the disease in the districts referred to may much more reasonably be attributed to the consumption of infected pork and pork products than to any other possible source. From the fiscal year ending March 31, 1912, until the fiscal year ending March 31, 1916, additional information was accumulated. The information over the years proved conclusively that the feeding of uncooked garbage was a frequent cause of hog cholera and had been responsible for many serious outbreaks of the disease. As a result, it was decided to limit this practice to those who were willing to cook garbage and to maintain their hogpens in a sanitary condition. Therefore, the following regulation was passed during the fiscal year ending March 31, 1916: "The feeding of swine upon garbage, either raw or cooked, obtained elsewhere than on the premises where fed is prohibited unless special permission in writing is first obtained from the Veterinary Director General."

Following the passing of this regulation, inspectors endeavored to have all persons engaged in the business of garbage feeding apply for a license which was issued by the Veterinary Director General. The above quoted regulation has been amended from time to time, and at present reads as follows:
"Unless special permission in writing is first obtained from the Veterinary Director General, no person shall feed to swine or permit swine to have access to or to be fed on his own premises, or on the premises of any other person, corporation or municipality, any garbage raw or cooked, composed of any of the following, namely, meat scraps, offal, kitchen waste, fruit or vegetable refuse, or other matter edible by swine, and which has been obtained elsewhere than on the premises where fed, or from any hotel or restaurant."

It is obvious that the law prohibits the feeding of collected garbage to swine unless the owner first has in his possession special permission in writing which is in the form of a license granted under the authority of the Animal Contagious Diseases Act and the regulations made thereunder. Application for license to feed garbage to swine must be on a form provided for that purpose. The owner must agree in writing: (1) to boil thoroughly all garbage before feeding it to swine, and to prevent his swine from having access to uncooked garbage; (2) to maintain his swine in a clean, sanitary condition; (3) to sell no hogs except for immediate slaughter; (4) to notify the Veterinary Director General without delay if sickness appears among his swine.

If the building in which the swine are to be housed is reasonably well constructed with good concrete or other flooring, well drained, ventilated, and lighted, and there is provided in a separate section of the building, or a separate building, a steam boiler with cooking vat or a cook vat mounted on a structure so that the garbage can be thoroughly cooked, then on approval of one of our inspectors the owner is granted a license. He can retain that license as long as he observes the terms of the agreement which he has signed.

Garbage being handled on the premises must be handled in such manner as to prevent uncooked garbage reaching the swine.

Each divisional veterinarian in sub-districts, with the assistance of lay inspectors, is held responsible for the enforcement of the regulations in his sub-district.

Regular inspections are made to see that all who hold a license are living up to the terms of their agreement. Should carelessness in this regard be detected the owner is warned and, if he does not readily comply, our officer reports accordingly and in most instances the license is promptly cancelled. If the owner then continues to collect and feed garbage to his swine, either raw or cooked, no time is lost in instituting prosecution proceedings against him.

In order to determine whether all garbage produced at hotels, restaurants, hospitals, and public eating places is collected by a licensed feeder, visits are made by our inspectors to such eating establishments to ascertain the method of disposal. Should it be found that the garbage is collected by an unlicensed feeder, steps are taken immediately to prevent its being fed to swine until such time as the owner complies with our regulations.

There is always the possibility of garbage being collected at roadside inns and the like without our officers' knowledge, but only for short periods before it is discovered and a stop put to the practice.

Again, there is always the problem of farm garbage which we cannot control. We do not consider this a serious problem although there is an element of danger.

We believe that the system followed in regulating the feeding of collected garbage
to swine, while not 100 per cent perfect, has been a major factor in the control of hog cholera in Canada.

Our records indicate that no cases of the disease have appeared in Canada since the fiscal year 1946–47 when 44 hogs were slaughtered for the disease, with the exception of an outbreak in the province of Newfoundland during the fiscal year 1951–52 involving two premises and the slaughter of 112 hogs. The source of infection is said to have originated from a United States military base where garbage obtained was apparently not properly cooked or reached some of the hogs in a raw state.

Apart from the control of hog cholera, it is obvious that the cooking of garbage is a major factor in preventing the dissemination of other virus and parasitic diseases of livestock and poultry which is of economic importance, not only to the livestock producer, but to the nation as a whole.

We, in Canada, have no thought of relaxing our regulations in connection with the feeding of swine on collected garbage. A backward step in this regard would be courting disaster for our livestock industry.

As you are no doubt aware, we do not permit garbage from foreign steamships or aircraft to be collected and fed to swine or other livestock. Garbage from foreign aircraft must be incinerated on arrival at a Canadian airport, and garbage from steamships must not be removed from the ship while in Canadian waters unless at designated points and then only for incineration under the supervision of one of our officers. We do not consider we can take the risk of introducing disease through this medium to Canadian livestock.
DISCUSSION OF DR. HALL'S PAPER

PRESIDENT WEST: You have just listened to a splendid exposition regarding Canada's method of the control of hog cholera, and it emphasizes the statements made yesterday, that the papers and reports referring to the proper cooking of garbage in this country should include the control of hog cholera as one of the principal reasons for cooking it.

Does anyone have a question to ask Dr. Hall, or is there any discussion of Dr. Hall's paper?

MR. RAY DANKENBRING [Farm Journal, Philadelphia, Pennsylvania]: Regarding your regulation, I wonder if you could tell us how many garbage feeding establishments you have to inspect, and how often you make the inspections.

DR. ORLAN HALL: Answering your question, sir, during the year ending March 31, 1951 we had 631 licensed garbage feeders. Those feeders are visited, in most instances, at least once a month, and sometimes more frequently. We have our country divided up into sub-districts. We have a man in charge of a province, and a veterinarian is in charge of a sub-district, which may take in one, two or three counties, as the case may be. He in turn has some laymen whose job it is, among other things, to inspect these garbage feeders, unknown to them, to find out whether they are fairly cooking the garbage or whether they are not.

Further, they ascertain if the premises are in a clean and sanitary condition. The inspector takes a casual look at the hogs, and if there are any hogs that do not look just right to him, he reports to the veterinarian immediately in charge of the district.

You must police it. You just can’t issue a license to a garbage feeder and never go near him again. If you do, you are defeating the very purpose of the law. You have to follow through.

In the past we have discouraged the feeding of garbage. First, it is a dangerous food to feed to swine, because in that food disease can be transmitted; so why do you want to encourage the feeding of it, especially to the little fellow? If the fellow can afford to equip his place, all right; but he must comply with the requirements.

PRESIDENT R. L. WEST: Are there further questions?

MR. FRANKLIN C. SMITH [Ohio]: How much heat do they use, and how long do they boil the garbage? Do you have any ruling on that?

DR. ORLAN HALL: When we say “boil”, we mean “boil”. It must be brought to 212°F. We don’t stipulate how long you must hold it at 212°F, but it has got to be boiled.

PRESIDENT R. L. WEST: Dr. Hall, in what way do you determine whether a boiling temperature has reached all parts of the garbage? Do you mean that you just bring the garbage to a boil, or do you insist on determining in some way that the entire mass has reached 212°F?

DR. ORLAN HALL: In the cooking of garbage in our country, when the vat or the ordinary boiling kettle is used, or whatever method is used, there is always liquid added to the garbage in the form of water. It is made into a soupy mass, because you can’t boil it otherwise. Most of our men carry thermometers with them.
They check the heat of the garbage in the center, at the ends, and on the sides. One thing that the owner is always told to do during the cooking process is to stir the garbage as frequently as possible.

Dr. Carl J. Norden [Nebraska]: This is an excellent presentation, and I have enjoyed it very much. I would like to ask Dr. Hall if they have any regular methods of vats or boilers. What kind do you find the most effective and efficient?

Dr. Orlan Hall: The large feeders, I believe, use a cooking vat, in many cases mounted on a framework so that heat can be applied underneath it, with the vat covered during the cooking period. Many of them have steam pressure boilers, with the pipes going around the edge of the vat and sometimes up through the bottom and along the top. Those vats are covered, and steam pressure is turned on and goes into the vat.

The small feeder, with just a few pigs, often uses an open stock pot cooker. We have no centers for municipal cooking of garbage that I know of. As far as I am aware, it is all done on the premises of the feeder. In fact, we have a little trouble sometimes in that regard, because the man who is collecting the garbage will tell you that the garbage he collects has been cooked at some institution, so why can't he take it home and feed it to his hogs? Well, we just don't permit that. He has to cook it on his own premises, where we can see it being cooked.

Dr. C. J. Norden: Do you have any information showing the comparative and comparable food value before and after cooking?

Dr. Orlan Hall: No; I can't answer that.

Dr. J. R. Hay [Ohio]: From the time that you passed your regulation, how much time was allowed the garbage cooker to comply with the regulation?

Dr. Orlan Hall: Well, you will recall that I told you that the first law was passed in 1916. We had our troubles. You just can't enforce the law immediately. We had to be patient.

You ask how much time elapsed between the passing of the law and the notification of the garbage feeder. There was very little time when it was decided that we were going to have a law controlling the feeding of garbage. We made the law and then we told them we had the law, and then we sent our men out to talk to these people and to tell them what they had to do. Many of the fellows at that particular time could not equip themselves immediately to feed garbage. Some of them took a month to get into position to do it; others required two and others three months. During that period we did not prosecute anyone, but we did chase them up to get them equipped to feed it the way they should.

Dr. J. Smith: What are the rules on conveyances that haul the garbage from the hotel or house to the garbage feeding plant?

Dr. Orlan Hall: We may be a little slack in that regard, sir, but in most instances we have no restriction on the conveyance of the garbage. I don't know of any garbage collected in any city in an open tank or conveyor. It is principally all put in garbage cans with tight lids on them. The feeders put a tarpaulin over the top of the whole lot and take the cans home. There may be an odd case of a feeder using an open truck to carry it, when it is not put in cans, but I am not aware of that.
DR. ERNEST L. BOLEY [Kansas]: About how many hogs are you feeding on garbage in Canada?

DR. ORLAN HALL: I should say about 50,000. That is a rough estimate.

DR. A. E. CROUSE [Washington]: Are indemnities paid on slaughtered animals?

DR. ORLAN HALL: Yes. We use the slaughter method in the control of hog cholera in Canada, and we compensate the owner for his loss. When we say we slaughter, we mean that if we go to a man’s farm and find evidence of hog cholera on his farm, we slaughter the entire lot and compensate him for his loss. We don’t pay him for the hogs, but we compensate him for the loss. That compensation is to help him bear his loss.

In the case of a garbage feeder, if he is a careless individual in the collecting of garbage, we have the right to withhold compensation in whole or in part, because why should we pay a man compensation for an infection which he established through his own carelessness?

DR. JACK KNAPPENBERGER [Ohio]: Does Canada have any laws controlling the distribution of carcasses of animals dying of disease or otherwise—controlling the feeding or the disposal of those carcasses?

DR. ORLAN HALL: Do you mean a full animal carcass? No, not under the Animal Contagious Diseases Act; I believe the Public Health Act and some of the municipal acts control that. If he is going to collect dead horses or cattle to feed to swine—boy, that’s garbage as far as we are concerned.
REPORT OF THE NATIONWIDE COMMITTEE ON ERADICATION OF
HOG CHOLERA


The National Committee on Eradication of Hog Cholera makes the following brief report:

1. The recommendations made in the comprehensive report of this committee in 1951 are hereby reaffirmed. Furthermore, we recommend that the Executive Board of the United States Livestock Sanitary Association and all state livestock sanitary officials immediately promote legislation and activation in conformity with this committee's report of last year.

2. Reprints of the 1951 report of this committee are to be sent with a covering letter to the following agencies with the recommendation for activation:
   - Secretary of Agriculture
   - Livestock Conservation Incorporated
   - Major farm and swine organizations
   - State secretaries of agriculture
   - House and Senate agricultural committees
   - American Veterinary Medical Association
   - Agricultural press

3. By formal motion, the chairman of this committee has been requested to call to the attention of the Committee on Laws and Regulations the urgent need for revision of existing laws, rules and regulations involving the interstate and intrastate movement of swine, with specific reference to the use of anti-hog cholera immunizing agents other than serum and virulent virus.

4. Your committee has taken preliminary steps to ascertain the procedures necessary to establish one or more areas in the nation as pilot test areas for the inauguration of a full scale hog cholera eradication program.
ADMINISTRATIVE CONSIDERATIONS OF GARBAGE FEEDING WITH REFERENCE TO VESICULAR EXANTHEMA AND TRICHINOSIS

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It is the hypothesis of this paper that the prevention, control and eradication of trichinosis, vesicular exanthema and foot-and-mouth disease depend upon the elimination of raw garbage feeding of livestock in the United States. To do this will require complete integrity of purpose on the part of the authorities concerned. Unfortunately, there is at present among many officials a very apparent lack of interest and desire to find ways and means of eliminating the dangerous disease-spreading practices that are an inherent part of raw swill feeding operations. It appears that they fail to realize that the one-half of one percent of garbage fed livestock imperil the entire agricultural economy of the country. The garbage-hog raiser himself cannot be depended upon to take the initiative because, despite storms of disease, he has had a lucrative business and, therefore, is not greatly concerned with his disease-spreading potentialities. However, from the standpoint of Biological Warfare, Civil Defense authorities are greatly concerned by the confusion that the recent outbreak of vesicular exanthema is causing because of its marked clinical similarity to foot-and-mouth disease of swine and the extensive diagnostic procedures necessary to differentiate the two on the occasion of each new outbreak. This alarming situation is actually of more vital importance to cattlemen than it is to the swine raiser, because, should foot-and-mouth disease in its early stages be masked by simultaneous infection in hogs by vesicular exanthema, our cattle industry would be in great jeopardy.

The practice of feeding garbage to hogs has developed through the years in areas adjacent to large cities. The reason for this is quite obvious; the hotels, restaurant chains, hospitals and other institutions provide an easily accessible cheap feed. The practice is by no means limited but is actually a large interstate problem. In New Jersey, for example, garbage feeding occurs almost exclusively in two areas—one in the southern part and one in the northern part of the State. The major part of the garbage fed in New Jersey crosses either the New York State Line or the Pennsylvania State Line.

The U. S. Bureau of Animal Industry and the U. S. Public Health Service have, in their studies, shown that raw garbage feeding of hogs results in a high percentage of trichinosis-infected carcasses. \textit{Trichinella spiralis} causes the disease trichinosis in humans when infected pork is eaten raw or in a semi-cooked state.\textsuperscript{4} It is interesting to note that in the many surveys throughout the United States on the diaphragms

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of human cadavers the percentage of times trichinae have been found were much higher than one would expect. Queen reported in one particular study an infection rate of 27.6 per cent and the general rate has been found to be over 16 per cent (1–3). The feeding of raw garbage is also a prime source of the virus of vesicular exanthema. Furthermore, it has been clearly established that the last two outbreaks of food-and-mouth disease in this country originated in hogs fed raw garbage on California ranches (4).

It is of interest to note in passing that Syvertson et al. have shown that the trichina larva can serve as the intermediate and transmitting host for lymphocytic choriomeningitis virus, transferring this virus from guinea pig to guinea pig with lethal results (5). This proven case of disease transmission stimulates the imagination to think of other possibilities, as yet unknown, in which this situation could prevail. It seems to us not to be beyond the realm of possibility that the importance of raw garbage in the epizootiology of trichinosis, vesicular exanthema, foot-and-mouth disease and, to some extent, hog cholera may be more than merely coincidental and that the problem may present a common factor that has not been as yet adequately recognized. One of us (6) showed a number of years ago that a nematode of swine, the swine lung worm, can and does serve as an intermediate host for swine influenza virus. The work of Syvertson et al. has shown that another nematode of swine, Trichinella spiralis, can serve as an intermediate host for another virus. These two demonstrations of the virus-carrying potentialities of swine nematodes should alert us to the possibility that the trichinosis aspect of garbage feeding may bear a direct relationship and not merely a coincidental one, in the epizootiology of certain virus diseases of swine having a notable relationship to garbage feeding.

In view of the facts outlined previously, it is known that trucks picking up raw garbage in New York and Pennsylvania for use on the hog farms in the adjoining State of New Jersey are actually engaged in the interstate movement of a feed dangerous not only to hogs, but to humans and other livestock. There is a basis, therefore, for the Federal control of the interstate movement of raw garbage if for no other reason than to limit the amount of trichinosis in the country. A perfect example of the dangers inherent in the interstate movement of raw garbage is no more clearly shown than in our present outbreak of vesicular exanthema. This outbreak was definitely started by the interstate movement of raw garbage-fed pork from California to Wyoming. This pork, incidentally, was undoubtedly United States inspected and passed. Supplies for the Transcontinental Union Pacific trains were purchased in California; the garbage produced was disposed of on a hog farm in Wyoming. The vesicular exanthema virus which left California in pork has already been the cause of disease outbreaks in twenty-nine (29) states. The costs involved in the feeding of raw garbage bring to mind the last two outbreaks of foot-and-mouth disease in the United States in 1924 and 1929 which were caused by the feeding of raw garbage. It is indeed a high price for the taxpayer to be expected to pay the costs of indemnity, costs of control and inspection procedures, and, in addition, to have to live with and be subjected to diseases that can be eliminated: a high price indeed simply to make raw garbage feeding a profitable business for the few. We maintain that public interest demands concerted action to eliminate
the interstate movement of raw garbage, raw garbage fed hogs, and the pork derived from raw garbage fed hogs. This will most certainly involve a great deal of planning, but most of all we feel it requires the will to accomplish.

It is suggested that the ineffectual method presently employed by the United States Public Health Service in attempting to control the use of raw garbage on the farm level could well be supplanted by a direct prohibition of interstate garbage movement or by a selective licensing method based on facilities for adequate treatment of garbage prior to use. It is likewise suggested that dumping of garbage across state boundaries, whether or not for pig feeding, is not an innocent practice and may lead to disease spread. The use of garbage for fertilizers has been suggested. Studies by various groups, including the United States Bureau of Animal Industry, show that foot-and-mouth disease virus has been at times very resistant. Authorities, therefore, should assure themselves of the innocuousness of fertilizer made from garbage. Some methods will be found to be safe while others will not be.

One issue that has been raised by several high ranking Federal officials should be settled. These men misunderstand the United States Public Health Service regulations and think that they prohibit the interstate movement of raw garbage to be fed to hogs. As an example of the need for closer liaison and for a more realistic approach to the true facts of the situation, we quote from a letter written by a top official of the United States Department of Agriculture, “The United States Public Health Service currently has a regulation that prohibits the interstate movement of uncooked garbage for hog feed”. The statement is false but much to be desired if it were true. The regulation in question does no such thing. It is, in our opinion, unenforceable and, in fact, has not been enforced since its promulgation over 10 years ago. To enforce it in the State of New Jersey alone, would require that Federal officials inspect and keep under continuous supervision over 300 hog farms. The regulation in effect says, “You may bring raw garbage from New York to New Jersey, but, if after you get it to your farm in New Jersey you decide to feed it to your hogs, then the New York garbage must be cooked even though your New Jersey garbage may be fed raw”. It is agreed that all garbage should be cooked, but the loophole in this regulation is so big that even 15-ton garbage trucks can and do drive through it. The authors feel it is outside the province of Federal authorities to get down to such detailed inspection controls within a state. We feel that Federal officials should act and act effectively at state borders—not at the individual farm level within a state.

The Federal Government would do well to exercise one of its prime responsibilities and functions, namely, to control by interstate regulations where State controls can not effectively handle a problem. In the case of vesicular exanthema and trichinosis, we, at the State level, know that State controls alone are not enough. An example may help:

California hogs fed California garbage in California can enter Wyoming or New Jersey in one of the following methods:

1. As Federally inspected and approved pork.
2. As hogs moved interstate for slaughter or further feeding.

Hogs and pork so moved are disease-dangerous and, in addition, are unfair competition to the New Jersey hog raiser if his costs of operation are increased by
garbage cooking requirements placed in effect within the State. We have been threatened with injunction to prevent a New Jersey garbage cooking regulation unless interstate competition is equally affected. Our legal advice is to the effect that such enjoinment would probably be upheld. In any event, if raw garbage-fed hogs and pork derived from raw garbage-fed hogs can traverse State lines with impunity, it would nullify garbage controls within each of the several States.

RECOMMENDATIONS

Knowing, therefore, that the experiences in trichinosis and vesicular exanthema have shown that raw garbage feeding of hogs is the prime method of the spread of the causative agent of both; knowing that present interstate raw garbage controls are ineffective; knowing that the 1924 and 1929 outbreaks of foot-and-mouth disease started at raw garbage feeding enterprises, we therefore recommend that a complete review be made and all concerned be properly apprised of the need for coordinated federal and state action in order to:

1. Prohibit the interstate movement of raw garbage except under certain specified conditions as:
   a. For sanitary land fill operations or incineration: This to be under specific permit only to prevent ordinary dumping wherein vectors may spread disease by mechanical or carrier-state means.
   b. For manufacture into fertilizer, but only where the process is shown to be effective in killing the viruses of foot-and-mouth, vesicular exanthema and agents of other similar diseases.
   c. For movement to centralized cooking vats where adequate mechanical recording controls may be maintained. The raw garbage shall not be transported to these plants in the same trucks which pick up the cooked material for distribution to the individual hog farm, unless complete sterilization can be obtained on the truck, including attention to the personnel and equipment.

2. Prohibit the interstate movement of hogs fed raw garbage. Require certificates from official agency of state or origin certifying to the fact that the animals were not fed raw garbage.

3. Prohibit the slaughter in any Federal Meat Inspection establishment of hogs unless accompanied by a certificate indicating that they have not been fed raw garbage. Except:
   a. Hogs may be slaughtered in specified plants where all meat will be processed and bones removed and tanked. This should be done only in specified plants.

4. Prohibit on an intrastate basis essentials of items 1, 2 and 3 above.

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DISCUSSION OF PAPER BY SHOPE, SUSSMAN AND HENDERSHOTT

Mr. E. R. Shannon [Indiana]: My name, sir, is Shannon. I am a hog man. I would like to suggest that this very excellent paper by Dr. Shope (and I don't know when I have heard anything better) add hog cholera as a disease transmissible by the feeding of raw garbage. We have a Committee that may be visionary but that hopes some day to see the eradication of that disease, if it can ever be accomplished. Could that be added to the paper, by some amendment, without hurting it?

President R. L. West: I may be mistaken, Mr. Shannon, but it was my impression that hog cholera was included in Dr. Shope's paper; am I correct, Doctor?

Dr. O. Sussman [New Jersey]: Dr. Shope is at a radio broadcast. The statement is well taken. We did include hog cholera, but we didn't include it in quite the way you have stated it.

As we look back at Canada and see how they have eradicated hog chorera, we know and have heard from the Canadian authorities that one good way of eliminating hog chorera (it won't do the whole trick) is to eliminate raw garbage feeding.

Mr. E. R. Shannon: "Knowing, therefore, that the experiences in trichinosis and vesicular exanthema have shown that garbage feeding of hogs is a prime method of spread," and so on. I would like to have hog cholera added there, if it can be done. Nothing will scare a group of hog men like a mention of hog cholera.

Dr. O. Sussman: We discussed that, and we were thinking of including it. We felt we would stay on the grounds we were on. However, if this report, as Dr. Shope has requested, is turned over to the Executive Committee for resolution by this Association, they might include that particular point, saying, "Whereas, it has been shown that hog cholera also is spread by raw garbage feeding," and so forth.

President R. L. West: Would you have any objection, Doctor, to including hog cholera in the report?

Dr. O. Sussman: I am sure we would have no objection to it, and we will revise the paper to that extent.

President R. L. West: I agree with Mr. Shannon wholeheartedly that hog cholera should be included. It was my impression that it had been; I am sorry I was wrong.
HEAT TREATMENT OF GARBAGE TO CONTROL DISEASE

J. DEWEY LONG, B.S., M.S.¹ AND CHARLES C. JOHNSON, JR., B.S., C.E.²

There are several beneficial uses that can be made of garbage. Among these are: reclamation of land through sanitary landfills, the production of soil conditioner or fertilizer through composting, and production of pork through utilization as hog feed. The last represents, perhaps, its greatest economic value. In 1941, the Department of Agriculture, as a result of a survey of urban garbage production, collection, and utilization, estimated that 200,000,000 pounds of pork could be produced annually if all the garbage produced in the urban areas of the United States were utilized for hog feeding.

There is one major disadvantage to the use of this waste material in that manner. Raw garbage has been found to serve as a carrier of various parasites and microorganisms which adversely affect humans and animals. It is generally considered that the feeding of untreated garbage to swine is a common method of spreading hog cholera, foot-and-mouth disease, vesicular exanthema, and trichinosis, and in some instances tuberculosis, swine erysipelas, and stomatitis. The disinfection of garbage, in a manner sufficient to destroy viruses and bacteria contained in parts thereof, offers a practical solution to the control of diseases transmitted in this manner.

Canada requires the heat-treatment of garbage as an essential part of its program to control and eradicate hog cholera. Through this, and certain other measures, Canada has been able to keep herself virtually free of this disease. England considers it of primary importance for garbage to be disinfected, in order to prevent foot-and-mouth disease from becoming established there. Mortality and morbidity rates among garbage-fed hogs in both of these countries appear to be significantly lower than those in the United States. The incidence of human trichinosis in both Canada and England is said to be about one-twelfth of that in the United States.

A popular belief among public health workers is that “Nothing will sell a public health program like an epidemic.” This idea appears to be borne out by the current vesicular exanthema epidemic and the efforts it engendered among the authorities concerned to promote the disinfection of garbage. Public health agencies are taking advantage of the widespread, sudden interest in “V. E.” to promote the control of trichinosis, since all authorities agree that the disinfection of garbage before its use for swine feed will help to control both diseases.

Agricultural and health authorities now have a common purpose in a program that is designed eventually to require that all garbage intended for hog feeding be disinfected. Officials of the Department of Agriculture and the Public Health Service, anticipating a large number of inquiries concerning equipment and standards to be used in the disinfection of garbage, decided that a joint publication on this

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phase of the problem would be desirable. Consequently, your speakers were assigned
to collect, evaluate, and publish available material and experiences relative to
equipment and procedures for the disinfection of garbage for swine feed.

The fruits of our efforts appear in the paper that has already been distributed
among you. Basically, we found that heat treatment of garbage is a practicable
and economically feasible means of disinfecting garbage without apparent reduction
of its feeding value. Our paper places major emphasis on the description and time-
temperature operation of various types of heat treatment equipment with daily
capacities ranging up to 15 or 20 tons. Particular attention was given to the equip-
ment for the wet-steaming (or boiling) procedure, which is considered to be most
suitable for use by the individual farmer. Boiler capacities suitable for the wet-
steaming operation are shown graphically. Descriptions of auxiliary equipment,
some recommended principles for hog farm sanitation, and a discussion of future
research possibilities are also included in the publication.

The time-temperature standards recommended in this paper are based on studies
conducted by the National Institutes of Health of the Public Health Service. In
order to determine the minimum time required for the cooking of garbage to destroy
trichinae in pork scraps contained therein, tests were carried out by introducing,
into garbage cooked by steam in an open tank, pieces of trichinous pork varying
in dimensions from 1” x 1” x 1” to 6” x 6” x 4.5” and in weight from 20 grams (0.04
pound) to 2,297 grams (5.06 pounds). The experimenters concluded that boiling
garbage for 30 minutes in an open container will effect the destruction of trichina
larvae in pieces of pork up to three inches thick, and probably in pieces of greater
thickness when the garbage is allowed to cool gradually. This is the only study, to
our knowledge, in which a time-temperature relationship has been established for
eliminating a disease organism from garbage. Since vesicular viruses have a thermal
death point in the same range as trichinae organisms, it is reasonable to believe
that the same procedure would effectively prevent the transmission of both diseases.

A frequent objection to feeding cooked garbage to hogs is that such hogs fail to
make daily gains equivalent to those on raw garbage. Actual studies in this regard
are scarce. Dr. Willard H. Wright, in his article, “Public Health Problems Concerned
in the Disposal of Garbage by Feeding It to Swine”, reported that the California
Agricultural Experiment Station had conducted some feeding trials to test this
point, under the direction of Prof. E. H. Hughes. These experiments indicated that
the simple heat treatment of garbage by the introduction of steam to an open con-
tainer was most satisfactory from the standpoint of food value of the product.
Hogs maintained on garbage cooked in this way made better gains than those fed
on dehydrated material. Furthermore, in the feeding trials there was very little
difference between the average daily gain of hogs fed the open-steam-cooked gar-
bage and those fed raw garbage collected from the same source. These observations
are supported by abundant testimony from the field; in fact, some farmers have
declared that they get more pounds of pork per hog from garbage which has been
cooked.

Types of equipment that can be recommended for the disinfection of garbage
are limited, primarily because the most effective and efficient time-temperature-
power relationships for various types of equipment have not been established.
Applying steam to an open vat, or to a steam-jacketed kettle, or cooking over an open flame are, at the moment, thought to be the most efficient and effective methods for complying with the current time-temperature requirements: 212 F. held for 30 minutes.

The injection of steam into open vats is not limited to any one approach. The disinfection of the garbage has been accomplished by placing pipes for steam distribution in the bottom of tight, steel-body trucks used for garbage pick-up, or in vats mounted on flanged wheels and rolled over a light industrial track to the feeding pens. Stationary concrete vats, metal-lined wooden vats, and steel tanks are also in use.

The application of steam, not the type of container, is the critical point in this procedure. Steam should be applied in such a manner that an even distribution of heat is obtained throughout the mass. A loose cover over an open vat will help to effect more uniform heat distribution in the top layers of garbage. Varying densities in the batch will result in vertical steam-escape channels, necessitating manual or mechanical stirring of the entire batch during the warm-up period to obtain uniform heat distribution. Having all particles of small, fairly even size also will insure more uniform heat distribution. This last recommendation may require the grinding of all particles more than three inches thick.

Because vats vary in size and shape and boilers in capacity and pressure, as well as other variables, it will probably be necessary to try different pipe sizes, hole diameters, spacings, and arrangements to achieve uniform heat distribution in any individual installation.

The use of steam-jacketed kettles prevents the addition of water from the condensation of steam. Thus, the material retains approximately its original moisture content. This relatively dry garbage may be preferred by some feeders. Steam-jacketed kettles are built to a typical design, and are available in a wide range of capacities. Those manufactured for the cooking or processing of food for humans are made of expensive metals, and may be equipped with accessories which are not essential for garbage treatment. Because the steam is confined and recirculated, this method may be more economical of heat than that of wet-steaming in an open vat.

Steaming in a pressure cylinder is a method which deserves further study. This process takes advantage of the higher heat content of high-pressure steam and the disruptive effect on the garbage when this steam is forced into the particles being treated. This heat-and-force combination is sufficient to soften fish, poultry, and meat bones, and make them edible by hogs. Generally speaking, however, the extra cost of such equipment is not justified by the extra food value and speed obtained, except where large quantities of fish-waste or meat-bones are processed. The treatment period in this process will vary according to the steam pressure and the type of garbage being treated. We have no information on which to base a recommendation as to the most economical time-temperature or steam-pressure requirements for this equipment.

There will be instances when utilizing steam for disinfection of garbage will be neither practical nor feasible. Swine growers treating approximately 200 gallons or less of garbage may find it more economical to utilize a vat over an open flame.
Such a unit is very similar to the scalding vats found on most farms. It consists of a fire box, a chimney, and one or more semicylindrical metal vats for holding the garbage.

The use of dehydration equipment to produce a dry feed from garbage has been suggested by some sources. In spite of the high temperature of the combustion gases introduced into the cylinder, there is some question as to whether or not there is sufficient heat-penetration to the center of garbage particles to kill viruses and microorganisms. Because of this and the results obtained from the feeding trials conducted by the California Agricultural Experiment Station in the use of dehydrated material, it is recommended that further research be conducted to determine its effectiveness as a heat-treatment for garbage and the feeding value of the product.

Whatever methods or procedures are chosen for the disinfection of garbage, we believe it important to point out that the benefits of garbage disinfection may be lost unless good sanitation is incorporated into routine practices of swine production. It is unreasonable to expect that animals raised in insanitary surroundings will develop normally and produce healthy litters. Careful attention to the essentials of sanitation will do more, probably, than any other single thing, both to reduce swine losses from filth-borne disease and parasites, and to help to control those diseases transmissible from swine to man.

In the final analysis, it should be recognized that garbage has a definite economic value and is not merely a waste material, the satisfactory disposal of which must be costly and unprofitable. Its highest economic value is probably as hog feed. This warrants a determination of the most economical means and facilities for sanitary utilization. A research study would be desirable of heat-treatment systems and equipment related to studies of suitable collection equipment, and of the entire swine-production, housing, and feeding layout design. An integrated system, complete with the design of structural units and the specifications of mechanical equipment for proper management and sanitary feeding of garbage, would be of obvious advantage to the farmer. Further research should be directed specifically to suitable equipment for the disinfection of garbage, feeding trials to determine the attractiveness and nutritive value of the feed produced by different processes, and studies of all the economic factors involved in the disinfection of garbage for swine feeding.

REFERENCES


DISCUSSION OF PAPER BY CHARLES JOHNSON AND J. DEWEY LONG

DR. O. SUSSMAN [New Jersey]: I would like to congratulate Mr. Johnson and Mr. Long for the fine presentation they have made. From the standpoint of a state official who actually has to control a garbage feeding operation, however, I would like to call to your attention the fact that the possibility does exist, in the present phase of trying to push everyone into the cooking of garbage, of having from four to 100 little individual vats in which we are supposed to determine whether the garbage in them has been cooked or not.

I believe you noted from Dr. Shope's original presentation that we have limited our cooking facilities to centralized cooking facilities. We took that into consideration, and we hope you will take it into consideration also. If a man takes a can of milk and puts it on the stove and warms it and then labels it pasteurized, I defy anyone to tell me whether it actually has been properly pasteurized or not.

This is a disease control matter, and we must remember that any money spent in determining how well garbage has been cooked is money that should be put on top of the price of that garbage-fed hog.

The number of pounds of hog meat that is being produced is less than 0.5 per cent of the livestock economy of the United States. In California alone, in one year, in order just to regulate the garbage feeding enterprise, that State spent over $118,000 just to supervise it, and they still have VE. We have VE in New Jersey, and there have been four or five of Dr. Hendershott's men working full time for six months, and two of our Department men also working full time.

I think before we push these folks into small garbage cooking apparatus we should consider whether it is better to put that operation out of business, if it happens to be handled ruthlessly, in order that we may protect the major part of our livestock economy.

MR. J. DEWEY LONG [Washington, D. C.]: I anticipated some such reaction from Dr. Sussman, since we have argued the point on one previous occasion. It is obvious that, from the standpoint of supervising this work, perhaps you would prefer to have it done the way he has indicated. However, it is also possible to do it this other way, starting with what the individual farmer may design or may wish to use.

I think it is up to other authorities to determine what will be done. However, I would suggest that if you go into these larger municipal or central plants, you secure adequate qualified counsel and advice on the design and operation of the plant.

Thank you very much.
PROGRESS REPORT ON THE CONTROL AND ERADICATION OF VESICULAR EXANTHEMA

DR. S. O. FLADNESS, D.V.M.¹ AND FRANCIS J. MULHERN, D.V.M.²

Mr. President and Gentlemen: We were requested to prepare a paper showing to some extent the history, progress and present status of the vesicular exanthema campaign. Dr. Mulhern prepared a paper, but we never did quite get around to preparing the final draft. As Dr. West said, Dr. Mulhern has had to return to Washington.

Some twenty years ago, out in California, a vesicular disease appeared among swine, and it looked a lot like foot and mouth disease. It was finally diagnosed as such and the Bureau and State proceeded in the classical manner called for in the eradication of foot and mouth disease. Apparently they were successful; however, the following year (1933) it appeared again, at a considerable distance from the first center, and again it appeared only among swine.

A good deal of doubt had arisen in the minds of scientists as to the identity of this malady, and whether it really was foot and mouth disease. They went ahead and eradicated it in the same manner as they had done in 1932. It involved only a small number of swine in this second outbreak.

The following year (1934) it appeared still further away, in another part of California. In the meantime the scientists in California had been doing a good deal of work on this peculiar type of foot and mouth disease, as it first appeared to be, and Dr. Jacob Traum, who is at this meeting, determined that it was a distinct virus and therefore a distinct disease. That fact was confirmed in Germany, in the Beltsville laboratories in Washington and in Great Britain. It was finally recognized as a distinct malady, and was called vesicular exanthema.

The Bureau was not in a position to cooperate in the eradication of this disease, which up to that time had been unknown, so no further intensive efforts were made then to eradicate the disease, and for all those years it existed to a greater or lesser extent in various parts of California, never appearing elsewhere. That brings us up-to-date.

On June 16, 1952, a vesicular condition was observed in hogs in an establishment in Grand Island, Nebraska. One of the field diagnosticians, who had been especially trained in this vesicular disease diagnosis, was dispatched immediately, and within a couple of days the disease was confirmed as being vesicular exanthema.

Immediately we started to trace the sources of the swine that this establishment had acquired within a certain period previous to the outbreak. All of them proved to be negative except one, a garbage establishment in Cheyenne, Wyoming, where the disease was found and confirmed within the next forty-eight hours. That place in Cheyenne seems to have been the initial center outside of California. How it got there, we don’t know for sure.

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It is significant, however, that for the previous sixty days this particular garbage feeder had been getting garbage from transcontinental trains at Cheyenne. That is about as much as we can say about how the disease got out of California and into Wyoming. The garbage feeder, of course, was one of the suppliers of swine to the establishment in Grand Island.

We did not know at that time of any other center of the infection. It seemed to be a fairly clear-cut trail that ended at Grand Island. However, in a short time we began to get reports from California about shipments arriving there from Omaha, breaking with vesicular exanthema. We had no knowledge of any infection near Omaha up to that time, Grand Island being some 150 miles from Omaha; but one shipment after another began showing vesicular exanthema upon arrival on the West Coast.

The immense cosmopolitan and metropolitan areas in California and on the Atlantic Coast, too, for that matter, rely on the Middle West for a very large part of their supply of pork; in fact, they tell me that about 85 per cent of the pork consumed in California, for example, has to be imported, and trainloads of swine go out to those heavily populated centers weekly.

Well, it certainly pointed to the fact that there must be infection in the Omaha yards, although no disease had been observed there. Measures were taken, and arrangements were made with the various interests involved to close the yards, liquidate the hogs that were in the yards as promptly as possible, and clean and disinfect the yards. Officials in the various states, where these animals had been unloaded en route for feed, water and rest were alerted, and they cleaned and disinfected all of those yards.

It was not too long that, while we had a tremendous number of hogs going through there following and picking up infection behind the ones ahead of them, we had everything along the Union Pacific and including the Omaha stockyards all cleaned up. We had no further infected shipments show up after the cleaning and disinfecting was completed.

In the meantime, we had been trying to find out how the infection got into the Omaha yards. That finally was pretty well established. It was learned that the establishment in Grand Island, which has a farm outside and moves hogs back and forth, had shipped a consignment of swine to Omaha, a day or two before the vesicular condition was reported in Grand Island. All but about eighteen head of those swine had been sold for slaughter locally. Those eighteen head were sold to a man in Fremont who is in the business of buying swine to fill orders on both the Atlantic and the Pacific Coasts. When we made inspection at Fremont we found the disease.

In the meantime, of course, he had been shipping both ways. One of the shipments unfortunately went East, destined for the garbage feeding center at Secaucus, New Jersey—some feeder animals that introduced the disease there. Some of them went to the State of Washington. We began to have the disease pop here and there from those centers.

Around the end of July I believe it had shown up in sixteen states. That sounds a lot worse than it was, because in most of those states the shipments were slaughter hogs going to packers, some to Alabama, some to Georgia, and North Carolina.
Several of them showed up in California, also in Oregon, Washington, Arizona, and various other points. In most instances, however, there were only two or three centers in each state, and some of those were eliminated before any real program got under way for the eradication of the disease.

Eventually we got the yards cleaned and disinfected through the cooperation of the livestock commission folks, the stockyard managements, Federal and state men and everyone else. It had spread from one yard to another. We had infection show up in all the yards up and down the Missouri Valley, in the central markets that ship hogs to all points. St. Joe, Kansas City, Omaha, Sioux City—all of those markets revealed infection. In each instance the people in the states of destination took vigorous action in the way of local quarantine and control and eventual disposal of the animals.

In each instance we had to clean and disinfect the stockyards. Some of them had been cleaned and disinfected two or three times; in fact, I think one of them had been disinfected four times. We didn't know infection was present until a shipment showed up somewhere. Of course, that was natural. Hogs arrive at the market at night, and are sold early the next morning. If they are sold to go some distance, they are put on a train and sent on just as rapidly as possible. If there is infection they will pick it up and will break at about the time they arrive at their destination. That has been almost entirely curbed. Just when we begin to get a little pleased that we have it curbed, another infected shipment shows up somewhere else, so we are not talking too bravely about it. Nevertheless, in the last four or six weeks we have had only three infected shipments show out of the central market.

During the past few weeks we had quite a little storm of infected shipments showing up out on the Pacific Coast from a point where we haven't seen the disease yet. I am talking about Minnesota, Dr. West's home State. All of a sudden shipments out of St. Paul arrived in Spokane, Tacoma, Seattle, Portland and other places in that area and the swine showed evidence of the disease on arrival. There we went through the same procedure as before.

We never yet have found a case in Minnesota, and they traced down every farm of origin that could be identified from which hogs included in these shipments emanated; and yet, in some way infection had gotten into the alleys and pens in the South St. Paul Stockyards, and by the time they arrived at their destination the hogs were breaking with vesicular disease and we had to clean and disinfect all the federal yards en route just the same. It has stopped abruptly since then. That was September 16 or 17, a month and a half ago, and we have had no further reports from there. We have had some shipments from Mississippi River markets that broke with the disease. Currently that is the picture of the spread of the disease.

I mentioned that when it developed in California back in 1932 and 1934 it was a new disease, not foot and mouth disease nor vesicular stomatitis. The Bureau was not in a position to cooperate because there was no provision or appropriation act or any basic law concerning it.

Since then it has changed, and the very rapid spread of this disease, and its appearance in sixteen states within two to three weeks, created an emergency which is provided for in the present statutes, when the Secretary declares it an emergency, it makes available funds for eradication measures.
After a conference in Washington with the state veterinarians from states where the disease had already appeared, a procedure was decided upon of salvage, that is, the slaughter and special processing of animals and indemnification of owners for the difference between the returns from slaughter and the appraisal made before slaughter. That is the program we are now following.

In the utilization of those carcasses for food purposes, they are to be processed by more advanced measures in the way of temperatures than is the usual routine processing by the packers themselves. They are sold subject to that sort of special processing, so the infection may not be carried out again and be the means of infected scraps of meat going into garbage and back into a herd of hogs, which is the route it follows.

We have done a lot of work on it since then. We have been successful in liquidating the hogs in practically all of the original states affected. As of now I think we do not have more than two herds of hogs west of the Mississippi River that have not been liquidated. That was where the disease originally centered—in Iowa, Nebraska, Kansas and South Dakota. As far as we know, all of those areas now are free.

A good many of the states found, that they were not in a position to allot funds for this work. Their statutes were specific and referred only to diseases known before vesicular exanthema came into the picture. Therefore, they were unable to match funds with the Department of Agriculture, which is required under our laws and regulations. That presented rather a difficult problem to overcome.

Nevertheless, in most of those states the infected swine have been liquidated, on the basis that possibly they may be given funds by forthcoming sessions of their legislatures so that they have the hogs appraised and a record made of the salvage returns, thereby providing the basis for the payment of indemnity pending legislative action making money available in the state.

We think now we have the control of movements in yards fairly well established, so that only an occasional shipment is now getting away that may break. Then it becomes a local problem, as it has been in a good many centers in California for twenty years, a problem of infected garbage, and of herds being infected and going through a mild form of the disease without its ever being known. If the owner does not report it, and if we don’t get around to inspect garbage farms as often as we should—you know, state and Bureau forces everywhere are so tremendously short of veterinary personnel that this is almost impossible. The hogs are marketed, and the carcasses go to the trade without special processing to destroy the virus. Scraps of the carcasses get out into the garbage again, and the virus comes back to more herds.

That is where we stand today. In most instances where these long distance shipments implant the infection, mostly in slaughter hogs, as a matter of fact, the hogs go to a packing house, and it is not too difficult to handle the situation. It may stop the market for a day or two until we can get the market cleaned and disinfected.

Concerning this rôle of infected garbage: For instance, in St. Louis we found they get garbage from a dump. Some of the feeders get selected garbage from hotels and restaurants, other feeders go out to a city dump and dig it up and take it home and feed it to the hogs. If there are animals in herds that were marketed carrying the
virus, and if no authority knew about it, that meat will go to the trade, and then infected meat scraps will show up again.

We are not sure we have the answer to that problem. I think everybody knows the answer, but how to bring it about is quite something else. The answer is either to cook garbage before it is fed to hogs, or don't feed garbage to hogs at all.

That is our status right now. There is some infection left in Oklahoma that has not been liquidated. I believe there is infection also in Texas, and I know of one infected herd in Illinois, and one or two in the St. Louis area. I believe Cook County and adjoining counties in Illinois have eliminated the disease. Others are now making arrangements to liquidate the affected herds.

Mainly, we are getting rid of the infection, with the exception of three or four states, just as promptly as it can be arranged. That takes quite a lot of doing, because you have to find people who will buy that particular class of hogs and subject them to this particular special processing, which naturally they claim is going to cost them a lot of money and will reduce their return on the product. People are inclined to bear down on price in a case like that.

All of the states that do not have funds that can be used for this purpose, face a serious problem. If they don't get money from legislatures so that indemnities can be paid, you can see there is going to be quite a howl put up. Even if they can get the money, it will be months before the situation is cleaned up, and maybe these feeders need money to re-establish themselves in business. And so the howls continue.

I have never seen a finer demonstration of really bearing down on the part of state officials that has been the case in this vesicular exanthema campaign in the Middle West and also in the South, with three or four exceptions. The cooperation has been the finest I have ever seen in my long experience in this work.

Where do we go from here? We are going to snuff out every outbreak that is discovered, just as fast as we can. We hope that all of this will have a very strong influence on something being done about the feeding of raw garbage, and we hope to be able to do more inspection work in the nests of garbage fed herds than we have been able to do up to now.

As I say, the states and the Bureau are both handicapped with a shortage of veterinary personnel, and we have to take men off of very essential work in order to handle this campaign. We feel that a great deal of progress has been made. We have sort of shoved it back more to the East. With the exception of the storm from South St. Paul, which I mentioned, I can't recall any of the disease going out of the Middle West to the Pacific Coast.

A lot of problems come up in this marketing deal, and there has been a good deal of misunderstanding, and a good many errors have been made here and there, but they were to be expected. After all, we have had to proceed on a sort of trial and error basis to a considerable degree. Gradually, however, there is coming to be an understanding on the part of everyone, among our own men and the various state sanitary authorities, as to just what this, that, and the other thing means and what it signifies and what it is intended to accomplish.

I believe that is about all I have to report, Dr. West. If there are any questions I will try to answer them. I know there have been a good many questions come up for discussion, as to just who should do what, and when.
I would like to say one more word about that: Basically it was considered by Congress, when writing the law, that the problem of disease control is primarily the business of the state. But the Department of Agriculture is authorized under certain conditions to go into a state and cooperate in the extirpation of any communicable disease.

The police authority governing those cooperative efforts, however, rests with the state. The Federal Government, outside of our federal quarantine, which applies only to interstate movements from the areas involved is helpless. The police authority must be exercised by the state.

We can't exercise authority locally within a state. The authority rests with the state. The responsibility we certainly will share in so far as we can share it. We will cooperate in every way we can, but we cannot exercise local police authority within a state.

That is something I have said at least 4,000 times in the last thirty-five years.

I believe that is all I have to say, Dr. West. Thank you.
DISCUSSION OF PAPER BY MULHERN AND FLADNESS

PRESIDENT WEST: Thank you very much, Dr. Fladness.

Before opening this to general discussion I am going to call on Dr. A. R. Miller, Chief of the Meat Inspection Service, to say a few words.

DR. A. R. MILLER: Thank you, Dr. West.

During this convention there have been expressions of interest in the part that federal meat inspection can play in this VE eradication program. I think meat inspection, in fact, is playing a very important role through the opportunity of the meat inspectors seeing and conducting post mortem examinations on more than one million swine each month.

As you know, we have veterinary meat inspectors in some 500 large meat packing plants conducting slaughtering throughout the country. We have such inspected establishments in all states in the Union except in New Mexico.

Several years ago, in order to better bring our inspection facilities to bear on this vesicular disease problem in California, we issued a regulation to our meat inspection personnel which I would like to read to you. I would like to have you keep in mind, as I read this regulation, that the principal and only effective functioning of the veterinary meat inspector, in connection with a program such as this, which is essentially an animal disease control program, is to detect and report occurrences of those diseases in which the animal disease control officials are interested.

This is the regulation that was issued several years ago, and was calculated to meet that vesicular disease condition in California:

“Section 9.18 of the Meat Inspection Regulations: Vesicular Disease: Immediate notification shall be given to the local state and federal livestock sanitary officials having jurisdiction when an animal is found to be infected with a vesicular disease. No animal under quarantine by state or federal livestock sanitary officials, on account of a vesicular disease, will be given ante mortem inspection.”

That is a technical way of saying that no animal shall be passed for slaughter—that no animal or lot of animals connected with this finding will move into slaughter or out of a meat packing plant. In other words, the meat inspector not only detects and reports, but he is effective to hold in status quo the lot of animals infected and the lot of animals in which the disease control official is presumed to be interested.

“If no quarantine is invoked, or if a quarantine is invoked and later lifted, ante mortem inspection shall be conducted.” That completes the picture.

The meat inspection officials were alerted to the import of this regulation when vesicular exanthema broke out of the confines of the State of California. Several notifications went out to our men, the meat inspectors, because we realized how important it was that they should be alert and should detect any possible occurrence of a vesicular disease in the area over which they had control, namely, the animals offered for inspection at a federally inspected meat packing plant.

As the eradication program for vesicular exanthema progressed and you men decided that special processing of animals and carcasses should be required under those circumstances that you specified, we then notified our veterinary meat inspecting officials of the provision for special processing that you included in your
eradication program, and they were told to see that the provisions of that special processing were completely carried out in these meat packing plants over which they exercise jurisdiction.

You will see now that through all of my discussion here the thread of authority and exercise of authority which rests with the animal disease control official, particularly the state control official to whom Dr. Fladness referred, who has basic jurisdiction.

In other words, our objective is to see that the official, who has the power to act, is given full information on which he can act. Then, as you developed your program, the arrangements were made for the inspection officials to participate to the extent that they could see that your orders, your decisions, are carried out to the fullest extent in the federally inspected plant.

A very business-like and effective arrangement, has been worked out and as can be worked out in this relationship between the disease control official in each state and the meat inspector in each federally inspected meat packing plant, contemplates, as I said before and as it seems necessary to keep repeating, that the disease control official make the decision, and that that decision can be made quite informally as far as we are concerned.

It is not a question of our men standing on formality. It is sufficient that the disease control official state categorically and clearly that he is quarantining all lots of animals that are found, on the premises of these meat packing plants, to be infected with a vesicular disease.

The veterinary inspector then informs the plant manager as soon as a vesicular disease is detected. The disease control official has already acted with respect to that lot, namely that they are quarantined, and that he is informing the state official of his findings, and that any question or any transaction connected with the quarantine can and must be considered between the management or the owner of the stock and the responsible state official.

That has worked out very well in many, many instances. Certainly, as Dr. Fladness has pointed out, there have been those cases where confusion has entered into the picture. Even mistakes have been made, but what I have expressed to you here is the basic proposition of how this corps of veterinary meat inspectors, who see a large number of swine every day, have been integrated into your animal disease control program.

Thank you very much.

PRESIDENT WEST: Thank you, Dr. Miller.

SECRETARY HENDERSHOTT: I am very glad that Dr. Miller explained to us just what the modus operandi is. As I said in my report as Secretary, when there were very few members present to hear it, I made my apology for failure to tie up some of the paragraphs of the meat inspection requirement. I was in error when we met Monday, in taking apart the good Meat Inspection Division. In part, I think, I was in error. I believe there are still some matters that need to be straightened out.

However, Dr. Miller has indicated to us this morning what our procedure should be. I had quite a talk with him Tuesday evening, and he clarified some questions in my mind. They were these:

That state regulatory officials are the only ones who have a right to issue a quaran-
tine on animals within the confines of their respective state. My quarrel was that heretofore I saw no need for the veterinary trained personnel in meat inspection unless they were entitled to use that veterinary training intelligently, and to act upon it in situations such as we are faced with in VE.

Now, under the paragraph Section 8:18 Dr. Miller read, it provides that we are to be notified by the meat inspector in charge on ante mortem inspection if he discovers any vesicular condition. Once we are notified, then the ball rests with us, and we can short-circuit this system and save a great deal of time, as I understand it, if we will give authority in writing to the federal meat inspectors to quarantine any lot of hogs that arrive at destination in a federal establishment showing vesicular disease. Immediately, then, the federal meat inspector can issue the quarantine and can simply state to the owner, "I am doing this on the orders of the state veterinarian."

In the event we as state regulatory officials fail to issue that order or request to the federal meat inspector, to quarantine, then this is the manner in which they must proceed to handle that lot of hogs, under paragraph 1134, entitled, "Vesicular Exanthema and Vesicular Stomatitis", which reads as follows:

"Any carcass affected with vesicular exanthema or vesicular stomatitis shall be condemned if the condition is acute or if the extent of the condition is such that it affects the entire carcass, or there is evidence of absorption or secondary change, or (b) any carcass affected with vesicular exanthema or vesicular stomatitis to a lesser extent than set forth in paragraph (a) of this section may be passed after removal and condemnation of affected parts if the carcass is otherwise in good condition."

You can see very clearly that unless we as state regulatory officials inform the federal government Meat Inspection Division that in our respective state we request and order them to place a quarantine in our name on any lot delivered to them that shows vesicular disease, they have no other recourse than to put it through federal meat inspection in accordance with paragraph 1134.

I want to make that clear. I think it is important that we have that point clarified, and certainly I know that when I get home I am going to send a letter to them, so that I have it in black and white, ordering them to quarantine in my name. I don't say they haven't been doing that, because at the Miller Packing Plant, when this first came up and it was called to my attention, I gave an order that no hogs of any lot would be put through for kill if there was any vesicular disease in any one animal in any group of hogs. They quarantined something like 2600 hogs at that market, on that order. It was not until later, when my Board rescinded my quarantine order, that we got into difficulty. That, of course, was no business of the federal meat inspectors. When the quarantine order was countermanded they moved through slaughter under paragraph 1134, and of course that certainly didn't help to stop the spread of the disease.

If we have these points clearly in our mind, and if we know what we can do and how we should operate, I think it will be very helpful for us to move in that direction.

There are some other things about this whole procedure that needs clarification. Dr. Fladness told us of the instances of the East St. Louis yards contaminated
four times in a row. Whenever any yard permits itself to become infected on four different occasions, then I think it is time a few of us got wise enough to embargo against that yard on shipments through that yard.

Beyond that, I will make this statement, and I am happy to make it because I am sincere about it: We are never going to keep these yards clean until owners have enough God-given intelligence to stop sending exposed animals—I don't care whether they have been exposed to hog cholera or vesicular exanthema or any other infectious disease—of livestock and poultry. The filthy habit in this country of trying to salvage some dirty dollars out of exposed animals by foisting them on someone else, ought to be stopped.

Until livestock markets provide that any animal presented must be accompanied by a certificate of health indicating that the herd from which it comes is free from any infectious disease, we will not control this disease, but shall continue to have outbreaks ad infinitum.

There should be official veterinary supervision over all livestock sales yards and markets if we are seriously thinking about control of diseases of livestock, to say nothing about the possibility of biological warfare.

There are a lot of things that have to be done. Trucks and railway stock cars certainly should be cleaned and disinfected before being loaded with healthy livestock.

The veterinary profession in this nation has a grave responsibility to discharge, by promptly reporting, the existence of any infectious disease and can do much to point out to their clients the fallacy of marketing diseased and exposed stock.
INFECTIOUS ATROPHIC RHINITIS IN OHIO

R. S. SMILEY, D.V.M.*

Columbus, Ohio

The increasing prevalence of infectious atrophic rhinitis of swine in Ohio points out the need for serious study of the disease as well as a more thorough understanding of the condition. Also called atrophic or dystrophic rhinitis and sometimes confused with the condition known as "bull-nose", the disease has been encountered throughout the United States in recent years. Bull-nose is a condition which develops following injuries and resultant infection and is usually limited to a few individuals in a herd. It is rarely observed as a yearly occurrence on farms and if present, is usually not of serious consequence. The insidious nature of the disease as well as the serious economic effect have caused many breeders to forego swine production.

Field observations show that the extent and degree of involvement in various areas is apparently in direct relationship to the volume of sales and movement of infected swine. In some localities, the infection has been traced to as many as 50 farms from one specific source of infection. Infectious rhinitis has an insidious onset and the condition ordinarily does not attain full significance until the second or third year after infection enters the herd. Thus the disease may exist on a farm for two years before the owner realizes the severity of the condition.

A certain syndrome occurs on infected farms. For instance, a boar of unknown history is purchased and used to propagate litters from home raised gilts. The first progeny do not tend to reveal evidence of infection, although the owner may notice five or six showing crooked snouts as well as tilted heads. During the following year gilts retained from this herd will produce progeny that are seriously affected. Symptoms usually develop within the first three weeks after birth. Baby pigs develop a sneezing and coughing which may or may not be accompanied by nasal discharge. Symptoms of pneumonia usually develop a week to ten days later. General unthriftiness, rough hair coat, diarrhea and consequent emaciation frequently follow. The death rate in this stage may be as high as 20 to 30 per cent with the losses generally due to the development of a secondary pneumonia. Approximately 5 to 20 per cent of the pigs which survive the initial attack are stunted for life and never attain market weight—90 to 125 lb. being the maximum. This group shows the major amount of visible changes in the appearance of the snout as lateral distortion develops. A second group may show little or no visible changes in appearance but will require three to five extra months of feeding to reach market weight. The remainder of the herd will apparently be unaffected and will be ready for marketing at the usual time.

A brief review of the history of atrophic rhinitis discloses that it is not a new disease. It has been recognized in European countries for some 70 years, assuming a cyclical enzootic nature. According to a report by Jensen (1) in 1916, the disease has been especially prevalent in Denmark, North Germany, Poland, Sweden and

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Norway. It is the contention of a Canadian investigator that the disease was brought to America by the importation of Danish Landrace breeding swine from Sweden. According to Quin (3), "The disease is well distributed from Ontario and Ohio on the east and throughout the swine belt states to Nebraska on the west, and from Minnesota to the Gulf on the south." With the increasing frequency of reports of this disease, we became more concerned as to its presence in Ohio. By incorporating a discussion of the disease in our Civil Defense programs held with veterinarians and farmers, we soon developed a "consciousness" of the disease and received numerous requests for consultation assistance.

One of the first farms visited disclosed what we believe to be a typical history. This investigation was made October 31, 1951, on the farm of an average swine breeder, having 11 sows which had farrowed 100 pigs nine months previously. At the time of the visit there were 60 of these shoats still living; 11 having an average weight of 200 pounds, 16 an average weight of 145 pounds and the remainder from 40 to 125 lbs. This breeder had anticipated expanding his swine program and had rented additional ground for corn production. He was now faced with the unfortunate circumstance of an over-supply of corn and virtually no hogs, since we recommended consigning 27 hogs, as well as the sows, to immediate slaughter and sending the remainder to a reduction plant.

Following other investigations it was deemed advisable to survey the disease on a farm where purebred swine were raised, since this type of management would afford more complete histories relative to purchases and sales.

In December 1951, a breeder of purebred Hampshire swine informed us he believed he had the disease on the premises and had unknowingly been guilty of selling gilts affected with the disease. He further indicated his desire to cooperate in any manner which might disclose how the disease was introduced into his herd. It was felt this old established herd would provide an excellent opportunity for an historical study of the disease. To avoid any embarrassment for this breeder, we shall refer to him as Jones and Son.

At this farm, symptoms of atrophic rhinitis were first noticed in 1948, occurring in feeding shoats of five to six months of age, and characterized by crooked, distorted snouts which were believed to be a form of bull nose. At the Jones farm it is common practice to maintain 20 older breeding sows, 20 to 30 breeding gilts and three boars for herd sires.

In 1949 a few distorted snouts were observed along with tilted heads similar to middle ear infection. Those with tilted heads usually became very thin and eventually died. In the spring of 1951 approximately 20 older sows and 20 bred gilts developed nose bleeds. This condition developed about a month before farrowing time. At farrowing time the sows averaged eight to ten pigs per litter, but from two weeks to weaning time 10 per cent of these pigs became thin and died. From weaning age to three months the shoats were slow but appeared to be growing fairly well. At four to six months these hogs became unthrifty and rough. These February pigs were sent to slaughter in September weighing 210 pounds. Mr. Jones reported he found two to three dead hogs every 30 days during the feeding period. During the farrowing period of August and September of 1951, the sows and gilts developed nose bleeds but farrowed seven to eight healthy appearing pigs per litter. Then at
about ten days to two weeks of age these pigs appeared to be "drying-up" and
dying at the rate of four or five per litter.

In the fall of 1951 Mr. Jones estimated his losses at 30 per cent between farrowing
and weaning time, or a loss of 100 pigs. The remaining feeders were about half
normal size ranging from 40 to 90 pounds.

Mr. Jones kept five gilts and one barrow for meat purposes. These reached weights
of 270 to 300 pounds but were 1951 spring pigs. At the time of slaughter, all five
gilts showed a complete absence of turbinates; the barrow was normal.

**Resume of Farrowing—Weaning Period**

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In the study of this herd history it was deemed advisable to check the additions
of breeding stock as well as farms to which Mr. Jones had sold hogs. During the
period from September 1946 to 1950 Jones and Son purchased four boars designated
as A, B, C and E. Pigs sired by the B boar showed evidence of atrophic rhinitis;
this boar was sold in March 1949 together with five gilts to a breeder, Mr. X. A
check at the X farm revealed his hogs did so poorly that he was forced to dispose
of his entire herd. The C boar was used in 1949–50 and distorted snouts appeared
in litters sired by this boar. Other boars were used during the same period but a
higher percentage of infection appeared in C boar bred sows. A son of the C boar
was later used as a herd sire. Pigs sired by this boar also showed distorted snouts
but in no greater percentage than other boars used.

One sow and gilt were sold to Mr. Jones in August 1951 at a state sale. This sow
and gilt developed nosebleed and their litters developed distorted snouts. Two bred
gilts were sold to Mr. Z at the same sale. Mr. Z apparently had no trouble before
this purchase, but a survey at the Z farm disclosed the herd to be infected. This
basic history was true in each instance where sows or gilts had been sold. Mr.
Jones moved to his present farm in 1941 and during that year he had a few pigs
with distorted snouts which he believed to be bull-nose, whether this constituted
the initial onset is unknown.

A check of herds from which Mr. Jones had made purchases was not completed
because of the untimely appearance of anthrax and vesicular exanthema but it is
hoped the study may be completed. Currently the Division of Animal Industry, in
cooperation with the Bureau of Animal Industry personnel, are carrying on educa-
tional meetings with the swine breeders in the several counties of Ohio. These
meetings are apparently creating sufficient consciousness to atrophic rhinitis that
efforts are being expended by breeders to exercise critical judgment in both sales
and purchases to minimize further spread of the disease.
SUMMARY

1. It is very apparent that more investigational work must be done to identify the etiological agent.

2. Observations reveal the disease to be highly infectious.

3. Atrophic rhinitis can be present with no visible distortions.

4. In every case observed, when unthriftness and stunting of the hog is apparent the animal not only shows atrophy of the ventral turbinates but reveals consolidation of the apical lobes of the lung.

5. Secondary infections apparently cause the stunting and unthriftness as we have observed good thrifty hogs showing complete destruction of the ventral turbinates when slaughtered.

REFERENCES


DISCUSSION OF DR. SMILEY’S PAPER

DR. T. LLOYD JONES [Ontario]: Thank you, Mr. President. I have enjoyed this paper very much.

In commenting on it I would say that it would appear to me that in Ohio they probably are dealing with more than infectious atrophic rhinitis, per se, comparing our experience with what was described in the paper.

For instance, the matter of pneumonia developing soon after the initial symptoms were shown, is not our experience; and, considering the fact that I take it that the pneumonia is characterized by being confined usually to the apical lobes, I wonder whether or not virus pneumonia is present in Ohio pigs. It is, of course, a very common disease, but we have not associated a pneumonia with rhinitis excepting as a definite secondary condition.

In Alberta, compared to Ontario, in much older swine with distortion of the nose, corynebacterium abscesses were found quite frequently in the lungs.

Recently we have become interested in the possibility of a localized nutritional deficiency being associated with the infection in the nose. We wonder if perhaps there may be a localized vitamin C deficiency. I am not well versed in nutritional diseases, but there are so many points about the lesion of rhinitis that simulate lesions in the human resulting from a vitamin C deficiency—the lack of development of the bone, atrophy of the turbinate, and rarefaction of the affected area, for example.

One of the earliest indications of infection that we have found is a purulent inflammation involving the ethmoid or ethmoturbinate. You will find this before seeing any evidence of turbinate involvement; I am speaking now of the experimentally produced disease.

We have tried streptomycin as an agent that may contribute to reducing the effect of rhinitis in an infected herd. Doing this on a field basis, we found that there were fewer cases of rhinitis in litters when half of the number were given three injections of 100,000 micrograms of streptomycin within the first month.

Gwatkin, in Ottawa, has done a similar thing by giving the streptomycin locally, instilling it in the nostril on five consecutive days, and similarly he found a reduction in the incidence of the disease.

I would think that, from our experience, rhinitis, like most other infectious diseases, becomes less serious as the disease progresses in a certain area. It seems to me that herds that were seriously affected with rhinitis developed a certain natural immunity from being exposed to the infection. New herds are showing the infection all the time, but the older herds, wherein the disease became well established, are, I think, clearing up. Therefore, it appears as though there is a natural immunity developing as the result of being infected with the disease.

I go back to the vitamin C proposition: There are a lot of things about this disease that make it different from a straight infectious disease. First of all, the most susceptible pig is the one that ordinarily has a certain amount of maternal immunity. In other words, the younger the pig, the more susceptible it is to this infection, and there is an age resistance in rhinitis.
DISCUSSION OF DR. SMILEY'S PAPER

We are switching our interest in an endeavor to find if there are two factors acting in concert here, whether or not there is not only infection but whether the infection itself is resulting in a localized dystrophy.

PRESIDENT R. L. WEST: Thank you very much, Dr. Jones. Are there any questions from the floor? Any discussion?

DR. H. J. HIGHT: How about developing a vaccine?

PRESIDENT R. L. WEST: Can anyone answer Dr. Hight's question as to the possibility of developing a vaccine?

DR. A. H. QUIN: I think the old postulation holds, that before you perfect your vaccine you first must discover the cause. Certainly at the present time that is completely hazy. I don't believe anyone can give you even a specific hint other than the research approaches, as Dr. Jones has outlined.

I would like to express a bit of feeling here. For the life of me I can't understand the lack of specific intensive concern of the livestock officials in the respective states and the United States Bureau of Animal Industry over the seriousness of this disease. Here is something that, within a period of as few as five years, has involved almost every swine-raising area in the United States. Specific instances can be given.

I know an Iowa breeder who for several years has averaged over $50,000 in the sale of purebred swine annually. He has dispersed his animals and is now out of the swine business. One of the leading Ohio swine breeders also is out of the swine business. I know that the largest Hampshire herd in America is in the process of dispersal, and the farmers are changing over to a cattle economy on that ranch. I know of a county in Iowa that I defy any breeder in the United States to go to and buy purebred swine from a clean herd. There is no such thing in the county.

Yet, while we express grave concern over vesicular exanthema, and while we bewail the great bogy of foot-and-mouth disease that hangs over our head, here is a disease that is cutting the swine industry off at its foundation. Why in the name of all that is sensible don't some agencies correlate their efforts and concentrate research on this disease? Procrastination has threatened to ruin the swine industry, and this is one disease that, to my mind, can put these breeders completely out of business.

PRESIDENT R. L. WEST: Thank you, Doctor Quin. Your remarks are well taken. Is there any further discussion on this paper on atrophic rhinitis?

I might say that I agree wholeheartedly with Dr. Quin. I think there certainly is a crying need, first, for research so that regulatory officials will have a basis upon which to establish regulations, and then prompt and efficient action by regulatory officials to take advantage of the facts as developed by research.

If there is no further discussion, we will proceed.
REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

J. D. Ray, White Hall, Illinois, Chairman; Frank Breed, Lincoln, Nebraska; R. Fenstermacher, St. Paul, Minnesota; H. U. Garrett, Des Moines, Iowa; Roy A. Thompson, Springfield, Illinois.

To obtain an over-all picture of the transmissible disease problem in swine over the country, your committee communicated with livestock sanitary officials of the 48 states and 42 of them replied, furnishing reports on current conditions. These reports are submitted in summary.

VESICULAR EXANTHEMA

Vesicular exanthema suddenly became headlines in the livestock disease control column this year. It has been recognized in California for about 20 years and had been confined to that state. During the summer of 1952 it became widespread throughout the country, invading 29 states up to this time. Raw garbage seems to be the primary source of the infection. Shipment of infected animals through central markets contaminated these markets. Swine exposed in these places were scattered over a wide area before it was recognized that vesicular exanthema was a factor. As soon as a diagnosis was established, quarantine measures were set in motion and shipments that might have been exposed were traced and quarantined.

As of today, the disease has been eradicated from 18 of the 29 states where it became established. Thus far, it has been confined primarily to raw garbage feeding establishments, public stockyards and hog cholera serum plants which were infected by garbage fed hogs obtained for serum production. Fortunately, infection has not spread to farm herds in general.

It is evident that considerable infected and contaminated pork is in storage and as long as this supply lasts and raw garbage is fed to hogs there will likely be sporadic outbreaks of vesicular exanthema in swine. This committee hoped to have a panel discussion of vesicular exanthema on this program but time could not be obtained.

HOG CHOLERA

The incidence of hog cholera has remained unchanged or decreased in 32 of the states reporting during the year. Seven states indicated an increase and only one of these was a major swine producing state. Two of the major swine producing states reported a decrease in incidence. A few reports were listed where unfavorable results followed the use of the new type attenuated hog cholera vaccines on pigs kept in garbage feeding lots.

SWINE ERYSPIELAS

Swine erysipelas remained about static for the year. Four states reported increased incidence. Only one of these was a major swine producing state. A total of five states reported a decreased incidence of this disease and two of these were major swine producing states. The simultaneous use of anti-swine erysipelas serum and Erysipelothrix rhusiopathiae vaccine is permitted in 24 states. The vaccine is a
potential hazard to both animals and man if improperly handled. Therefore, this committee recommends that this association actively support the continuation of controlled distribution of *Erysipelothis rhusiopathiae* vaccine through veterinarians.

**ATROPHIC RHINITIS**

Atrophic rhinitis is becoming a major problem in swine production. Its incidence increased in eight states and six of these were in the Midwest. A discussion of this disease as it has been encountered in Ohio is scheduled elsewhere on this program. More information about this disease is needed.

**TRANSMISSIBLE GASTROENTERITIS**

Transmissible gastroenteritis continues to cause the death of many baby pigs. However, it was reported on the increase in only three states. None of these were in the Midwest. There were four states that experienced a decrease of the disease and two of these were major swine producing states. More information is needed on the prevalence of this disease in feeder hogs where no baby pigs are on the premises.

**ENTERITIS COMPLEX**

The enteritis complex continues to be an important problem in swine production. However, reports this year indicate that less trouble than usual was experienced. Only three states had an increased incidence and none of these were in the Midwest. Five states noted a decrease of the trouble. One of these was a major swine producing state. The problem of relapses where Vibrio colon infection prevails continues to be a factor following whatever treatment is used.

**EDEMA DISEASE OF SWINE**

Edema disease of swine was considered on the increase in five states. One of these was in the Midwest. However, two other major swine producing states indicated a decreased incidence during the year. The disease was not recognized in 24 of the states reporting. Unless careful observations are made at time of autopsy, this condition will be overlooked in many cases.

**POST-VACCINATION TROUBLES**

Post-vaccination troubles were much less prevalent this year. Only two states found an increase and one of these was a midwestern state. There were 12 states which reported a decreased incidence of post-vaccination trouble and six of these were of the major swine producing group.

**GENERAL REMARKS**

Anthrax was reported as a problem in swine during the year by four states. How widespread this disease was among swine over the country as a whole was not ascertained.

One state official reported respiratory complications (swine influenza and pneumonia) on the increase. Losses from these complications have not been uncommon during the summer in the Midwest. Reports indicate that an improved situation
as far as swine diseases in general was concerned developed in some states as a result of restricted movement of swine during quarantine periods this year. Community sales were closed and back to farm movement of swine was at a standstill in some states for a number of weeks. This experience should give sufficient proof of the worth of quarantine with proper sanitary precautions and control of traffic in swine to make it possible to do a better job of this kind in the future.

The Committee on Brucellosis will handle that subject, but we want to emphasize the importance of this disease and the need for better control in swine.

Increased interest in research on transmissible diseases of swine has become evident. However, the Committee feels that it is still inadequate compared to the monetary value of the swine industry and the enormous losses that occur annually.
At the 1951 meeting of this association, the unsatisfactory status of poultry meat inspection was discussed. Since that meeting this situation has been subjected to further study. The findings are as follows:

1. Efforts are being made toward wider application of checking and enforcement of sanitary requirements relative to poultry and poultry products.

2. Conferences for poultry lay sanitarians have been offered in appropriate locations by the Production and Marketing Administration and for professional sanitarians by the United States Public Health Service.

3. After July 1, 1953, the Grade A shield can no longer be used on dressed poultry.

4. There is a serious shortage of veterinary meat inspectors.

The following data supplied by Mr. W. D. Termohlen, Poultry Branch, Production and Marketing Administration, U. S. Department of Agriculture, indicate quite clearly the problems involved in attempting to establish a satisfactory inspection service:

"There were approximately 1,750 poultry processing establishments (including many smaller plants) in the United States in 1949. We have 528 official processing plants in the United States, including those which dress only, eviscerate only and those which do both. On March 1, 1952, there were 194 plants contracting for the inspection of wholesomeness. One hundred and ninety-four plants operate under official inspection. There are few, if any, plants which operate under intermittent inspection, but many work seasonally. The PMA has 204 full time veterinary inspectors and 35 W.A.E. (when actually engaged), including supervisory personnel. In addition to these the PMA has a number of lay inspectors, 34 on the line, 23 processing inspectors. Also 159 lay inspectors of the Meat Inspection Division hold poultry inspection cards and work part time. All the lay inspectors work under the supervision of veterinary inspectors, and all lay inspectors who perform postmortem inspection work on the inspection lines are under the immediate supervision of veterinary inspectors who are stationed in the same plants."

Some figures supplied by the chief of the food inspection service of one of our largest cities offer one explanation for the shortage of meat inspectors. In that city there are 35 slaughter houses under city inspection. There are 26 veterinary inspector positions provided for in the budget. The maximum salary for the veterinarians is $4923 per year plus paid overtime at the usual rates of time and one-half. At present this city has ten veterinary inspectors, a chief veterinarian and two associate veterinarians. The balance of the veterinary vacancies have been filled with lay inspectors at health inspector salaries of $4,126 per year maximum.

As a way out of this difficulty, the creation of a new profession of meat inspectors has been suggested. The pros and cons of such a move were discussed by the chairman of this committee in a paper presented at the meeting of the American Veterinary Medical Association at Atlantic City, N. J., in June of this year.
In the opinion of this committee, the present poultry inspection service is, from both an administrative and an enforcement standpoint, too remote from the problem. We have precedent to go by in the present methods of milk production as to sanitation and inspection. Nothing can be found in the methods or economics of the poultry industry, either from a production or processing standpoint, that would not adapt itself to a similar setup. Your committee recommends the setting up of local administration and enforcement of poultry sanitation and poultry inspection. There should be a state supervision to guarantee uniformity and the maintenance of minimum standards of both sanitation and inspection. To assure widespread uniformity and acceptance of the product, a system of public health scoring by areas should also be established.

Model ordinances for both poultry sanitation and poultry inspection should be formulated.

The new committee, proposed below, should be instructed at the next meeting to recommend for consideration minimum standards for sanitation and minimum standards for inspection; or that the U. S. Public Health Service be urged to present such recommendations; or, that, possibly, the two working together present them jointly.

Mention has been made of the problem faced by cheese manufacturers and others because of antibiotics in milk. According to Kosikowsky, et al.,(1) this problem is evidently not a very serious one. However, promiscuous medication of dairy cows with antibiotics and sulfa drugs should be discouraged. Sufficient amounts of antibiotics in milk interfere with cheese making and the possibility also exists that sensitization may be experienced by consumers of milk containing antibiotics.

The question has been raised as to whether dairy and milk hygiene and meat hygiene are veterinary problems and whether they should be handled by veterinary organizations or by the U. S. Public Health Service.

Your committee feels definitely that dairy and milk hygiene and especially meat hygiene are veterinary problems; and that the meat inspection service must be left in the Bureau of Animal Industry, where it has been so well handled in the past.

A most convincing reason for keeping the meat inspection service in the Bureau of Animal Industry is the close relation which it bears to infectious disease control, the chief function of the BAI. Through meat inspection we have a most useful adjunct to other means of disease detection, the first step in effective control and eradication of communicable disease. For example, the program of eradicating tuberculosis in cattle throughout the United States probably ranks as one of the larger interests of this association. It has been the experience of the BAI in recent years since its eradication program has progressed to the point where it can be considered to have practically accomplished its objective, that the finding of lesions of tuberculosis on post-mortem examinations made by veterinary meat inspectors have assumed prime importance. It has been realized for some time now that the testing routine, that has brought the tuberculosis program to this last stage of accomplishment, is not longer a practical device for further lowering the incidence of tuberculosis of cattle or even keeping it at its present low rate. In more than one case, more tuberculosis-infected cattle were detected in a state as a result of
tracing to their origin cattle that were found to be affected with tuberculosis when meat inspection postmortems were made than were found through the testing routine in the state.

The following recommendations are included in this report at the suggestion of some members of our Association from New Jersey:

"To strengthen existing regulations more effectively for the purpose of controlling not only trichinosis but also other hog diseases which are or may be spread by feeding uncooked garbage and to control the interstate shipment of hogs which have been fed uncooked garbage, it is strongly recommended that:

1. The U. S. Bureau of Animal Industry, Meat Inspection Division, refuse to accept into federal plants any hogs for slaughter which have been fed raw garbage.

2. The U. S. Bureau of Animal Industry refuse to permit the interstate shipment of hogs which have been fed raw garbage.

3. The U. S. Bureau of Animal Industry refuse to permit the interstate shipment of hogs which have been fed improperly cooked garbage or which have been raised under insanitary or vermin-infested conditions contrary to regulations established by the Bureau.

4. The U. S. Public Health Service further amend the interstate quarantine regulations to prohibit the interstate shipment of uncooked garbage."

In view of the fact that the main interest of this association is livestock sanitation, a subject inseparable from epizootiology, and that the relationship of communicable diseases of animals to public health is receiving more and more attention, your committee recommends the creation of a committee on veterinary public health, in place of the present committee on milk and meat hygiene. Such a committee would have a wider field of activity which could, when deemed necessary, include meat and milk hygiene problems.

REFERENCES

SCRAPIE


Scrapie is a chronic neurosis of sheep and goats characterized by intense pruritis, progressive incoordination, weakness, paralysis and death. It seldom appears in animals under 18 months of age and is usually fatal after a course of some months. It was reported in France by Besnoit and Morel (1898) and by Carre and Lucam (1937). It has been known in Britain for 200 years and was studied in that country by M’Fadyean in 1918, Stockman in 1926 and by Greig and his coworkers at the Moredun Institute since 1940. It was reported in three Canadian flocks in 1945. The disease has recently been diagnosed in a band of sheep in California.

Etiology. Cuille and Chelle (1936–1938) reported the transmission of the disease by means of emulsions of cerebrum, medulla and spinal cord from infected animals when administered intraocularly, intracerebrally, epidurally and subcutaneously. The incubation period varied from 11 to 22 months. They also reproduced the disease by the introduction of filtered spinal cord emulsion, intraocularly and subcutaneously in 16 months.

Greig (1940) reported that the disease was transmitted by pasture contact after three years and three months.

As a result of apparent transmission of scrapie through the medium of louping ill vaccine Wilson, Anderson and Smith (1950) carried out extensive research at the Moredun Institute in which it was shown that emulsions of diseased brain and spinal cord filtered through gradacol membranes with apertures of 0.41 and 0.65 microns would readily transmit the disease when injected intracerebrally. They subjected the virus to nine serial passages. The incubation period in these experiments was in some instances as short as ten days but usually it was four or five months.

No information was obtained on the natural means of transmission. Desiccated brain tissue remained virulent when held at 0°–4° C for two years.

Symptoms. The disease is insidious in its development, the first signs remaining unnoticed unless carefully observed. Restlessness and excitability are first apparent. Tremors and grinding of teeth may be seen. Pruritis is characteristic with rubbing against solid objects and scratching with the hind feet. When the back is scratched by hand the sheep responds with contraction of the lips and wagging of the tail. Soon the wool is lost from the flanks and hind quarters.

Appetite remains good and there is no rise in temperature. Incoordination of locomotion gradually ensues. Excitement may result in convulsive seizures followed by coma. Finally emaciation and weakness comes on, the sheep goes down and is later unable to rise. Fatal termination is usual but some of the experimental cases are reported to have recovered.

Lesions. Outside of loss of wool and injury from scratching, and emaciation, lesions are microscopic. Vacuolation of the nerve cells of the medulla was most characteristic. Perivascular lymphocytic infiltration was widely distributed in the

1 Sheep Diseases—Published by: The Williams & Wilkins Co., Baltimore—1952.

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central nervous system and the meninges but only a small proportion of the vessels were so affected. The histologic changes may be interpreted as indicating a chronic meningo-encephalitis.

Control. Since the means of natural transmission are still unknown, no adequate control measures are available. Because of the chronic nature of the disease it is doubtful if vaccines would be effective. The destruction of diseased animals as soon as a diagnosis is made would seem advisable.

REFERENCES


SCRAPIE IN CALIFORNIA

ARTHUR G. BOYD, D.V.M.

Veterinarians of the Division of Animal Industry of the California State Department of Agriculture recently observed sheep on two ranches in Butte County, California, showing clinical symptoms of the disease known as Scrapie. The animals on these premises were placed under quarantine. There are 534 sheep on one premise and 52 on the other. There is a history of direct movement of sheep between these two ranches. All possible contacts are being traced. Subsequent studies both in the field and the laboratory have confirmed our earlier suspicions and the diagnosis of Scrapie has now been agreed upon by veterinarians and pathologists of the California Division of Animal Industry and several veterinarians of the United States Bureau of Animal Industry.

It is our understanding that this disease has not been reported as having occurred heretofore in the United States. Indications are that the disease was brought into California by sheep imported from Canada where, we understand, Scrapie has occurred on a few occasions. One of the owners involved purchased 100 bred pure-bred Suffolk ewes in Ontario, Canada, which arrived at his ranch in California October 19, 1948. To date there have been two deaths reported on each of the two premises involved. At this writing four sheep on each ranch are showing symptoms of Scrapie. One animal was sacrificed for laboratory study and another died upon arrival at the laboratory. All of the affected animals to date exhibited symptoms indistinguishable from those described in the literature for Scrapie. The affected sheep in the outbreak reported have only been observed in ewes averaging about three years of age.

Reports pertaining to this disease have been given to Dr. B. T. Simms, Chief of the United States Bureau of Animal Industry, and others of his staff, commencing at the time when we made our first observation. An invitation was extended to Dr. Simms to send representatives to California to observe the infected animals, resulting in his delegating two veterinarians, Doctors C. L. Davis and H. E. Kemper, to visit California within the past several days. Both of them have made studies of the problem in the field and in the laboratory and, together with the United States Bureau of Animal Industry Veterinarian In Charge in California, they concur with our veterinarians that the disease constitutes a threat to the sheep industry of the nation and should be eradicated without delay by destruction of the sheep on the two premises involved.

Scrapie is reported to have occurred in Great Britain during the past 200 years and there is evidence of its occurrence in Germany and France during the latter part of the eighteenth century. It has been reported in Canada in 1945, 1951 and 1952. Reports indicate that Australia has experienced its first outbreak recently and in July 1952 the first outbreak of Scrapie appeared in New Zealand among sheep imported from two English farms. It is of interest to note that the sheep in New Zealand in which the disease occurred were held in routine quarantine for a time after arrival and released early in 1950.

1 A. G. Boyd, Chief, Division of Animal Industry Cal. Department of Agriculture Sacramento, California.
Scrapie is a fatal neurosis characterized by symptoms of intense and progressive itching and increased debility and loss of muscular control. It is caused by a filtrable virus which has been found in the brain, spinal cord and spleen. It can be transmitted through the pasture, by congenital infection through either parent and by experimental inoculation. The incubation period is reported to be three years or longer. The disease is seldom seen in animals less than eighteen months of age.

The appetite of the affected animals does not seem to be disturbed. There is no elevation of temperature. Early in the disease the animal when moved appears excited and sometimes evidences muscular tremor. They have a tendency to carry the head high. Feces and urine may be involuntarily passed during periods of excitement. Probably the most characteristic clinical symptom is the development of progressive itching which frequently starts in the region of the rump and gradually extends forward over the body. When the skin over the back is rubbed the affected animal will exhibit nibbling movements of the lips. The sheep repeatedly rubs itself against fixed objects, but apart from abrasions on the skin and loss of wool no lesions of the skin are observed. There is progressive emaciation and weakness and difficulty in rising. The affected animals show a peculiar trotting gait and occasionally
convulsions and paralysis of the hind quarters. The symptoms tend to increase in intensity throughout the course of the disease. The disease is reported to be usually fatal although upon occasion recoveries have been noted. The course of the disease shows marked variation in its duration. The literature reports instances in which a fatal termination was reached within 14 days after the first signs of illness, but usually the disease is chronic in type and runs a course of six weeks to six months or longer before terminating in death.

On post mortem examinations no significant changes were observed. Histopathological studies in our Sacramento pathology laboratory on two affected ewes revealed vacuolation of some of the neuron cells of the medulla. This finding is reported in the literature as being observed in Scrapie. Insofar as we have been able to determine the histopathological findings are unlike those described in any other infectious disease of animals. Bacteriological studies have been negative.

Because of the unusually long incubation period involved in Scrapie it presents a most difficult situation in any attempt to control it by inspection and quarantine methods. In view of this and the fact that there is no treatment it would seem that the only proper procedure would be to destroy the affected animals on the two premises.

In the interest of protection of our sheep industry it is our sincere hope that the
United States Department of Agriculture will agree with our request to enter into an immediate cooperative arrangement with the California State Department of Agriculture to participate on a fifty-fifty basis in the expenses involved in indemnifying owners of the animals to be destroyed. California laws will permit such an arrangement, but are contingent upon federal participation on a fifty-fifty basis. We feel that it would be economically unwise and would ultimately prove to be extremely costly if this disease were permitted to become established, first in our breeding flocks and then later extend to our commercial bands of sheep.

On October 31, 1952, the Secretary of Agriculture proclaimed a state of emergency, arising from the existence of Scrapie in the State of California. This action permitted the United States Department of Agriculture to cooperate with State authorities in a program to eradicate the disease, including indemnity payments for animals destroyed.

The United States Bureau of Animal Industry and the California Department of Agriculture, on November 3, 1952, in an exchange of telegrams, agreed on a plan for joint cooperation to eradicate Scrapie. The following day all sheep, numbering 19, showing any evidence of Scrapie were destroyed and burned on the two infected ranches. Immediately following this the remaining sheep on these two premises were slaughtered at one plant under close supervision and the meat salvaged. The affected animals ranged in age from 2½ to 3½ years or over.

Investigation revealed that no sheep had been sold from one of the infected ranches, however, 51 premises were placed under Hold Order where breeding animals had been purchased from the other infected flock. These exposed flocks were located in 11 California counties with the exception of two which were located in Southern Oregon just over the California State line. The State Veterinarian of Oregon has been notified concerning these sheep and arrangements were made to move the animals back to California. No evidence of Scrapie has been found on any premises other than the two mentioned in Butte County, California.

The eradication procedure on the non-infected flocks then consisted of slaughtering only the animals that originated from the infected flock as well as any pure-bred sheep that have been exposed by breeding. Most of these were disposed of at rendering plants as they were in small lots not practical to ship for salvage. There were 363 exposed sheep in 51 flocks destroyed. A grand total of 906 sheep were slaughtered from 53 separate flocks. All of the slaughtered animals were appraised by Federal and State veterinarians. Where the owners could present satisfactory evidence that the animals were registered or were eligible for registration the appraisal was not over three times the estimated meat value. The eradication in connection with the 53 flocks was completed on January 7, 1953 and the owners are to receive indemnity amounting to the difference between any salvage obtained and the appraised value. The Federal and State Governments will share equally in the indemnity payments.

No record of Scrapie having been reported in the United States could be found when the outbreak was first reported in California. It developed later, however, that the disease had occurred in Michigan in 1947. A report concerning the Michigan case appeared in a recent issue of the M.S.C. Veterinarian (Volume 13, No. 1).
SCRAPIE

PRESIDENT WEST: Some of you noticed in the report of the Committee on Resolutions a reference to a new virus disease that has appeared in California, known as scrapie. We have no place on the program for it. With the permission of this group and the people who are to present the next paper, I believe it would be very advantageous and highly important to show a film which has been furnished by courtesy of Dr. A. G. Boyd, the State Veterinarian of California. This film was shown to the National Assembly of Chief Livestock Sanitary Officials earlier this week. It is a short film but is very instructive. Doctor Boyd, will you please come up and explain the film as it is shown? Doctor Boyd explained the film.

SECRETARY HENDERSHOTT: I might report on the telegram sent to Secretary Brannan.

The Executive Committee, in session on October 29, passed a resolution that the Secretary of this Association, in the name of the Association, send a telegram to the Hon. Charles P. Brannan, Secretary of Agriculture, dealing with the matter of scrapie in California. This is the telegram sent:

Honorable Charles P. Brannan,
Secretary of Agriculture
United States Dept. Agriculture
Washington, D. C.

"It is our unanimous opinion that scrapie, a virus disease of sheep which has just been diagnosed for the first time in the United States, is a threat to the livestock industry. It would be economically unwise and ultimately prove to be extremely costly if the disease is permitted to become established among the sheep in this nation. Therefore, in the interest of protecting the sheep industry, it is our sincere hope and we strongly urge you will agree to our urgent request to enter into immediate cooperative arrangement in the cost involved in the eradication of scrapie. We are prompted to make this plea to you as the Executive Committee of the United States Livestock Sanitary Association. Because of the unusually long incubation period involved in the disease, presenting a problem not comparable with any other disease of livestock and not lending itself to inspection and quarantine methods, and the fact that there is no known treatment, immediate action is necessary."
THE LANCET LIVER FLUKE, Dicrocoelium dendriticum,
INFECTION IN NEW YORK STATE LIVESTOCK,—DOES THIS
REPRESENT A NATIONAL LIVESTOCK HEALTH
HAZARD?

DONALD W. BAKER, D.V.M.
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The lancet liver fluke, Dicrocoelium dendriticum, has become established as a parasite of cattle and sheep in New York State. Information which has been obtained from twelve years of observation and study by workers at Cornell suggests that this parasitism will be difficult to eradicate from the endemic region. Since no effective program of control or containment has been attempted, the parasitism is spreading. The life cycle of the parasite is known and the method by which it is spread to susceptible animals was demonstrated this summer by Krull and Mapes.

It seems to me that now is the time and this meeting is an appropriate place for a consideration of our attitude respecting the control of this serious parasitism of cattle and sheep.

This outbreak is not a static situation. There has been a steady and continual spread of the infection around the periphery of the endemic zone during the decade in which we have known of the existence of this parasitism in New York State.

Will the cost of eradicating this parasitism from the six counties in New York State be prohibitive? Will it be possible, regardless of the cost, to eradicate the lancet fluke from the known endemic region? Is the Dicrocoelium liver fluke infection really a health hazard to our animals, and will it prove to be an economic liability to the livestock industry of this country? What assurance do we have that this parasitism does not exist in the cattle and sheep on farms in New England, Pennsylvania, New Jersey, Ohio, or even California? How many veterinarians would recognize the liver fluke if they found it while performing a post mortem examination on a cow, sheep, deer, woodchuck, or rabbit? How many inspectors employed by the federal, state, or municipal meat inspection services would recognize the parasitism in the course of routine inspection? How many veterinarians regardless of their special activities know that there is a species of liver fluke known as the Dicrocoelium dendriticum? Shall we decide to ignore the lancet fluke as a new health hazard and add it to the long list of established worm parasites which we are presently forced to live with? How much would it cost to eradicate the parasitism from the known endemic region at this time? How much will it cost the livestock industry in the form of condemned bovine and ovine livers during the next ten or 100 years? These are a few of the scores of questions which have been asked me recently by interested farmers and veterinarians in New York State.

The lancet fluke was first observed as a parasite of cattle in the United States by Dr. William Kinchelow of the United States Bureau Animal Industry. He was serving as the veterinary inspector at Abattoir #1016 in Linden, New Jersey when he encountered a bovine liver containing these flukes. This finding was reported immediately to the Headquarters in Washington, D. C. and Dr. Charles Morris of
the bureau field staff was instructed to visit the region where the shipment of cattle had originated in order to learn the identity of herd from which the infected animal had come.

The administrative offices of the federal and state bureaus in New York State invited me to collaborate with Doctor Morris on his survey and studies of the fluke infection. We were never able to definitely incriminate any herd from which the various animals had been taken. In two cases, the animals in the shipment represented the entire herd. There were no survivors left on the farms, and there was presumptive evidence that the infected animal was an Ayrshire cow which had been imported some time previously from Canada. We continued the project of surveying herds in the area suspected of being infected and in 1942-43 valuable assistance was rendered by Dr. F. K. Nelson who was serving as the inspector in charge at the Camp slaughter house in Cortland, New York.

Since the published information on this parasitism suggested that sheep, deer, and other ruminants might also be affected, we attempted for several years to survey all animals in the regions from which flukey livers were obtained. Dairy farming predominates in the counties surrounding Cortland, N. Y. and very few farmers raise sheep, goats, or even pigs any more on their farms. In the summers of 1944, 45, 46, and 47 we surveyed the few flocks of sheep as well as the herds of cattle in the region where the lancet fluke livers were obtained, but without discovering any infections outside of the dairy herds.

In 1948 we located one flock of sheep in which almost 100 per cent of the animals were suffering from the parasitism. The owner of this flock, Mr. George Dawson, of Cazenovia, N. Y., became interested in our work and put the flock at our disposal for investigational purposes. In 1949 Doctor Mapes began his investigations of the biological, pathological, and immunological, aspects of the parasitism using chiefly the sheep farm mentioned above. Our report which announced the first observation of the *Dicrocoelium dendriticum* in sheep was published in January 1950. Later in the year Doctor Mapes and I reported on our findings from a study of the livers of three white-tailed deer which had been killed and examined in the region of the Dawson farm. The livers of these deer showed evidence of infection with the *Dicrocoelium* liver flukes. Later in the year 1950, Dr. Mapes reported the results of his study of the other animals which he had suspected as possible carriers of the fluke, and he was able to identify the common woodchuck as an animal which was very susceptible of infection and which we believed to serve as a reservoir host.

In the course of his investigations Doctor Mapes incriminated the terrestrial snail known as *Cionella lubrica* as the necessary molluscan host. In the collection of over a dozen species of snails which were found commonly on the farms in central New York State only this species was susceptible of infection experimentally with the *dicrocollium cercaria*. Sporocysts and cercaria recovered from the experimentally infected snails were identical with those found in naturally infected snails of the same species on the Dawson farm. During the summers of 1951 and 52 Mapes and Krull have studied the processes by which the infection is distributed throughout the herds and to susceptible animals. The early attempts to infect susceptible hosts
with the cercaria in slime balls failed, but this year in August 1952, they were able to report a successful infection experiment, and they have incriminated the species of ants known as *Formica fusca*.

The information which we obtained from the surveys in the early years indicated that the fluke infection had become established on farms in at least six of the counties in the South central part of New York State. Our discovery of the flock of sheep maintained on a farm in one of these counties, Madison, in which practically all of the animals by October had become infected, gave us additional information. We know that the pasture provided the infective stage for the animals. Incidentally we learned that the sheep acquired a much heavier infection for the size of the animal and probably suffers more than the cow. The lambs which are sold for market in the early winter usually carry only a moderate infection. As the animals become older the parasites accumulate in greater numbers and some of the older ewes suffer considerably from the effects of the parasitism. The livers of these older ewes are useful for the study of the pathology of the disease. Later we were able to announce that the deer which grazes over much of the pastures used by cattle and sheep in this part of the State are also susceptible and may also acquire an infection of *Dicrocoelium dendriticum*. Naturally this makes the matter of control more difficult. Mapes finding that the woodchuck which abounds on the farms in New York State is a good host for this parasite aggravates the control situation. Farmers have been trying to eradicate woodchucks from their farms in this region for over 150 years, and the census for the past year indicates that they are as abundant as ever. Mapes incrimination of the small snails, *Cionella lubrica*, as the usual intermediate host aggravates the matter of control because this snail, which is very commonly found in the higher pastures of the farms in New York State, has a range which almost covers the United States. Krull's finding that a common species of ant can act as the transport or second intermediate host certainly does not improve our chances for an adequate control. With all of these animals available for infection it is unnecessary to add any comment in order to prove that this infection is not static but is spreading in all directions from the region which we know to be endemic. Now what should we do about this problem? If the meat inspection division of the bureau of animal industry and the meat inspection agencies representing state and municipal health departments require a condemnation of the livers which are infected with dicrocoelium fluke, it will result in a tremendous loss.

Bovine and ovine livers are used for medicinal purposes as well as for food. For over a decade various plans for the control and eradication of this parasitism have been considered. Any effective program will be expensive but the longer that we delay putting it into operation the more expensive it will become.

In his presidential address at the annual meeting of the Society of Parasitologist's this year, Dr. Emmett W. Price, eminent parasitologist of the United States Bureau of Animal Industry, noted that losses in the country from condemnation of livers, most of them, of course, condemned because of fasciola infection represented several millions of dollars annually. New York State always considered itself lucky because the intermediate snail host did not live within the borders, and although
for many years, thousands of infected animals were brought into New York State annually for feeding before putting on the market, the faciola infection had never become established.

The control program for faciola infection should be more easily carried out than the one which will be necessary for the control of dicrocoelium. The snail necessary for the development of the larval stages of faciola lives in water and it can be killed very easily by a low concentration of copper sulfate. Dangerous pastures can be made safe by draining the swampy areas. In contrast, the intermediate host for Dicrocoelium, Cionella lubrica, is a land snail and seems to prefer the higher pastures. It will be very difficult to eradicate this mollusk. I have never heard of an effective campaign to eradicate ants in any location. There are no effective quarantine regulations which will prevent animals which are infected in New York State from moving into the adjoining states or to other parts of this state. The unfortunate introduction of an infected cow into the central region of New York State sometime over ten years ago has posed a problem which will be difficult to solve.
This year the report of your committee on Parasitic Diseases is limited to a consideration of parasites and parasitic diseases of cattle.

**EXTERNAL PARASITES**

So far as known, cattle in the United States are free of common or psoroptic scabies; they are also free of cattle fever ticks, except those in the long, narrow buffer zone along the Rio Grande River, into which ticks are introduced from time to time as a result of the drifting of cattle from both sides of the river. The most important of the ectoparasites now affecting cattle in this country are lice, chorioptic and sarcoptic mites, horn flies, cattle grubs, screwworms, and spinose ear ticks.

**LICE**

During the winter months cattlemen all over the country appear to be more concerned about louse infestation than almost any other parasitic condition. Lice are present in practically every herd, these pests tending to persist from year to year. Besides annoying cattle and making them unthrifty, lice have a tendency to colonize on certain individual bovines to such an extent as to produce a severe anemia and even death. A field study, made in New Mexico by veterinarians and parasitologists of the Zoological Division of the Bureau of Animal Industry, showed that the degree of anemia in louse-infested cattle was in direct proportion to the degree of louse infestation.

Currently, sprays are being used extensively and successfully for the control of cattle lice. Power sprayers at a pressure of 200 to 400 pounds are the best substitute for the dipping vat. To accomplish the destruction of lice by spraying, all parts of the animal must be wetted thoroughly, not omitting the head, face, the inside of the ears, inside of the thighs, inside of the flanks, as well as the neck, brisket, and abdomen. Practically all the commonly used chlorinated hydrocarbon insecticides, as well as rotenone and pyrethrum, may be used for killing lice. Instructions on how to use various insecticides as lousicides on cattle, and how to prepare materials for spraying, dipping, and dusting, are given briefly and concisely in Leaflet No. 319, U. S. Department of Agriculture, entitled Control of Lice on Cattle. This leaflet may be obtained by writing to the U. S. Department of Agriculture, Washington 25, D. C.

**SCABIES**

The persistence of chorioptic and sarcoptic scabies in cattle in the United States probably is due to a variety of factors, among which are (1) the apparently greater resistance to insecticides of the mites causing these two types of scabies than that
of the mites which cause common scabies, and (2) replacing of the dipping vat by the power spraying machine. At present, comparatively few dipping vats are available, or maintained in good repair. Therefore, future efforts to eradicate the existing residual scabies in bovines will necessarily involve the use of pressure sprayers, for the most part.

Although ground has already been broken in adapting BHC, to the control of cattle scabies, much more work will have to be done before specific recommendations can be formulated for eradicating the residual cattle scabies in this country with this insecticide. The limited data already available show that sarcoptic and chorioptic bovine scabies may be controlled, if not eradicated, by spraying thoroughly and liberally with a 0.075 per cent suspension of wettable lindane at intervals of ten to 12 days. A single spraying with a concentration of 0.12 per cent of this chemical has not given consistently good results.

**HORN FLIES**

Horn flies may be controlled by spraying with 0.5 per cent DDT or methoxychlor suspension, the latter insecticide being preferable from the standpoint of producing milk that is safe for human consumption. In fact, DDT should not be used on dairy cattle, or on beef cattle to be consigned to slaughter within 30 days. Methoxychlor, at the concentration names, may be used for all cattle, several sprayings being necessary to control horn flies during the warm months.

**CATTLE GRUBS**

Spraying is the method of choice for the destruction of the two species of cattle grubs occurring in the United States, and rotenone-containing powders are the only insecticides that are being used to kill these parasites. The sprays are prepared from derris powder or cube powder containing approximately 5 per cent rotenone. The standard quantity to use is 7½ pounds of the powder to 100 gallons of water. Cattle should be sprayed under high pressure, from 400 to 500 pounds per square inch. A very high percentage of grub kill has been obtained by the use of a spray gun that will emit a stream the size of a lead pencil, in the form of a jet. The treatment must be repeated approximately every 30 days during the grub season. The volume of spray needed varies with the length and thickness of the hair coat, but on the average it is about two to three quarts per animal.

**SCREWWORMS**

The currently-recommended treatment of choice for the control of screwworms is a preparation known as EQ-335, which contains 3 per cent lindane mixed with pine oil, mineral oil, an emulsifier, and silica gel. This preparation is applied with a paint brush to the wounds made by the screwworms. The preparation destroys the maggots, and also the flies that are attracted to the treated wounds. Usually, the treatment is applied every seven days, but in cases where many maggots are present in wounds, the treatment may have to be used every three or four days.
A currently recommended spinose ear tick remedy, of which 1 per cent lindane is the active ingredient, is prepared by mixing 4 parts of a 25 per cent lindane emulsion with 96 parts of pure pine oil. This mixture is introduced into the ears of affected cattle by means of a spring-bottom oiler, having a spout cut down to a 2-inch length, and fitted with a rubber tube. One-half ounce per ear is the recommended dose. Another remedy consists of 7 parts of emulsifiable chlordane, containing 74 per cent of this chemical, mixed with 93 parts of pure pine oil, and used in the same manner as the lindane-pine oil mixture. Reinfestation after treatment may occur in about three weeks; an infested herd should be treated, therefore, a second time within six weeks after the first treatment.

INTERNAL PARASITES

Roundworms of the Digestive Tract

Although cattle are known to harbor a rather sizable array of roundworms in the gastrointestinal tract, consideration is given in this report only to those which are known to be the most important from the standpoints of frequency of occurrence and pathogenicity. These include the common, or anemia-producing, stomach worm, *Haemonchus contortus*; the medium stomach worm, *Ostertagia ostertagi*; the hair stomach worm, *Trichostrongylus axei*; the hookworm, *Bunostomum phlebotomum*; intestinal roundworms, *Cooperia* species; intestinal threadworms, *Strongyloides papillosus*; and the nodular worm, *Oesophagostomum radiatum*. The first three parasites named occur in the fourth stomach, and the others in the intestine.

These roundworms all have direct life cycles, which means that no intermediate hosts are involved in their transmission. The female worms in the stomach or intestine produce the eggs, which pass out with the droppings. On pastures, or elsewhere on the ground, the larvae hatch in about 24 hours and reach the infective stage in about a week or less, under favorable conditions, in the spring, summer and early fall. The infective larvae migrate upward on grass, and are swallowed by grazing animals. Some of these parasites, namely, the hookworm, the nodular worm, and the intestinal threadworm, can also penetrate the skin, reaching their preferred location in the digestive tract by migration by way of the blood to the lungs, thence by upward migration along the respiratory tract to the gullet, and thence through swallowing into the stomach or intestine.

The interval between the infection of cattle with the larvae of gastrointestinal parasites and the appearance of the parasite eggs in the droppings is known as the prepatent period, during which the worms develop to maturity. Depending on the species involved, the prepatent period, during which fecal examinations will disclose no evidence of parasitism, may be as short as ten days for threadworms, and as long as about six weeks for nodular worms, and eight weeks for hookworms; in the case of stomach worms, the prepatent period lasts about three weeks. In studies made at the Louisiana Experiment Station and at the U. S. Regional Animal Disease Research Laboratory, Auburn, Ala., it was observed that severe symptoms of parasitism and loss of weight were apparent during the prepatent period, in cases
where calves were given heavy infections with various parasites of the gastroin- 
testinal tract. Diarrhea, loss of appetite, and marked retardation in weight were 
the principal symptoms observed during that time.

Parasitism of the gastrointestinal tract can become sufficiently severe to cause 
death. However, it is important to bear in mind that stomach and intestinal round 
worms are insidious, and can cause much damage, even when present in numbers 
insufficient to provoke obvious symptoms. Controlled experiments carried out at 
the regional laboratory in Auburn, Ala., showed that moderate parasitisms with 
the common stomach worm, the medium stomach worm, and the intestinal round- 
worms of the genus Cooperia retarded the weight gains of young cattle as much as 
45 pounds per head, on the average, during a six-month-period on pasture. The 
retarded animals, did not at any time show any obvious symptoms of parasitism. 
These unapparent losses mean much more from the standpoint of beef production 
and the rearing of dairy replacements, than the spectacular death losses that occur 
from time to time. Inasmuch as the parasites of the gastrointestinal tract begin to 
produce their most injurious effects before they become susceptible to the anthel-
mintic action of drugs, the prevention of the acquisition of these parasites by 
management practices would appear to be of paramount importance. What the 
practices should be has not been satisfactorily determined.

**Lungworms**

The cattle lungworm, known as *Dictyocaulus viviparus*, is distributed throughout 
the United States. Fortunately, however, this parasite does not occur in every herd, 
as do some of the species that have just been discussed. The free-living stages of 
the lungworm appear to have rather restricted temperature and moisture require-
ments. Lungworm disease, therefore, is apt to be more troublesome in cattle grazing 
on low, wet pastures in the South, in the Pacific Coast states or elsewhere, than in 
animals grazing on well-drained pastures. Lungworm disease becomes increasingly 
serious with overstocking, a situation which is apt to prevail on irrigated pastures, 
where this parasitic infection is likely to become a more and more serious problem.

The lungworm has a direct life cycle. The female worms in the lungs produce eggs 
which hatch in the respiratory tract, the liberated microscopic larvae being coughed 
up, swallowed, and eliminated with the droppings. The larvae undergo their devel-
opment and reach the infective stage outside the host in the course of a few days. 
After being swallowed with grass, they make their way to the lungs by way of the 
blood stream or lymphatics, and develop to maturity in the course of three to four 
weeks. A catarrhal bronchitis develops as a result of the persistent irritation set up 
by the worms, and this may be followed by pneumonia due to secondary bacterial 
infection. The principal symptoms observed are coughing, labored breathing, dis-
charge from the nose, progressive weakness, and marked unthriftiness.

For a long time it was believed that lungworm disease was limited to calves and 
yearlings, but recently cases of parasitic bronchitis have been recognized in mature 
cattle in England. In such cases the worms frequently failed to develop, but re-
mained in the lungs in their larval state. When this occurred, a diagnosis could be 
made only on the basis of the chronic bronchitis. This diagnosis was confirmed by
autopsy findings, which revealed pulmonary lesions containing the immature lungworms.

The English workers consider lungworm disease or parasitic bronchitis in two categories, namely, typical and atypical. The typical form was seen in young animals, and was associated with large numbers of adult worms, lodging principally in the terminal air passages of the lungs. The atypical form occurred in adult animals, and was caused by the lodging of the immature lungworms in the lungs, presumably because the cattle had sufficient resistance to check the growth of the parasites. Secondary bacterial infection occurred more frequently in the atypical form of the disease, which was characterized by loss of appetite and a persistent high temperature. Both the typical and atypical forms of the disease resulted in loss of condition, reduced milk production, and coughing, the last symptom being severe enough to sometimes produce abortion a week or so before expected parturition.

Liver Flukes

Cattle in the southern states bordering on the Gulf of Mexico, as well as those in the Rocky Mountain and Pacific Coast states, may be infected with liver flukes of the genus Fasciola. Whether the common liver fluke in this country is F. hepatica in all cases, or whether another species of Fasciola, possibly F. gigantica, also occurs in the United States, is still problematic. It is known, however, that a third species of liver fluke, commonly known as the giant liver fluke, Fascioloides magna, occurs in cattle in this country. This parasite is native to North America, and occurs in deer and other wild ruminants. The evidence at hand indicates that it has become adapted to cattle since these animals were introduced into the North American continent. The adaptation is still incomplete, however, as shown by the fact that the reaction of cattle to the invasion of these parasites is so pronounced, that the flukes become completely enclosed in cysts in the liver and, apparently, remain there in blind alleys, their eggs being incapable of reaching the outside. Still another liver fluke, known as the lancet fluke, Dicrocelium dendriticum, occurs in the Finger Lake region of the state of New York, and has already been discussed by the preceding speaker.

Although there are reports that cattle in certain parts of the country are apparently unaffected by the flukes they harbor, this certainly has not been the experience of observers and investigators in other parts of the country where flukes occur, and is not in line with observations made in most parts of the world. However, regardless of what other losses liver flukes may cause, the condemnation under federal meat inspection of fluky cattle livers extracts an annual toll of about $3,000,000.

The common liver fluke has an indirect life cycle, the parasites becoming infective to cattle and other ruminants only after they have undergone a rather complicated developmental cycle in their snail intermediate hosts, this cycle involving a large increase in numbers. Although various control measures for liver flukes have been recommended and tested, including the killing of snails with chemicals and the medication of fluke-infested animals with various chlorinated hydrocarbons, the liver fluke problem is still before us, unsolved for the most part.
PARASITISM IN CATTLE IN RELATION TO GRASSLAND AGRICULTURE

In the southeastern states especially, and elsewhere in the country, there has been a marked shift to grassland agriculture during the past decade or so. Among the factors that have given a strong impetus to the expansion of grazing lands in the Southeast, especially for cattle, are (1) increased emphasis on soil conservation and proper land utilization; (2) reduction in cotton acreage through controls and as a result of a shift of farm labor to industry; (3) better markets and improved marketing facilities for livestock; and (4) the prospect that cattle would add materially to the net income of the farmer.

Several adapted varieties of grasses and legumes are available to establish satisfactory grazing systems for cattle on most southern soils. The greatest emphasis is currently being placed on the development of year-round grazing. In connection with this development in the South, the problem of internal parasites assumes considerable importance, since these parasites are largely pasture borne. Moreover, the environmental factors that favor prompt establishment and continued growth of pastures, also favor the propagation of parasites. Under conditions favorable to the development, survival, and accessibility of parasites to livestock, sufficient numbers may be acquired which, short of causing death, would certainly cause significant losses, due to lowered weights, poor productivity, and increased feed requirements of the affected animals.

Some investigations on the relation of pasture management to parasitism in the South are now being conducted in limited areas by parasitologists of the Bureau of Animal Industry working in cooperation with those of the southern States. Experiments at the North Carolina Experiment Station showed that the extent of gastrointestinal parasitism in young cattle was related to the rate of stocking on improved pastures. Parasitism in beef calves on various types of winter pastures has been under observation by workers of the Bureau of Animal Industry in cooperation with those of the Georgia Agricultural Experiment Station.

In the course of these observations the number of worm parasites acquired was higher and weight gains were lower, in yearling beefs grazing on fescue and white dutch clover than in similar groups of animals grazing on crimson clover, or on temporary pastures of oats, rye grass, and crimson clover. Half the animals on each type of pasture were fed a supplemental ration of corn, and these had significantly fewer worms, especially immature ones, than those not given this ration. The factors responsible for these results should be given extensive consideration, not only in the South but elsewhere in the country where the shift to grassland agriculture has been significant. To overlook the factors responsible for increased parasitism could vitiate a progressive program designated for economical land use through livestock production.
Tests of the Efficacy of a Textile Bag Sanitizing Machine


In discussing the role of the used feed bag as a means of transmitting poultry diseases at a meeting of the Eastern Federation of Feed Merchants in New York City on June 9, 1947, the author expressed the belief, as he had on other occasions, that it ought to be relatively easy to construct a machine to destroy infectious agents that might contaminate such bags. The machine was conceived as consisting of a conveyer belt on which a vacuum-cleaned bag could be placed and thus carried under the hood of a machine in which it would be exposed to jets of steam under pressure. About two years after the above mentioned meeting, Mr. A. J. Balshi of Catawissa, Pa., requested the author to criticize blue prints that he had made on the basis of the idea expressed at the 1947 meeting. In the course of time the machine was constructed, and the author was requested to test its efficacy in destroying various types of infectious agents likely to be found on returned feed bags.

Infectious Agents Used

Viruses

Newcastle Disease. Our Epstein spleen 4 strain of this virus was used in the form of a pool of amnioallantoic fluid from 3 eggs (nos. 45, 47, and 48) of the sixth passage harvested September 22, 1949.

Fowl Pox. The chorioallantoic membrane of a single egg (2184) of the 39th passage, harvested August 27, 1949, was ground with sand and suspended in about 10 cc. of broth, after which it was lightly centrifuged.

Bacteria

Salmonella gallinarum. The strain used was isolated from an outbreak of fowl typhoid at Barto, Pa., July 11, 1941 (case 14581). The 24-hour broth culture used was from a transfer made November 23, 1949.

Erysipelothrix rhusiopathiae. This strain was isolated from an acute outbreak of swine erysipelas in turkeys (1) in Allendale, N. J., on November 17, 1934 (case 6678). The suspension used was a 24-hour broth culture transferred on November 23, 1949.

Sarcina sp. This organism was used merely because its chromogenicity facilitated recognition. The 24-hour broth culture used was also transferred on November 23, 1949.

Spore-former. The growth from an agar plate culture that had been held in the laboratory for a few weeks was suspended in broth on November 26, 1949, and used immediately before the spores could vegetate.

1 Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, the State University of New Jersey, Department of Poultry Husbandry.

2 New Jersey Agricultural Experiment Station New Brunswick, New Jersey.

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PROTOZOA OOCYSTS

_Eimeria tenella_. Since the test material would be needed at a time when ceca coccidiosis was not common, a pair of bloody ceca was collected in advance and held in a frozen state to prevent sporulation.

ROUNDWORM EGGS

_Ascaridia galli_. Several females of this species were held under the freezing chamber of a refrigerator to prevent embryonation of the eggs.

![Vehicle for Infectious Material](image)

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**Preparation of Vehicle for Infectious Material**

An ordinary paper clip was straightened out except at one end. Around this end a piece of filter paper 2.5 x 4 cm. was wound tightly and fixed in place with a staple. This length of filter paper permitted three complete layers around the wire. The other end of the wire was looped and a numbered chick leg band was attached for identification. (See fig. 1.) The vehicles were placed in large tubes and sterilized. After impregnation, they were inserted into protective envelopes, which were necessary to prevent contamination, if possible, of the infectious agents before and after exposure in the machine. The protective envelopes were made by placing a thickness of cotton 8 x 10 cm. on two layers of gauze of the same size and folding this to make a pocket 4 x 10 cm., which was stapled on the side. A single fold of bond paper about 1 x 16 cm. was also included in the pocket. It was hoped that by means of this fold of paper the vehicle could be more easily inserted in the pocket after impregnation and withdrawn at the time of examination without pulling out wisps of cotton which might favor contamination.
mature chickens the corresponding affection is known as chronic respiratory disease, according to Delaplane (3, 5) and is clinically indistinguishable from Newcastle disease and infectious bronchitis except for its slow rate of spread and long persistency.

The intensity and course of the disease varies widely and may be accompanied by delay in sexual maturity and decline in egg production of from 10 to 40 per cent, in the experience of Van Roekel, et al. (30). In turkeys the most characteristic clinical expression is the familiar fluctuating swelling in the region of the cheeks, known as turkey sinusitis. Dyspnea especially on exertion, and thinness in mature turkeys suggest air sac infection. In other species of birds such as partridge, pheasant and pigeon, the disease tends to bring about localized persistent swellings in the region of the head.

The principal gross pathologic feature of air sac infection is a fibrinopurulent serositis involving any or all serous covers of the lung, heart, liver, spleen or intestine. The inflammatory process may extend into the underlying tissues resulting in secondary pneumonia, pericarditis, and hepatitis. The occurrence of primary systemic affections without obvious serositis is suspected. The typical costoabdominal exudate is yellow, thick and tenacious, but may be soft and flaky in mild cases. In involvement of the infraorbital sinus, occasionally extending into the cranial subcutis, the exudate is clear, mucoid in character but may undergo purulent thickening, as in so-called “roup”. The changes in the trachea are in the nature of a simple catarrhal inflammation but the primary bronchi just below the bifurcation often contain caseous plugs. A rare sequela of the condition is serous arthritis and bursitis, of the metacorpo-phalangeal joint, and bursa presternalis, respectively.

The microscopic pathology (14, 15) is characterized by two types of lesions, namely (a) multiple granulomas composed of cellular debris with giant cell borders, and observed especially in the lungs and serous membranes of either embryos (fig. 1) or recently affected birds; and (b) multiple lymphofollicular foci in the subepithelial region of the sinus mucosa (fig. 4), in the alveolar walls of the lungs (fig. 2), or in the serous membranes, of chronically affected birds. The adjacent tissues often present secondary cellular infiltration predominantly with heterophiles. Under uncomplicated experimental conditions the cellular response to inoculation of the sinus (fig. 3 and 4) of the eye (fig. 5) is exclusively mononuclear in character.

**ETIOLOGY**

In a consideration of the cause of air sac infection in poultry it is necessary to differentiate—aside from predisposing and synergistic effects—between established disease agents causing a similar pathology, and essential etiologic factors. The principal difficulty lies in the fact that the entire field syndrome has not been reproduced experimentally.

Nonspecific factors perhaps acting like a trigger mechanism in initiating severe outbreaks, are suggested by field data. The general observation of greatest severity of the condition during extreme cold or hot weather signifies a relation to climate. Faulty brooder temperatures, dryness of litter (27), cases of coccidiosis with accompanying emergency treatment, may apparently precipitate outbreaks. Even on the same premises occurrence may be sectionalized, thereby pointing to pre-
AIR SAC INFECTION IN POULTRY

Erwin L. Jungherr, D.M.V., and R. E. Luginbuhl, B.S., M.S.

Affections of the air sacs in certain poultry diseases have been known for a long time, but the popular term "air sac infection" came into prominence in poultry parlance about 1947. It was then that poor lots of broilers were observed frequently to present on evisceration, thick yellowish exudate over the internal organs. Anatomically there are nine air sacs in birds, thin transparent membranous sacs which confer buoyancy to birds for flight but also constitute—by virtue of their connection with penetrating bronchi and pneumatic bones—a direct communication between the costobdominal organs and the outside. This arrangement in birds—unlike that in mammals with their caudally closed respiratory tract—constitutes an anatomic predisposition to the frequently observed systemic spread of avian respiratory diseases.

Although the knowledge of air sac infection is in the early stages of development there are definite indications that the affection of broilers which has given rise to the popular term, is etiologically and epizoologically related to chronic respiratory disease of chickens, and to sinus and air sac infection of turkeys, partridges, pheasants and perhaps pigeons. It is this broad concept which is of interest to the livestock sanitarian and is made the basis of the present outline.

PATHOLOGY

As in most respiratory diseases, the symptomatology and pathology of air sac infection are neither specific nor diagnostic. Furthermore, there are reasons to suspect that the common term is applied to different etiologic entities or to the resultant of several synergistic factors. Under field conditions, the symptoms of air sac infection vary with the age and the species affected. The common feature however, is its occurrence in birds naturally or artificially immune to Newcastle disease and infectious bronchitis.

In broilers, the disease makes its appearance at an average age of four to six weeks, with a range extending through practically the entire growing period, and commences with anorexia, followed by a whitish diarrhea and hacking cough, especially noticeable at night. There may be high mortality, up to 50 per cent, especially during the subsequent two weeks and then unsatisfactory development for the remainder of the growing period. For the 1951 Delmarva production of 167,000,000 broilers, the overall loss from air sac infection has been estimated by McDowell (2) as 6 per cent above normal or over 10,000,000 birds. In growing and

1 Supported in part by funds provided by the Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture and by Public Laws 733 (9b3).
2 Department of Animal Diseases, Storrs Agricultural Experiment Station, University of Connecticut, Storrs.

All figures represent air sac infection in birds and are photomicrographs of histologic sections stained with hematoxylin-triosin, except as stated.
Oocysts. Daily microscopic examinations of all samples showed no evidence of sporulation. Evidently, the conditions under which this material was held before exposure rendered the oocysts incapable of sporulation; consequently, no information was gained from the tests.

Worm Eggs. Similar examinations were made for embryonation of worm eggs, but aside from two-celled stages found in the two control samples, no further development took place. In fact, not all of the control eggs reached the two-celled stage, and therefore deductions have to be made with caution.

DISCUSSION

Because of the necessity for having an envelope of gauze and cotton to protect the vehicle from contamination, the steam, in order to inactivate all infection, had to pass not only one layer of the burlap bag but also the two layers of gauze, a thickness of cotton, one layer of bond paper, and three layers of filter paper before reaching the innermost surface of the impregnated filter paper. Since under normal operating conditions such penetration would not be required, it is likely that at least a layer of two bags and perhaps three could be processed effectively. Although the results obtained from the exposure of oocysts and worm eggs will have to be disregarded because of poor material, the efficacy of the process on other agents leaves little doubt that active material would have been destroyed.

SUMMARY

Infectious agents such as fowl pox and Newcastle disease viruses, the fowl typhoid and swine erysipelas organisms, as well as Sarcina were destroyed on vehicles well protected by cotton and gauze envelopes when inserted at any place in a burlap bag and passed by means of a conveyer belt under jets of steam at 50, 75, or 90 pounds pressure. The controls containing viable material, when taken to the field but not exposed, yielded the original material on examination. The machine had no effect on the bacterial spores used.

REFERENCES

another control, and four of the five eggs inoculated with it were alive six days post inoculation, and all showed typical pox growth.

Of the five eggs inoculated with one nonexposed control sample, the two embryos that died at 24 and 48 hours, respectively, were discarded. A third embryo that died on the fourth day, as well as the one still alive on the sixth day, showed typical pox lesions. Of the five eggs inoculated with the other control, only one embryo was dead on the sixth day. The chorioallantoic membranes of each of the five eggs showed typical pox lesions.

*Newcastle Disease.* Each sample was inoculated into four eggs. Of the 48 eggs inoculated with the 12 exposed samples, only two embryos died of nonspecific causes—that is, within the first 24 hours. The remaining eggs were incubated until death of the embryo, or otherwise until seven days. But only two other embryos died and both on the fourth day. The inoculum in the one case was a sample exposed as a duplicate in the end of a bag at 75 pounds pressure, and the other as a duplicate in the end of a bag at 90 pounds. Subinoculations with material from each of the embryos showed that death was not due to Newcastle disease virus.

Of the four eggs inoculated with one control, one embryo died in 48 hours, two in 72 hours, and one in 96 hours. The four embryos inoculated with the other control had exactly the same death pattern. All embryos showed typical changes of the growth of Newcastle disease virus and were sterile bacteriologically.

**BACTERIA**

*Fowl Typhoid.* As already described, the vehicles were shaken in tubes of broth, and then a loopful from each tube was streaked on a sector of an agar plate. Of the seven streakings on one plate (six with exposed and one with control material), six sectors showed some growth including the control. Individual colonies were inoculated into broth and after growth was obtained, were inoculated into dextrose, lactose, maltose, and saccharose fermentation tubes. In every case a colon-like organism was found to be the contaminant, as shown by acid and gas production in the fermentation tubes. But the control also showed growth of the typhoid organism. On the second plate streaked with material from six exposed samples and a control, no contamination occurred, and the only growth obtained was the fowl typhoid organism from the control. The organism was identified by its ability to produce acid in dextrose and maltose and absence of effect on lactose or saccharose.

*Swine Erysipelas.* One plate on which seven samples had been streaked showed no contaminants, and the only growth was confined to the sector streaked with a control sample. On the other plate about 50 contaminant colonies developed, but none of these occurred in the sector streaked with a control. The only swine erysipelas colonies that developed were in the sectors streaked with control material. The organism in each case was identified by its ability to produce acid in dextrose and lactose fermentation tubes and absence of effect on maltose or saccharose.

*Sarcina* sp. Not a single colony grew on plates streaked with exposed material. In contrast, both sectors streaked with the controls gave an abundant growth of the chromogenic organism.

*Spore-former.* As was anticipated, growth was obtained from every sample, regardless of conditions of exposure.
infectious agent were repackaged and placed in the desiccator to be returned to the laboratory.

The vehicles impregnated with bacteria were examined that day for the presence of viable organisms. Those impregnated with viruses, oocysts, and worm eggs were kept in the evacuated desiccator in a frozen state until time permitted the examination for viability.

**EXAMINATION FOR VIABILITY**

**Viruses.** The fowl pox material was examined on March 14 and the Newcastle disease material on March 31. Each vehicle was removed from its protective envelope and the end with the impregnated filter paper thoroughly shaken in a tube (16 x 75 mm.) containing 1.8 cc. of saline and 0.1 cc. each of a solution of penicillin and streptomycin representing 10,000 units and 10 mg., respectively. The purpose of the antibiotics was to inactivate any bacteria that might have contaminated the vehicles during handling. The pox suspensions were inoculated into the chorioallantoic membrane in a dose of 0.2 cc. per egg. The eggs had embryonated 11 days, and incubation after inoculation was continued until death of the embryo, or otherwise for six days. Eleven of the pox suspensions were inoculated into five eggs each and three into four eggs each.

The vehicles impregnated with Newcastle disease virus were similarly suspended and inoculated in the same dose, which, however, was made into the allantoic sac of ten-day embryonating eggs. Four eggs were used for each sample. In this case, the eggs were incubated until death of the embryo, or otherwise for seven days.

**Bacteria.** The examination for viable bacteria was made on the evening of the day the samples were exposed in the machine. The impregnated portion of each vehicle was merely shaken in a 15 x 65 mm. tube containing 2 cc. of broth, and then one loopful of broth was streaked on a sector of an agar plate (seven samples per plate) and incubated for 48 hours.

**Oocysts.** Each vehicle impregnated with oocysts was shaken in a staining dish containing a small quantity of a 2 per cent solution of potassium dichromate. The dishes were covered to prevent excessive evaporation, and the material was examined periodically for sporulation.

**Worm Eggs.** The vehicles impregnated with worm eggs were treated as described under oocysts. Periodic examinations were made for evidence of embryonation.

**RESULTS**

**Viruses**

**Fowl Pox.** As already mentioned, four or five eggs were inoculated with each sample. Embryos that died the first or second day were discarded, but in only two cases were there as few as two eggs that came to harvest. None of the eggs inoculated with exposed material showed evidence of pox growth, regardless of whether it was a primary or duplicate test and regardless of position in the bag or steam pressure used. Sample 9024 was exposed as a duplicate test at 75 pounds pressure in the end of a bag and then, inadvertently, was reexposed as a duplicate in the middle of a bag at 90 pounds pressure. Thus, sample 9005, which was to have been exposed under the latter conditions, was not exposed at all. Consequently, it served as
The exposure tests designed required 14 vehicles for each infectious agent; hence this number of packets was wrapped in paper and tied. Eight such packets—one for each infectious agent—were prepared, sterilized in the autoclave, and then dried in the oven for a short time.

**IMPREGNATING VEHICLES**

The packets were opened in a dust-free room used for harvesting embryonated eggs in virus cultivation. Each vehicle was removed from a large test tube and impregnated with 0.2 cc. of the infectious agent dropped slowly from a pipette. When the material was absorbed by the filter paper, the vehicle was inserted between the fold of bond paper surrounded by the gauze and cotton envelope with a portion of the wire and its attached numbered band exposed. (See fig. 1.) Then the 14 vehicles impregnated with each agent were again wrapped in paper and tied as before.

The broth suspension of oocysts was prepared just before the impregnation so that no time was allowed for sporulation. Similarly, the female roundworms had been opened, and, to prevent embryonation, the suspension of eggs was made just before the vehicles were infected. These suspensions were shaken often during the pipetting to insure a more uniform suspension.

Immediately after the impregnations, the packets of vehicles were placed in a desiccator containing phosphoric anhydride, sealed, evacuated at -20°C., and held in this state until the day of exposure in the sterilizing machine. The purpose of this, of course, was to preserve the activity of the viruses and bacteria and to prevent sporulation of the oocysts or embryonation of the worm eggs.

**EXPOSURE IN MACHINE**

The vehicles to be exposed, as well as the controls, were taken to the field January 11, 1950, in the evacuated desiccator, which was opened by admitting air through a sodium hydroxide tube.

Eight vehicles, each impregnated with a different infectious agent, were placed at the bottom of a new burlap feed bag. A duplicate row of vehicles was placed in the bag at about the middle. The purpose of this arrangement was to determine the efficacy of the machine regardless of the position of the infectious material in the bag. After the vehicles were in place, the bag was placed on the conveyor belt and carried through the machine when the steam pressure was adjusted to 50 pounds. Another bag was prepared in the same way and run through the machine at the same pressure as a control on the first exposure. The duplicate control vehicles—16 in number—impregnated with the eight infectious agents were also taken to the field but were not exposed in the machine.

The steam pressure of the machine was then raised to 75 pounds, and duplicate bags were exposed as described above. Finally, the steam pressure was increased to 90 pounds, and the last duplicate bags were exposed.

As previously mentioned, each vehicle bore a number chick leg band for identification. Thus, a careful record was kept of the kind of infectious agent used, whether the vehicle was exposed at the end or middle of the bag, whether it was the primary or duplicate test, and finally, the steam pressure used.

After the exposure, the vehicles and the duplicate non-exposed controls for each
disposing managerial factors. Vaccinations against Newcastle disease are often blamed for outbreaks of air sac infection. The experimental disease induced by an essential air sac agent can apparently be intensified by superimposed stress factors such as infectious bronchitis (Grumbles (2)) or chemical caponetting (Wong (34)). Mixed infections with several respiratory disease agents are common in field outbreaks so that the existence of air sac infection as an independent entity is problematic.

The etiologically defined respiratory diseases which are capable of inducing noticeable inflammation of the air sacs are represented by pasteurellosis, aspergillosis, and Newcastle disease and perhaps by hemophilus coryza and infectious bronchitis. The character of the exudate on the air sacs in any one of these diseases does not differ sufficiently from that in so-called typical air sac infection to permit a specific diagnosis. Demonstration of the causative agents of these diseases, however, by the usual laboratory means, is definitely diagnostic, but does not necessarily rule out the presence of other air sac disease agents.

The essential air sac infection agents are twofold in nature according to current thought, namely a pleuropneumonia- and an ornithosis-like agent, but their relative importance and their relationship to other nonspecific and specific factors as discussed above, is not known.

The present concept of the possible implication of pleuropneumonia-like organisms in the causation of air sac infection probably had its inception in 1936 with the work of Nelson (20) who demonstrated so-called coccobacilliform bodies as the cause of an upper respiratory disease of chickens of slow onset and relatively long duration. In a series of papers the same author reported cultivation of the organisms in embryonating eggs, tissue cultures (21), and on blood agar (22), and classified them, on the basis of comparison with similar agents from infectious catarrh in mice and rats, as pleuropneumonia-like organisms (23, 24).

Virus-like agents were first reported as the cause of a chronic respiratory disease in chickens by Delaplane and Stuart in 1943 (5) and of air sac infection in turkeys by Minard and Jungherr in 1944 (18) and confirmed with respect to turkey sinusitis by Jerstad and Hamilton, (13) and by Hitchner (10). Doubt as to the true virus nature of these agents arose from the work of Groupé and associates (8, 9) who demonstrated an agent as the cause of turkey sinusitis which morphologically resembled the Chlamydozoaceae in producing elementary bodies and in susceptibility to antibiotics, but which lacked mouse pathogenicity and antigenic relationship to the lymphogranuloma venereum group. The observation of Delaplane (3) that the egg propagated chronic respiratory disease agent from chickens was capable of inducing sinusitis in inoculated turkeys, did much to unify the present concept.

A valuable contribution came from the accidental observation of pleuropneumonia-like organisms in embryonating eggs used for the study of human atypical pneumonia by Eaton, et al. (6). Subsequently Van Herick and Eaton (29) found the organism to stain with Giemsa, to be cultivable in horse serum-hormone broth, and to have hemagglutinating properties, inhabitable by specific rabbit immune serum. Experimentally inoculated chickens became weak after 26 days without presenting characteristic lesions while cotton rats developed consolidation of the lungs. These
findings might shed some light on the observation of elementary-like bodies in normal yolk sac cells by Pappenheimer, et al. (25). The regular association of agents resembling in general the chronic respiratory disease agent of Delaplane (4), but forming microscopically demonstrable Giemsa staining bodies, was broadly confirmed by Van Roekel, et al. (30). The relation of such organisms to the pleuropneumonia group was clearly brought forth by Markham and Wong (16) who first succeeded in the artificial cultivation of such organisms over many generations in a modified Edward's (7) medium, and were able to reproduce turkey sinusitis, after one egg passage, with such artificially grown organisms. Media and methods for the cultivation of pleuropneumonia-like organisms were recently evaluated by Morton, et al. (19).

On the basis of the literature and the authors' experience, the definition of a nonbacterial pleuropneumonia-like air sac agent would include cultivability in the yolk and amnionic sacs of seven-day-old embryonating chicken eggs, which should die, after a few blind passages, within five to eight days; stainability of small coccoidal occasionally elongated bodies with Giemsa or Gram stain (fig. 6), the latter modified by doubling the standard exposure time to crystal violet (the organism retains the basic dyes (blue) in both the Gram and the Machiavello stains); cultivability in Edward's medium; inability to produce serum neutralizing antibodies; hemagglutinability, inhibitable by specific antiserums; non-sensitivity to penicillin, bacitracin and polymyxin (Wong (34)), and sensitivity—in falling order of activity—to magnamycin, terramycin, streptomycin, aureomycin, and chloramphenicol (Wong (34)); and finally nonpathogenicity for mice by any route, but local pathogenicity for turkey sinuses and chicken eyes, with development of characteristic microscopic lesions.

The occurrence of ornithosis in man has been reliably traced, aside from psittacine birds, to such domestic birds as chicken (17), pigeon (28), duck (33), turkey (12), and pheasant (32). The possible implication of ornithosis-like agents in the causation of air sac infection is of recent date but of great interest both from the standpoint of etiology and of veterinary public health. Boney et al., (1) isolated a mouse

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**Fig. 1.**—Spontaneous case in chicken embryo. Lung shows large granuloma, surrounded by giant cells (in center) communicating with tertiary bronchus on right. 112X.

**Fig. 2.**—Spontaneous case in chicken. Lung shows tertiary bronchus with lympho-follicular thickening of alveolar walls in lower quadrants. 48X.

**Fig. 3.**—Infraorbital sinus of noninoculated turkey. The lining consists of low ciliated columnar epithelium with intraepithelial glands. 48X.

**Fig. 4.**—Infraorbital sinus of turkey, inoculated with pleuropneumonia-like agent. Marked subepithelial mononuclear infiltration of mucosa and early lympho-follicular reaction (in high center). 48X.

**Fig. 5.**—Eye of chicken, inoculated with pleuropneumonia-like agent. Iris (in center) and ciliary body (on right) show marked mononuclear infiltration. Anterior chamber (above) contains serous exudate. Lens (below) is normal. 48X.

**Fig. 6.**—Smear from fourth transfer culture of pleuropneumonia-like agent in Edward's medium. A dense group of organisms showing isolated coccoidal bodies in periphery. Modified Gram stain. 3362X.
pathogenic agent capable of producing serositis, but not sinusitis in turkeys, from 
a flock of turkeys known (12) to be infected with ornithosis. Doctor Ward (31) 
kindly informed the authors of his success in isolating an elementary-body forming, 
fuchsinophilic agent from chickens inoculated with glass filtered exudate from 
chicken air sac cases. His agent was cultivable in the yolk sac of embryonating 
eggs and capable of producing typical air sac lesions in inoculated birds, and proved 
highly sensitive to terramycin.

On the basis of the literature, the definition of a nonbacterial ornithosis-like air 
sac agent would include—as differential features from pleuropneumonia-like agents 
—killing of embryonating eggs within two to four days, Gram-negativeness and 
fuchsinophil properties of elementary bodies in Machiavello stain; non-cultivability 
in Edward's medium; ability to produce serum neutralising and ornithosis comple-
ment fixing antibodies but nonhemagglutinability; additional sensitivity to penicillin 
and sulfadiazine; and finally pathogenicity for weanling mice and young turkeys, 
the latter except by intrasinusoidal inoculation.

**DIAGNOSIS**

From the presentation of the etiologic aspects, the difficulties are apparent in 
arriving at an accurate diagnosis of air sac infection in poultry. The variety of tests 
required per case automatically limits the number of specimen lots which can be 
processed adequately. For the problem as a whole, the results of a few well 
worked-up cases are far more valuable than those of many incomplete field and 
laboratory diagnoses.

For accurate diagnosis of air sac infection, it is advisable to obtain good anam-
nestic data on the entire flock with emphasis on past and present respiratory diseases 
and vaccination therefore, and at least five live birds per affected lot. After routine 
clinical examination, large individual sterile blood samples are obtained and sub-
jected to hemagglutination tests for Newcastle disease and serum neutralization 
tests for bronchitis. Enhanced facilities should be developed for the indirect com-
plement fixation test for ornithosis. Gross postmortem examination is followed by 
routine bacteriologic and mycologic examination; at least trachea and lung are 
collected under aseptic precautions for histologic and virologic tests. The latter 
material may be pooled, comminuted in buffered saline, and divided for (1) culture 
in Edward’s medium; (2) filtration or bacitracin—polymyxin treatment for further 
(a) intranasal inoculation of four-week-old normal chickens; (b) intraocular injec-
tion of day-old chicks; (c) intrasinusoidal inoculation of eight-week-old turkeys; (d) 
intracerebral or intraperitoneal inoculation of 10–14 gm. mice; (e) yolk or amnionic 
sac inoculation of seven-day-old embryonating eggs; (f) allantoic sac inoculation of 
ten-day-old eggs for the possible demonstration of Newcastle or bronchitis virus. 
Experimental animals are killed after about one week and examined gross and 
histologically; tissues and cultures are examined bacterioscopically by Gram and 
Machiavello stains. Exclusion of bacterial contamination is necessary at all steps.

**TREATMENT AND CONTROL**

Individual treatment of air sac cases is available only for turkey sinusitis in the 
form of direct intrasinusoidal injection of 100,000 units of streptomycin, first
suggested by Hitchner (11). Parenteral treatment of turkey air sac infection is much less effective.

Flock treatments have been practiced extensively but their true value is difficult to assess. All medical treatments should be started at the first signs of disease and accompanied by increasing temperature, humidity and ventilation, in the houses. Antibiotics such as aureomycin and terramycin are widely used at a preventive level of 50 gm., and at a therapeutic level of 100 to 200 gm. of active ingredient, per ton of feed. Similar treatments have been used with some success to control early mortality of poults, perhaps on the theory of dealing with an air sac-like systemic infection (26). Ward (31) successfully treated air sac cases of broilers by spraying with terramycin hydrochloride applied with a 50 lb. pressure paint sprayer at the rate 1.5 gm. per gallon of tap water for 3,000 birds, on two successive nights.

Prevention and control would depend upon breaking the cycle of infection which is not definitely known. Maintaining different species of birds on the same premises should be avoided. The indications are that horizontal spread takes place by direct and indirect contact only over short distances and at a relatively slow pace, which facts point to the value of sanitary management in the control of air sac infection.

The most important aspect of spread lies in the possibility of vertical transmission of air sac agent(s) through the egg. An essential causative agent has been demonstrated in eggs from turkey breeders affected with sinusitis, by Jerstad and Hamilton (13). Although the usual experience is that sinusitis affected turkeys produce good hatching eggs and poults, the Utah Turkey Association has found it necessary to eliminate sinusitis-affected flocks from the hatching egg supply (2). Van Roekel, et al. (2, 30) first made the interesting observation that dead pipped embryos from chicken flocks affected with chronic respiratory disease, show air sac changes in a high percentage of the cases. Thus control at the present state of knowledge must take into account the possibility of egg transmission. The available means entail constant veterinary—medical supervision supported by laboratory diagnoses, of breeder flocks and their exclusion from the hatching egg supply, if in active state of respiratory disease; and gross examination for air sac lesions of all dead pipped embryos and live embryos unable to hatch. Poultry biologic houses preparing live egg-propagated vaccines, should exert similar control over their egg supply flocks and, in addition, test their products by intrasinusoidal inoculation of turkeys or intraocular injection of chicken eyes, as outlined.

Control during the brooder and growing period centers around minimizing possible stress factors by proper management and sanitation. Only absolutely necessary vaccination procedures and drug treatments—as dictated by prior experience—should be used, and emergency treatments instituted at the appearance of premonitory signs of air sac infection.

SUMMARY

The popular term "air sac infection" came into prominence about 1947 when poorly finished broiler lots were found to have thick yellow exudate over internal organs. In the broad sense as used here, the term includes chronic respiratory disease of chickens, and sinus and air sac infections of turkey, partridge, pheasant and pigeon. The principal gross pathologic features are fibrinopurulent serositis and
mucoid sinusitis; the histopathologic features multiple granulomas and lymphofollicular foci in lung and air sacs.

The etiologic aspects are discussed from the standpoint of nonspecific stress factors, air sac—affecting specific diseases such as pasteurellosis, aspergillosis and Newcastle disease, and essential air sac agents. The latter are divided into a pleuropneumonia-like agent which is penicillin resistant, nonfuchsinophilic, nonmouse-pathogenic and cultivable in artificial medium, and into an ornithosis-like agent which is penicillin sensitive, fuchsinophilic, mouse pathogenic and not cultivable in artificial medium. Accurate diagnosis must be geared to the present etiologic concept.

Antibiotics are available for palliative treatment. Control must take into account the possibility of egg transmission by continuous checking of parent stock for respiratory diseases and of non-hatching embryos for air sac lesions. Producers of live egg-propagated poultry vaccines should exert similar control over egg supply flocks and in addition, test products for absence of air sac agents by intrasinusoidal turkey or intraocular chicken inoculation. Definite control must await further research developments.

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SANITATION AND VACCINATION IN THE CONTROL OF NEWCASTLE AND OTHER DISEASES IN A LARGE BROILER PLANT

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The title of this paper may seem misleading and perhaps you may think we are going to tell you how to prevent and cure all poultry troubles by sanitation and vaccination, we are however, going to talk briefly about sanitation and then relate some of our experiences with vaccination against Newcastle disease.

The broiler plant at Val-Lo-Will Farms is a complete and closed unit. By that we mean that it has a breeding flock of about 35,000—40,000 birds to produce hatching eggs, which are hatched in the farm hatchery, two hatches per week. Chicks are started in heated batteries in large rooms holding 20 to 25 batteries, or 7,000 to 10,000 birds. Units are set up so that two large rooms are used for each lot or hatch, thus experimental work can be easily undertaken i.e., using one room for the controls and the other for the principals of the experiment.

Twenty-two rooms make up the baby chick department. At five and a half weeks of age, the chickens are transferred to larger, unheated batteries in rooms heated during colder seasons and maintained there for the so-called intermediate period of two weeks. They are subsequently transferred to and held in finishing batteries, also in heated rooms until ten to eleven weeks of age. At this time some birds are selected as breeders and the balance go to the dressing plant as broilers.

The dressing plant is also part of the farm unit and fresh dressed poultry is featured in the farm owned stores in Chicago, Illinois. The broiler plant has it's own feed mill and mixing plant with the result that the entire production operation is a closed unit; the only thing being brought to the farm is the feed. No new stock has been introduced for several years and in maintaining the large breeding flock very little inbreeding would occur.

As mentioned before, this is a battery plant except for the breeders, and great emphasis and attention are given to cleanliness and sanitation of the equipment and buildings. A large washing machine is used to clean and sterilize the batteries, including feeders and waterers. Water under pressure plus dry heat at the end of the operation (270°-300° F. for five minutes) does a thorough job of cleaning.

Rooms are thoroughly cleaned as birds and equipment are removed during transfer periods.

Strict sanitation is maintained in the hatchery and there is the minimum of traffic (personnel) between various units, i.e., hatchery, baby chick department, intermediate department, finishing department and dressing plant.

The breeding farm or henneries are a separate unit on the same farm, but manned by persons that have a minimum of contact with the broiler plant. The exception would be the flock selectors who select prospective breeders from each lot of 10 to 11 week old birds as they are finished off for the broiler dressing line.

The disposal of manure is a problem as it is on most poultry farms. The pans of

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the batteries are scraped daily and the manure hauled to nearby farms for use as fertilizer.

On a farm of this size, the total number of dead birds is large, and are hauled to a dump each day. These carcasses are covered with earth at frequent intervals.

In connection with the subject of sanitation we want to say that perhaps the poultryman as well as the livestock people are becoming a little lax in this all important part of disease prevention and relying too much on some of the newer "miracle" drugs and antibiotics. Also, a good cleaning job and sanitary practices require hard work, i.e., "elbow grease," and in these times we all try to cut corners. We need to think and practice strict sanitation and disease prevention and that is what we are trying to do on this farm.

At present we have no coccidiosis or other serious animal parasite problems because our birds are battery raised on wire floors. Some of the growing breeding stock gets a short time on clean range but many birds are never outside of the buildings.

We occasionally see a grey or leucosis eye in a bird, but if it is in a group selected for breeding, the bird is promptly removed to the dressing plant. Hence, here is a poultry flock practically free from the leucosis complex. The reason for this, we believe lies in a rigid selection program, the maintenance of an isolated or closed unit and exclusion of stock from outside sources over a period of years.

Naturally the selection has been for a meat type bird and our egg production is quite ordinary. However, more than enough eggs are produced to supply the hatchery and the surplus is sold by the stores.

**VACCINATION PROGRAM**

At present all birds are vaccinated against Newcastle disease and the breeders are vaccinated against fowl pox. Infectious bronchitis does not seem to be a problem, but chronic respiratory disease (CRD) is present on the farm and it is constantly necessary to control it. By this we mean strict sanitation, proper and carefully blended feeds, rigid temperature control and proper ventilation. A continuous vaporization of triethylene glycol aerosol is employed in the baby chick and intermediate departments. While it would appear to be a help in controlling respiratory diseases such as CRD, proper controlled evaluation of the procedure remains to be accomplished.

During the first four months of 1949 the mortality rate at the broiler plant was higher than during several previous years. The range was from a low of 9 per cent in January to a high of 17 per cent in early May. Normal losses were considered to be 4.5 per cent to 10 per cent.

Vaccination with a commercial killed ND vaccine was started about May 1, 1949 and continued for one month. The mortality rate decreased through the second week in June from 17 per cent to 11.5 per cent. Beginning June 1st a commercial live virus was used to vaccinate the broilers. This procedure was discontinued about August 1st. The general trend of the mortality rate was upward during this period from the low of 11.5 per cent to a high of 16 per cent.

From August 15th to October 1st, several different experimental live virus vaccines were compared, but no definite records were kept as to just when each strain
was used. The mortality rate ranged from 12.8 per cent to 20.8 per cent during this period.

Triethylene glycol aerosol was introduced about September 1, 1949, and was installed in the entire plant by February, 1950. No broilers were vaccinated from October 1949 until January 1952.

In December 1951, a severe outbreak of Newcastle disease occurred and the mortality was very high as is shown by the accompanying graph, 34.6 per cent. Vaccination with a commercial formalinized vaccine was started in January and the mortality dropped immediately.

In an attempt to find a virus with superior immunogenic properties several strains of NDV were made into formalinized vaccines and the results of the use of each product was compared to results obtained from the use of commercial vaccines. The several strains were designated as stock commercial A, stock commercial B, experimental strains X103, X105, X108, and X109.

A vaccine prepared from a strain of virus isolated from the farm flock (X108) was thought to be more effective than the others, at the outset, but after the results obtained with the several strains were compared and analyzed stock commercial strain A was found to be approximately equal to X108 in effectiveness.

One other experimental strain (X105) was found by statistical analysis to be superior to any of the vaccines tried. At present however, we are using stock commercial A which is almost as effective at X105.

When the vaccinating program was begun, birds were injected intramuscularly in the thigh with 1 cc. of vaccine. The birds were 3 to 4 weeks of age. Later the
age of vaccination was reduced to 2½ to 3 weeks and now vaccination is done at 15 to 17 days of age.

The experimental lots of birds included identical lots as controls. Careful records were kept of mortality and culling rates throughout the entire growing period of 10½ weeks.

**TABLE 1**

*Effect of vaccination on reducing mortality and culling rates*

<table>
<thead>
<tr>
<th>Lot Number</th>
<th>Number Vaccinated</th>
<th>Number not Vaccinated</th>
<th>% Death Loss Vaccinated</th>
<th>% Death Loss Not Vaccinated</th>
<th>Culling Percentage Vaccinated</th>
<th>Culling Percentage Not Vaccinated</th>
<th>X² Value in Favor of Vaccination</th>
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<tbody>
<tr>
<td>493</td>
<td>8,216</td>
<td>8,178</td>
<td>1.73</td>
<td>5.57</td>
<td>3.13</td>
<td>10.19</td>
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<td>494</td>
<td>8,660</td>
<td>6,403</td>
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<td>7,266</td>
<td>1.05</td>
<td>7.60</td>
<td>3.52</td>
<td>7.35</td>
<td>5.96</td>
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<td>496</td>
<td>12,702</td>
<td>3,287</td>
<td>3.39</td>
<td>8.93</td>
<td>5.04</td>
<td>12.44</td>
<td>107.89</td>
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</tbody>
</table>

X² Computed on Basis of living and dead only.

**TABLE 2**

*Comparison of various vaccines*

<table>
<thead>
<tr>
<th>EXP. NO.</th>
<th>VACCINE</th>
<th>NO. BIRDS</th>
<th>NO. DEAD</th>
<th>PERCENTAGE OF DEATH LOSS</th>
<th>X² VALUES</th>
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</thead>
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<td>(1)</td>
<td>Stock A</td>
<td>14,282</td>
<td>282</td>
<td>1.97</td>
<td>416.0</td>
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<tr>
<td></td>
<td>Stock B</td>
<td>14,411</td>
<td>411</td>
<td>2.85</td>
<td>23.46</td>
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<td></td>
<td>None</td>
<td>7,610</td>
<td>645</td>
<td>8.47</td>
<td>343.5</td>
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<td>(2)</td>
<td>Stock A</td>
<td>14,000</td>
<td>474</td>
<td>3.39</td>
<td>327.0</td>
</tr>
<tr>
<td></td>
<td>X105</td>
<td>9,508</td>
<td>292</td>
<td>3.07</td>
<td>334.0</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>13,075</td>
<td>1275</td>
<td>9.67</td>
<td>3.04</td>
</tr>
<tr>
<td>(3)</td>
<td>Stock A</td>
<td>7,254</td>
<td>254</td>
<td>3.50</td>
<td>97.5</td>
</tr>
<tr>
<td></td>
<td>X105</td>
<td>6,650</td>
<td>177</td>
<td>2.67</td>
<td>259.8</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>7,926</td>
<td>576</td>
<td>7.27</td>
<td>7.15</td>
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<tr>
<td>(4)</td>
<td>Stock A</td>
<td>14,000</td>
<td>474</td>
<td>3.39</td>
<td>372.7</td>
</tr>
<tr>
<td></td>
<td>X103</td>
<td>7,700</td>
<td>340</td>
<td>4.42</td>
<td>147.0</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>14,350</td>
<td>1,275</td>
<td>8.89</td>
<td>140.65</td>
</tr>
</tbody>
</table>

In this series of comparisons several lots were used for each test and the results summated. The culling rates are not shown, but were comparable to those given in Table 1.
Mortality of the vaccinated groups varied from 3.5 per cent to 5 per cent; in unvaccinated groups the mortality was as high as 14 per cent.

At killing time there was always a larger percentage of culls and squabs in the unvaccinated groups than among the vaccinated.

A study over a 6½ month period has provided data on more than 971,000 birds in 56 lots, some of which are included in the accompanying table.

In summing up the value of killed virus vaccination, we believe it is doing a good job. As stated before, vaccination is done at about 16 days of age using 0.5 cc. of a commercial stock formalinized vaccine. A crew of three girls does the vaccinating and can handle 1,000 to 1,200 birds per hour, in fact they have to average that to keep ahead of the crop of 32,000 to 35,000 birds per week. Pullets and cockerels for breeders are revaccinated with 1 cc. of killed ND virus vaccine when selected at 10½ weeks of age. Breeders are again re-vaccinated at six to seven months of age when they are handled for pullorum testing. The question still remaining is whether these breeders need an additional booster shot every six months, and we are now planning some experiments to determine the answer to this question.

Acknowledgement is made of the assistance of the Fort Dodge Laboratories, Inc., for preparing the several lots of experimental vaccine employed in this study.

The authors wish to acknowledge the technical assistance of Dr. C. A. Brandly and Dr. A. W. McClurkin in the preparation of this paper and the conduct of these experiments.

**STATISTICS**

A statistical analysis of the data was made by computing the value of chi-square ($X^2$) for each lot of experimental birds. Statisticians generally agree that a $X^2$ value of 3.841 is significant and a $X^2$ value of 6.635 is highly significant, not being encountered on a chance basis more than once in 100 times. The larger the value of $X^2$ the greater the significance.

It will be seen from the table that the $X^2$ values range from 97.5 to 416.0 in favor of vaccination.

By the facts that every analysis indicated a favorable response to vaccination and the value of $X^2$ were impressively large, we are assured of the efficacy of our program.

Several comparisons of other vaccines to stock vaccine A are also made. Only one vaccine, X105, showed a significant superiority, experimental vaccine X108 was almost equally efficacious, the others inferior to stock vaccine A.

These tables represent several lots that had definite controls. Other lots gave similar results as reported in the summary, but for brevity are not included in the tables.
REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY

B. S. POMEROY, St. Paul, Minnesota, Chairman; T. B. CLOWER, Atlanta, Georgia; J. P. DELAPLANE, College Station, Texas; L. E. HEEMSTRA, Washington, D. C.; ERWIN JUNGHERR, Storrs, Connecticut; P. P. LEVINE, Ithaca, New York; H. VAN ROEKEL, Amherst, Massachusetts.

The poultry industry in this country during the past decade has become an important phase of agriculture. Poultry and turkey production continued to expand in 1952 but because of reduced profits and the effects of a serious disease problem in some of the broiler raising areas, poultry and turkey production may level off in 1953. The problem of disease control in this rapidly expanding industry requires the whole-hearted cooperation of the livestock sanitarian, practicing veterinarian, laboratory diagnostician, feed manufacturer, hatcheryman, and research worker. The transmissible diseases of poultry still are the chief concern of the industry. It has been emphasized time and again that the poultry industry must build on the well established principles of sound sanitary and management practices. A report of the committee that made a field study on “Air Sac Infection” in June 1952, indicated that unsound management practices contributed greatly to the spread of the respiratory infections associated with this condition.

SALMONELLA INFECTIONS

Pullorum disease, fowl typhoid, paratyphoid and paracolon infections which are egg-borne and hatchery disseminated, continue to cause considerable economic loss to the poultry and turkey industries. The National Poultry and Turkey Improvement plans continue to show encouraging progress in the control of pullorum disease as indicated in table I. At the plans conference in June 1952 at Dallas, Tex., certain phases of the pullorum program were revised. The most important change was the reduction to 1 per cent tolerance of the U. S. Pullorum Controlled class in 1954 and complete deletion from the plans in 1956. Thus, if we are to consider eventual eradication of pullorum disease, it is necessary that we intensify our control efforts. The rapid whole blood test is used to test the majority of the chickens under the program. Eighty-eight per cent of the whole-blood testing is in the hands of some 4,000 pullorum-testing agents under supervision of official state agencies. The turnover in agent personnel is rapid and another problem is the fact that the agents are in the employ of the hatchery attempting to qualify the flocks and, as such, are in a position to influence the test results and consequent rating of the flock. Disease control officials must strengthen this phase of the pullorum control program.

The variant type of Salmonella pullorum is still an important problem in some areas and it is highly desirable that all pullorum isolates be typed in order that variant infected flocks may be tested by means of diagnostic antigens properly constituted as antigenic components.
Fowl typhoid is a real or potential significance in some areas. The incidence of the disease is apparently increasing, particularly in turkey flocks.

Paratyphoid and paracolon infections are primarily problems in turkey flocks but there are numerous reports of their incidence in chicken flocks. States and individuals should plan for the development of effective paratyphoid control programs. Infected flocks are a potential source of infection to other flocks and areas. A few states, notably California and Minnesota, have initiated paratyphoid testing programs in connection with the pullorum testing of turkey breeding flocks. Since the diagnostic antigens used are primarily produced from strains of *S. typhimurium* this work could more properly be referred to as typhimurium control program. Participation is voluntary and no official recognition is given to tested flocks. It is hoped that these relatively large scale programs will at least provide some of the answers with respect to effectiveness.

**COCCIDIOSIS**

Very little new information in the use of coccidiostatic compounds in the control of coccidiosis has been reported during the past few years, although various chemicals have come to be employed for this purpose.

With some of the compounds, there is a lack of sufficient reliable data to serve as a guide as to the efficacy of the coccidiostatic agent against the various species of coccidia. In some instances no known chemical tests are available to detect the presence of the coccidiostatic in the feed to serve as a guide in evaluating failure or presumed failure of the compound in controlling the various species of coccidiosis. This is of much concern to those doing poultry disease diagnostic work and the feed control agencies.

The recent work by Edgar in the development of a vaccine containing *Eimeria*
tenella to stimulate immunity against this species in young chicks has received much publicity. Such a product would seem to offer limited possibilities as it only represents one out of several species of coccidia for which protection would be established. The species in question is widespread in distribution in chickens grown in a conventional manner and it is the one readily controlled by coccidiostatics and sanitary measures.

**ERYSIPelas IN TURKEYS**

*Erysipelothrix rhusiptathiae* infections in turkeys becomes an increasingly more important problem each year. Antiserums and antibiotics prove of value in many flocks but have their limitations. Current research activities with killed bacterins may provide a satisfactory method of immunizing turkey flocks.

**BLUECOMB OR PULLET DISEASE IN TURKEYS AND CHICKENS**

In some areas, avian monocytosis, or bluecomb or pullet disease, results in considerable economic loss. In Minnesota in 1951, the disease was reported to have caused the turkey industry a loss of $500,000. from mortality and additional morbidity loss from loss of weight and market quality.

**AVIAN LEUKOSIS COMPLEX**

In a conference held at the U. S. Poultry Research Laboratory, East Lansing, Mich., for collaborators and representative leaders in the poultry industry, September 11-12, 1952, the present status of research on the avian leukosis complex was reviewed and the direction of future investigations projected.

The importance of the disease to the poultry industry stems from the recurring high loss estimated by Director Berley Winton to amount to $75,000,000. annually.

Gross pathologic studies indicate that of the various forms occurring in the field, visceral lymphomatosis (big liver disease) can be transmitted artificially with regularity, and osteopetrosis (marble bone) occasionally, while neural lymphomatosis (fowl paralysis) and ocular lymphomatosis (gray eye) are not transmissible with certainty. The anemic forms erythro- and granuloblastosis are rare, both in the field and the laboratory stock, according to Dr. R. F. Gentry.

Histopathologic studies by Dr. A. M. Lucas reveal the occurrence of invasive, tissue-damaging lymphoid aggregates in a variety of organs and species such as the pancreas, spleen and liver of chicken, turkey, pheasant and duck. Quantitative studies suggest that these aggregates actually represent an infective phase of visceral lymphomatosis, in distinction from the neoplastic one, and that their number—which can be significantly increased by live virus inoculation—is an indication of the proclivity of the birds toward overt lymphomatosis.

While a filtrable causative agent was suspected in diseases of the avian leukosis complex almost 50 years ago, the present concept is that such an agent can be demonstrated with certainty only for visceral lymphomatosis sometimes occurring together with osteopetrosis, and erythro-granuloblastosis, according to Dr. B. R. Burmester. A number of closely related agents, rather than a single agent, are suspected. Some lymphoid tumors yield a virus which causes a disease indistin-
guishable from lymphomatosis, while cell transplants induce a tumor at the site of injection in susceptible hosts. The filtrable agent of lymphomatosis has a long period of latency, often induces multiple pathologic manifestations, and is devoid of demonstrable antigenicity. Since it can be propagated only in the original host, the possibility always exists that either the original donor contains several agents or that the original agent became contaminated in chicken passages.

It is fortunate for the poultry industry and the project that Dr. J. W. Beard has become interested in the study of the causative agents of the avian leukosis complex, with special emphasis on that of erythro-myeloblastosis. In the latter disease Doctor Beard has demonstrated a sedimentable spherical agent of about 120 m in diameter, exhibiting definite enzymatic activity, and in general, lending itself to quantitative studies necessary in virology.

Lymphoblastoma and related conditions occur spontaneously in all species of domestic animals as pointed out by Dr. G. E. Cottral but to variable degrees, e.g., in sheep 1:357, 600; in man 1:10, 000; in broilers 1:1400; in fowl 1:270; and in regional laboratory chickens up to age of 600 days 1:4. Transmission of visceral lymphomatosis takes place both horizontally by contact through secreta, excreta and air, and vertically through the egg, the latter on evidence of epirnithic surveys, studies on isolated flocks and families and incubator transmission, and of demonstration of "healthy" carriers. The relative importance of egg transmission is undecided but its possibility should be taken into account in the widespread use of egg-propagated live poultry vaccines. Susceptibility to contact exposure seems to be high during the last stages of incubation and the first 20 days of brooding and then to diminish gradually.

Genetic studies have shown the possibility of developing lines of high susceptibility and resistance to the avian leukosis complex, according to Dr. N. F. Waters, but none of the lines has proved 100 per cent resistant. The factors for resistance seem to be recessive and multiple in character. Hybrids often have a higher incidence of the disease than the respective parent stocks, as if heterosis would favor the disease. Differences in incidence occur within lines bred for susceptibility and resistance, and are in themselves conditioned by environment.

The demonstration of altering the susceptibility to avian leukosis by selective breeding and of the contagiousness of lymphomatosis forms the basis of present-day recommendations for practical control, namely (a) to use stock of high resistance to the disease, and (b) to decrease the exposure by careful sanitary measures, especially during the early life of the birds.

With some of the basic facts on the disease complex available, future studies must be concerned with quantitative evaluation of the causative agents and genetic studies on a broad basis, to learn the degree of fixation of genetic resistance and its dependence upon environmental factors.

CHRONIC RESPIRATORY DISEASE

Because of the serious situation that exists in certain areas of the United States with regard to a disease condition which has been termed "air sac infection", numerous conferences of national scope have been held in 1952. On March 11–12,
TRANSMISSIBLE DISEASES OF POULTRY

1952, B. T. Simms, chief of the Bureau of Animal Industry, called a meeting of the poultry pathologists and industry representatives to formulate a coordinated research program. Twenty states were represented at this meeting. On May 22–23, a second conference of representatives from states interested in “air sac infection” was held. A cooperative research program involving seven experiment stations was developed involving an allotment of $235,000, for a two-year period (1952–54). On October 22–23 a third conference was held in Washington, D. C., to review the work to date of the seven cooperating stations and integrate the program in the regional Newcastle disease research programs.

During the past year chronic respiratory disease of chickens has received increased attention from poultry producers, poultry pathologists, and livestock sanitary officials. In recently published papers and reports (1–6) it is revealed that this disease is widespread in this country and is of great economic importance in certain sections.

The etiologic agents of chronic respiratory disease have been propagated in embryos, in laboratory birds, and in artificial media. Its known attributes do not conform to those of true viral or bacterial agents. Further investigation is necessary to ascertain its relationship to other microorganisms.

Natural outbreaks of the disease occur most frequently in birds over four weeks of age. In certain broiler raising areas the disease is very prevalent and frequently appears to be complicated with other predisposing or complicating factors. This may also be true in young replacement stock being reared for laying or breeding flocks. Tracheal rales, coughing, sneezing, nasal discharge, loss of appetite, inactivity, loss in weight, and retardation in growth are common symptoms observed in growing stock. Mortality has been reported to approach 50 per cent in growing flocks. In mature birds one may observe protracted respiratory symptoms, slight decrease in egg production, and a loss in body weight.

Well defined criteria for the identification of the disease have not been established. Adequate flock histories, differential diagnostic tests for other respiratory infections, embryo and bird inoculation methods offer an approach to a reliable diagnosis of the disease.

During the past year it was reported that the agent, when inoculated into embryos, produced characteristic respiratory lesions. Similar lesions were observed in dead and live embryos, pipped in the shell, and cull chicks obtained from breeding flocks affected with the disease. These findings suggest the possible perpetuation of the disease through egg transmission.

Comparative studies of the etiologic agents of chronic respiratory disease and infectious sinusitis in turkeys reveal that they have many attributes in common. Their definite relationship will have to be based on their antigenic similarity.

At the present time adequate measures for the control of the disease are not known. Antibiotics exert an inhibitory effect on the agent but their true effectiveness in controlling natural outbreaks has to be evaluated more fully. Depopulation of affected premises, followed by proper sanitary measures, appears to be the most satisfactory procedure in eliminating losses from this disease.
 Aside from virus isolation there are two methods available for studying the epizootic incidence of infectious bronchitis, namely virus challenge and a serum neutralization test, on recovered birds. Although neither of these tests has been used widely except in New England and thus the actual incidence of infectious bronchitis remains obscure, blood samples from 22 states tested at the Storrs (Connecticut) laboratory suggest widespread incidence of the disease, a fact also borne out by samples obtained in connection with a recent air sac survey—sponsored by the Bureau of Animal Industry in Delaware, Georgia, Maryland, and North Carolina. In view of the reported trigger effect of infectious bronchitis on “air sac disease”, the recognition of and preventive vaccination for infectious bronchitis may gain added importance.
Enterotoxemia ("pulpy kidney disease", "overeating disease") of sheep is considered to be due to the elaboration and subsequent absorption of epsilon toxin of type D Clostridium perfringens in the intestine (5). Immunization of lambs with alum precipitated toxoids of Type D Cl. perfringens has been effective in the prevention of the disease (1, 3, 5). A number of commercial products are on the market; all of these are whole culture bacterins toxoided with formalin and precipitated with alum. Animals are immunized with 5 ml of these bacterins administered by the subcutaneous or intramuscular route.

During the development of a product, a number of possible potency test methods were explored in order to evaluate comparatively a number of commercial bacterins and our experimental lots.

1. Intravenous Immunization of Mice. A single i.v. immunizing dose of bacterin (0.05 ml) failed to give mice any protection against challenge with toxin or culture. Mice (18-20 gm) were immunized with one i.v. dose of 0.05 ml of a commercial bacterin #243. This bacterin gives values of 100 units in our combining tests.

Group A was challenged on the eighth day with 10 micrograms (2MLD) activated toxin D-1 i.v.

Group B was challenged on the eighth day with 5 micrograms (1MLD) activated toxin D-1 i.v.

Group C was challenged on the 15th day with 10 micrograms (2MLD) activated toxin D-1 i.v.

Group D was challenged on the eighth day with 0.5 ml 1:150 dilution of trypsin-activated four-day culture i.p.

There was no significant protection in any group.

2. Intraperitoneal Immunization of Mice. The intraperitoneal and subcutaneous routes for immunization of mice with various bacterins was tried in a fairly large number of tests as a possible assay method. The protection demonstrated was of low order when challenge was made by the same route and the results were not readily reproducible. Single immunizing doses of 0.005 to 0.5 ml bacterin were followed by i.p. challenge three weeks later with 1 to 2.5 MLD of culture (nonactivated). The correlation between the protection results and combining power was not very good.

3. Rabbit Immunization Tests. Rabbits were immunized with a single subcutaneous dose of 1 ml of various bacterins. When bled two weeks later, those immunized with bacterins CS #243 and T15 (200 units in combining tests) showed less than 4 antitoxin units per ml.

4. Guinea Pig Immunization Tests. Preliminary tests suggest that guinea pig immunization may be of some value in the assay of type D bacterins.

* Lederle Laboratories Division, American Cyanamid Co., Pearl River, New York.
In the following experiment albino guinea pigs (300–350 gm) were immunized with single subcutaneous doses of 0.1 ml or 1 ml of bacterin CS #248 (150 CU/ml in combining tests). Three weeks later the animals were challenged with trypsin-activated fresh toxin injected subcutaneously. The results were as shown in table 1.

Toxin D-39 which was used in this test was prepared as follows: Supernatant of a four-day culture was treated with 0.5 per cent trypsin (25 mg/5 ml supernatant incubated at 37 C. for 45 minutes). This activated toxin had previously shown an intravenous mouse potency of 6,000 MLD/ml and a guinea pig subcutaneous potency of 20 MLD/ml.

Preliminary tests to ascertain optimal challenge levels had established that nonactivated cultures (0.01–0.5 ml in 2.5 per cent CaCl₂ intramuscularly) were sublethal.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Guinea pig protection test</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>BACTERIN</td>
</tr>
<tr>
<td>Group A</td>
<td>CS 248, 1 ml. s.c.</td>
</tr>
<tr>
<td></td>
<td>248 0.1 ml. s.c.</td>
</tr>
<tr>
<td>C (controls)</td>
<td>0</td>
</tr>
<tr>
<td>Toxin potency</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

5. Combining Power Test. A combining test method described by Baldwin, Frederick and Ray (1) in which the ability of the bacterin to combine with type D Cl. perfringens antitoxin is measured, has been modified and adapted for our purposes. It gives consistent values for each product.

In brief, varying proportions of bacterin are mixed with a constant amount of antitoxin (1 unit) and are allowed to combine at room temperature for two hours. A constant volume of trypsin-activated solution of dried standard type D toxin is then added and the bacterin-antitoxin-toxin mixture is further incubated for one hour. The volumes are so adjusted that each 0.5 ml intravenous mouse dose contains 0.002 to 0.04 ml of test bacterin, 1 unit of antitoxin and 5 MLD of standard toxin.

The bacterin combines with the antitoxin, then excess antitoxin is combined with the toxin. One combining unit (CU) is the smallest amount of bacterin which after combination with one unit of antitoxin, leaves just sufficient antitoxin to combine with 5 MLD of toxin and leave 1 MLD. This is necessarily a cumbersome definition. To illustrate: If 0.04 ml of bacterin, combined with 1 unit of antitoxin and 5 MLD of toxin results in the death of all the mice receiving this material in 0.5 ml volume intravenously, the combining unit is 0.04 ml or 25 CU per ml. If 0.005 ml of bacterin, but no larger amount, plus 1 unit antitoxin plus 5 MLD of toxin results in the death of the mice receiving that dose then the bacterin contains 200 CU per ml, i.e., the number of combining units per ml is the reciprocal of the largest
amount of bacterin in milliliters, which will still give 100 per cent mortality of test animals.

With this test method we investigated a number of factors which influence the potency of the bacterin. Some of these will be reviewed briefly.

I. Seed Culture. (A) The seed medium of pancreatic digest broth (PD) should contain glucose instead of dextrin as carbohydrate source. Thioglycollate broth is a poor seed medium for toxin production. CU values for subcultures prepared from these seeds may be compared (table 2).

(B) The youth of the seed culture appears to be very critical for production of potent subcultures (table 3).

II. Production Broth, Composition. (A) Although glucose is desirable in the seed, it inhibits toxin production in the subculture. Other carbohydrates were also inferior to dextrin (table 4).

(B) The optimal level for Fe in PD medium appears to be about 0.4 mg per 100 ml of medium (table 5).

<table>
<thead>
<tr>
<th>Table 2: Effect of seed medium on potency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T50a, b</td>
</tr>
<tr>
<td>T50c</td>
</tr>
<tr>
<td>T50d</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Effect of age of inoculum on potency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T41</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4: Effect of carbohydrate source on potency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T41</td>
</tr>
<tr>
<td>T41</td>
</tr>
<tr>
<td>T41</td>
</tr>
<tr>
<td>T41</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5: Effect of iron concentration on potency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T41</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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</table>
Other types of media have proven inferior to PD broth. A wide variety of media of various compositions was studied.

III. Alum Precipitation and Preservation. (A) Our tests indicate that alum slightly depresses the CU value for a toxoid. However, in view of its role in delaying absorption of antigen from the vaccination site, it seems unwise to omit this treatment and we compromised on a final content of 0.75 per cent alum instead of the 1.5 per cent concentration first tried (table 6).

(B) Following alum precipitation it is desirable to adjust the pH to about 6.5 since unadjusted products (ca. pH 5.0) deteriorate rapidly and would be too acid for parenteral use (table 7).

(C) In a single comparative test, the addition of merthiolate to make a final concentration of 1:10,000 did not alter the CU value for bacterin.

### TABLE 6

<table>
<thead>
<tr>
<th>Effect of alum concentration on potency</th>
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<tbody>
<tr>
<td>T35</td>
</tr>
<tr>
<td>No alum</td>
</tr>
<tr>
<td>T35</td>
</tr>
<tr>
<td>1.5% alum</td>
</tr>
<tr>
<td>T37</td>
</tr>
<tr>
<td>No alum</td>
</tr>
<tr>
<td>T37</td>
</tr>
<tr>
<td>0.5, 0.75, 1.0, 1.5%</td>
</tr>
<tr>
<td>T37</td>
</tr>
<tr>
<td>2.0% alum</td>
</tr>
</tbody>
</table>

### TABLE 7

<table>
<thead>
<tr>
<th>Effect of Final pH on potency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T32</td>
</tr>
<tr>
<td>No pH adjustment after alum pptn.</td>
</tr>
<tr>
<td>T32</td>
</tr>
<tr>
<td>pH adjusted to 6.5</td>
</tr>
</tbody>
</table>

This is by no means a complete report of all work done on the product. It is an abstract intended to convey an idea of the scope of the work. All experiments were replicated many times. We eventually arrived at the following standard procedure.

Production of Cl. perfringens Type D Whole Culture Bacterin, Alum Precipitated

**Supplement Stock Solutions.** Iron Solution: FeSO₄·7H₂O, 120 mg/100 ml in 0.1 N HCl. This solution should be freshly prepared and autoclaved.

Glucose: 50 per cent glucose, sterilized by Seitz filtration.

Dextrin: 25 per cent dextrin, Pfannstiehl. Autoclaved at 10 lb. for 20 minutes.

Frozen Stock Cultures. PD broth is autoclaved and rapidly cooled to about 37°C. Glucose solution is added to a final concentration of 0.5 per cent and ferrous sulfate to a concentration of 0.4 mg/100 ml medium. This broth is inoculated and incubated for 18–24 hours. The culture is distributed into small tubes in volumes of 0.3 ml and held frozen in a solid carbon dioxide box.

Seed Cultures. Tubes containing 25 ml of PD broth are autoclaved and rapidly
CLOSTRIDIUM PERFRINGENS TYPE D BACTERINS

cooled to about 37°C. Glucose is added to 0.1 per cent concentration and ferrous sulfate to a concentration of 0.4 mg/100 ml broth. The contents of a frozen seed tube are thawed and inoculated into the tube and the contents are mixed by rotation. Incubate at 37°C., 16 to 18 hours.

Production Cultures. Seven-liter-lots of PD broth in 9-liter Pyrex bottles are autoclaved and rapidly cooled to about 37°C. Dextrin is added to a 0.5 per cent concentration and ferrous sulfate to a final concentration of 0.4 mg/100 ml medium. Glucose is omitted in this production broth. The 25 ml of seed culture is inoculated into the bottle which is rotated to mix. Production cultures are incubated for five days at 37°C. On the fifth day, a sample is removed and examined for purity. Smears are examined microscopically and a loopful is plated on tryptose agar. These agar plates after 24 hours' incubation aerobically should show no growth.

TABLE 8
Production medium

| Medium: Pancreatic digest broth base (PD)*, adjusted to pH 7.7-7.8 with NaOH |
|---------------------------------------------------------------|--------------------------|
| Tryptic digest of beef heart, to make................................| 5.5% solids |
| Na₂HPO₄·12H₂O........................................................................| 5.76 gm/liter of H₂O |
| MgSO₄·7H₂O...............................................................................| 0.02 gm/liter of medium |
| KH₂PO₄.....................................................................................| 0.48 gm/liter of medium |
| Vitamin solution*....................................................................| 1.0 ml/liter of medium |

* Vitamin solution: Thiamin chloride—100 mg.; Pantothenic acid—100 mg.; Pimelic acid—100 mg.; Nicotinic acid—100 mg.; Pyrodoxin—100 mg.; Riboflavin—10 mg.; Distilled water—100 ml.

Inactivation of toxim. On the fifth day of incubation, formalin (U. S. P., 40 per cent formaldehyde) is added to a final concentration of 0.5 per cent and the pH is adjusted to 7.5 with 5 N NaOH. Incubation is continued for seven more days. On the seventh day of toxoiding, a sample is removed for mouse toxicity tests. Three mice are inoculated intravenously with 0.1 ml of toxoid (0.5 ml of a 1:5 dilution in peptone diluent). All mice should appear healthy 24 hours after inoculation. Tubes containing 20 ml of fluid thioglycollate broth are inoculated with 0.5 ml of toxoid. No evidence of growth should appear after 24 hours' incubation. If both tests are satisfactory, the material is ready for alum treatment.

Alum Precipitation. Alum is added to a concentration of 0.75 per cent (20 per cent KAl(SO₄)₂·12H₂O, Seitz-filtered while hot; add 260 ml of this solution to 7 liters of toxoid). The pH is adjusted to 6.6 to 6.8 with 5 N NaOH. Merthiolate is added to a final concentration of 1:10,000. The bacterin is allowed to stand at room temperature for 24 hours. A sample is removed for combining tests in mice. The remainder is stored at refrigerator temperatures.

Method for Potency Testing

A complete account of the potency test procedure follows:

Standard Dried Toxin. The supernatant fluid of a 4-day growth of type D Cl.
perfringens culture was 3/4 saturated with ammonium sulfate. The material rising to the surface was skimmed off and dried on filter paper over P2O5 in a vacuum desiccator (2). This toxin, designated D-1, has a potency of 0.5 microgram = 1 MLD after activation with trypsin.

For routine use we prepare a 400 micrograms/ml stock solution of this toxin by dissolving 20 mg of dried toxin in 50 ml peptone diluent (1 per cent Bacto peptone, 0.5 per cent NaCl) and adding 50 mg trypsin (Pfanstiehl—optimal dilution = 1:110). The mixture is incubated in a 37 C. water-bath for 45 minutes. The solution is then centrifuged and the insoluble trypsin residue is discarded. 1:10,000 merthiolate is added. This activated stock solution appears to be fairly stable when stored at refrigerator temperatures.

For combining power tests we dilute this stock solution 1:40 in PD (peptone diluent) for 10 micrograms toxin per ml or 2.5 micrograms (5 MLD) in each mouse dose.

Minimum Lethal Dose (MLD). This is the smallest amount of activated toxin which kills all mice (17–20 gm in weight) within 24 hours after intravenous injection.

TABLE 9
Potency of toxin D-1
Stock solution containing 400 micrograms activated toxin/ml. is diluted 1:50 in peptone diluent

<table>
<thead>
<tr>
<th>TOXIN, 1:50, ML.</th>
<th>PD. ML.</th>
<th>0.5 ML. DOSE =</th>
<th>MORTALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>1.5</td>
<td>2.0 micrograms</td>
<td>%</td>
</tr>
<tr>
<td>1.1</td>
<td>1.9</td>
<td>1.5 micrograms</td>
<td>%</td>
</tr>
<tr>
<td>0.75</td>
<td>2.25</td>
<td>1.0 micrograms</td>
<td>%</td>
</tr>
<tr>
<td>0.38</td>
<td>2.62</td>
<td>0.5* micrograms</td>
<td>%</td>
</tr>
<tr>
<td>0.19</td>
<td>2.81</td>
<td>0.25 micrograms</td>
<td>%</td>
</tr>
</tbody>
</table>

* 0.5 micrograms—1 MLD.

Antitoxin. One unit of antitoxin is that amount which just neutralizes 15 MLD of toxin. Antitoxin, serial #28, neutralized 15 MLD of activated toxin D-1 (7.5 micrograms) in a dilution of 1:500 and has been assigned a provisional value of 500 antitoxin units per ml. Antitoxin, serial #895010, has been assigned a provisional value of 400 A.U/ml on the same basis.

L+ Dose. This is the smallest amount of activated toxin which, after combination for one hour at room temperature with one unit of antitoxin, kills 100 per cent of i.v. injected mice. The L+ value for toxin D-1 is 10 micrograms. The L0 value (largest amount of toxin which is completely neutralized when combined with one unit of antitoxin) is 8 micrograms for this toxin.

Combining Power. In our tests we mix varying proportions of bacterin with a constant quantity of antitoxin (1 unit) and incubate at room temperature for two hours. Trypsin-activated toxin D-1 is then added and an additional incubation of one hour is allowed. The mixed volumes are such that each 0.5 ml mouse dose
CLOSTRIDIUM PERFRINGENS TYPE D BACTERINS

contains 0.002 to 0.04 ml bacterin, 0.002 ml antitoxin (1 unit of 500 unit per ml antitoxin) and 2.5 micrograms of toxin D-1 (5 MLD). The test will therefore measure from 500 down to 25 CU per ml. The test dose of toxin (2.5 micrograms) used in combining test is $\frac{1}{10}$th the L+ dose of toxin.

**TABLE 10**

*Estimation of L+ of Toxin D-1*

Stock solution described above was diluted 1:3.3 in peptone diluent. CS antitoxin diluted 1:125 in same diluent.

<table>
<thead>
<tr>
<th>TOXIN 1:3.3</th>
<th>PEPTONE DILUENT ML</th>
<th>CS ANTITOXIN 1/125 ML</th>
<th>0.5 ML DOSE =</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TOXIN micro-</td>
</tr>
<tr>
<td>0.55</td>
<td>0.45</td>
<td>1.0</td>
<td>16</td>
</tr>
<tr>
<td>0.47</td>
<td>0.53</td>
<td>1.0</td>
<td>14</td>
</tr>
<tr>
<td>0.40</td>
<td>0.60</td>
<td>1.0</td>
<td>12</td>
</tr>
<tr>
<td>0.33</td>
<td>0.67</td>
<td>1.0</td>
<td>10</td>
</tr>
<tr>
<td>0.27</td>
<td>0.73</td>
<td>1.0</td>
<td>8</td>
</tr>
<tr>
<td>0.20</td>
<td>0.80</td>
<td>1.0</td>
<td>6</td>
</tr>
</tbody>
</table>

**TABLE 11**

Scheme for combining power tests using toxin D-1 (and CS antitoxin 500 units per ml).

<table>
<thead>
<tr>
<th>DILUTION SCHEME</th>
<th>0.5 ML MOUSE DOSE CONTAINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 ml bacterin dilution.....................</td>
<td>0.04 to 0.002 ml bacterin</td>
</tr>
<tr>
<td>1.0 ml 1:62.5 diln. of antitoxin. Incubate at room temp. 2 hrs.........................</td>
<td>0.002 ml. antitoxin (1 unit)</td>
</tr>
<tr>
<td>2.0 ml. 1:40 diln. of toxin D-1. Incubate at room temp. 1 hr..........................</td>
<td>2.5 micrograms toxin (5 MLD)</td>
</tr>
</tbody>
</table>

*Correlation Between L+ of Toxin and Combining Unit of Toxoid*

Twenty-five lots of type D toxin were tested for their combining power before and after toxoiding and alum precipitation. After activation with 2 per cent trypsin the parent toxins were combined at various levels with one unit of antitoxin for one hour at room temperature and the mixtures were injected i.v. into mice. The results were expressed in terms of the number of L+ doses of toxin per ml. The same parent toxins (not activated) were then toxoided and alum-precipitated in the usual manner. The combining unit titer obtained on these finished bacterins closely approximated the L+ values obtained for their parent toxins. In view of these results it would appear practicable to use the simpler L+ test as a guide in the selection of batches of toxin for further processing. The results of these tests are given in table 12.
TABLE 12

Correlation between L+ and combining power

<table>
<thead>
<tr>
<th>PARENT TOXIN</th>
<th>FINAL BACTERIN CU PER ML.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MLD per ml.</td>
</tr>
<tr>
<td>6 Lots</td>
<td>1,000–4,000</td>
</tr>
<tr>
<td>4 Lots</td>
<td>5,000–10,000</td>
</tr>
<tr>
<td>15 Lots</td>
<td>16,000–&gt;18,000</td>
</tr>
</tbody>
</table>

DISCUSSION

Test Dose. In the assay of type D bacterins, we have attempted to follow the combining test method outlined by Baldwin, Frederick and Ray (1). These authors used a dry toxin which after activation with trypsin (2.5 mg for each mg toxin) had a potency of 2 micrograms = 1 MLD. A unit of their antitoxin (500 AU/ml) was the amount which neutralized 15 MLD (30 micrograms) of this toxin. In combining tests the mouse dose of toxin was 4.15 micrograms (2+ MLD). Using this system, Baldwin reported values of 50 combining units/ml for a bacterin produced in 1947.

After numerous adjustments in our test systems we have selected for our tests a mouse dose of 5 MLD of our test toxin (2.5 micrograms) because this amount of toxin gives values of 100 combining units/ml for commercial bacterin #243 and 150 units for #248. We have included these bacterins as reference standards for these arbitrary unit levels in our comparative tests with other commercial products and our experimental bacterins. Our test dose of toxin is therefore approximately twice that described by Baldwin; when this dose is reduced to 2 MLD (1 microgram of toxin D-1 or 250 microliters of fresh toxin D-40) the unit value for both reference bacterins is less than 25 units.

Fifteen MLD (7.5 micrograms) of toxin D-1 are neutralized by 1/600 ml of CS antitoxin #28 hence we have assigned a value of 500 antitoxin units/ml for this serum in our combining tests.

The CU values obtained for bacterin #248 with various levels of test toxin D-1 are shown in table 13. On such a basis we have selected a test dose of 5 MLD of toxin D-1 (2.5 micrograms).

TABLE 13

Effect of various concentrations of toxin on combining units

<table>
<thead>
<tr>
<th>ANTITOXIN CS #28</th>
<th>+ TOXIN D-1</th>
<th>COMBINING UNITS/ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.002 ml.</td>
<td>1 mcgm (2 MLD)</td>
<td>&lt;25</td>
</tr>
<tr>
<td>0.002 ml.</td>
<td>2 mcgm (4 MLD)</td>
<td>100</td>
</tr>
<tr>
<td>0.002 ml.</td>
<td>2.5 mcgm (5 MLD)</td>
<td>150</td>
</tr>
<tr>
<td>0.002 ml.</td>
<td>3.0 mcgm (6 MLD)</td>
<td>200</td>
</tr>
<tr>
<td>0.002 ml.</td>
<td>3.5 mcgm (7 MLD)</td>
<td>300</td>
</tr>
<tr>
<td>0.002 ml.</td>
<td>4.0 mcgm (8 MLD)</td>
<td>&gt;300</td>
</tr>
</tbody>
</table>
Test Systems. In earlier tests we employed the scheme described by Baldwin of combining a constant volume of bacterin (0.05 ml) with various levels of antitoxin (0.5 to 5.0 units) followed by addition of the test toxin. In all later tests the procedure was slightly modified by varying the levels of bacterin and combining these with a constant amount (1 unit) of antitoxin. The second method has given slightly higher CU values for all test bacterins. The results obtained when the two methods were compared in parallel tests are shown in table 14.

| Potency of Test Toxins. Our earlier combining tests were beset with difficulties because we did not appreciate that the MLD value for our dried toxin was influenced by the concentration of toxin during activation and the type of diluent used in test systems. In preliminary tests when antitoxin was assayed, the MLD for toxin D-1 was 0.5 micrograms. In later tests this value rose to 5 micrograms and remained constant at this level in numerous mouse potency tests. This shift in potency was due to the manner in which the toxin was activated. In order to eliminate the frequent weighing of very small amounts of material we found it expedient to prepare a stock saline solution (400 micrograms/ml of toxin); this was stored at 4°C. As needed this stock was then diluted and activated with fresh trypsin solution (1 mg/ml). For example:

(A) A 1:13.3 dilution of activated toxin was prepared by mixing 1 ml stock solution, 1 ml trypsin solution and 11.3 ml saline and incubating the mixture at 37°C for 45 minutes. Further dilutions were prepared in saline for mouse potency titration. These preparations consistently showed 1 MLD to be 5 micrograms toxin.

(B) When further dilutions of (A) were made in peptone diluent instead of saline, the MLD was uniformly 2 micrograms.

(C) A stock solution of toxin activated in peptone diluent (20 mg toxin, 50 mg trypsin, 50 ml PD—37°C. 45 min.) has been stored at 4°C. When dilutions fo this stock are made in PD the MLD value for the toxin is 0.5 microgram.

It should be noted that the toxin:trypsin ratio of 1:2.5 was adhered to in all instances; the only variables were the concentrations activated and the type of diluent.

The foregoing data may be summarized (table 15).

These results indicate that stock solutions of dried toxin are fairly stable, but they should be trypsin-activated before and never after dilution for mouse potency tests. An activated stock solution of toxin in PD (Solution C) appears to be fairly stable when held at 4°C. Addition of merthiolate (1:10,000) as preservative has not influenced the potency or combining capacity. Physiologic salt solution should be
avoided as diluent since it gives lower potency values. It seems likely that peptone diluent may protect toxin potency through its buffering capacity and that other diluents might be of similar value.

**Antitoxin Responses in Immunized Sheep**

Six lots of type D bacterins were tested on six groups of four lambs. Three of the bacterins were commercial vaccines of low, intermediate and high combining unit titer and three were experimental lots of high titer. All 24 lambs received a single subcutaneous dose of 5 ml. of bacterin. Test bleedings were taken one day prior to and 21 days after vaccination and the sera of each group were pooled. Antitoxin titration was made by combining various levels of each serum pool for one hour with 15 MLD of activated standard toxin solution and injecting the mixture intravenously into mice. The results (table 16) indicate that the animals receiving a single immunizing dose of bacterins of 150 CU titer or higher showed responses of 20–90 antitoxin units.

**SUMMARY**

A method of production of a Cl. perfringens, type D toxoid has been described, together with a satisfactory method for determining its potency.
Data are presented to show that a substantial antitoxin titer is induced in sheep immunized with a single dose of toxoid of high titer.

ACKNOWLEDGEMENT

We are happy to acknowledge the technical assistance and valuable suggestions of Mr. F. V. Martini and R. L. Bolton.

REFERENCES


REPORT OF THE COMMITTEE ON BIOLOGICS AND PHARMACEUTICALS


Your committee on biological and pharmaceutical products plans in this annual report to bring the membership (1) highlights of advancements or developments and (2) suggestions and recommendations for your consideration and further action.

SULFONAMIDES AND ANTIBIOTICS

In the broad field of veterinary therapeutics, the sulfonamides and, to an even greater extent the antibiotics, dominate the pharmaceutical picture. The sulfonamide situation appears rather static as only three new ones have attained prominence the past year. These are sulfisoxazole, sulfacetamine and phthalylsulfacetamide.

Sulfisoxazole may be administered by mouth or parenterally. Following peroral administration, it is picked up rather quickly from the intestine and rapidly eliminated from the body by the urinary system. Due to this rapid elimination, multiple doses should be given during a 24-hour period to maintain adequate blood and tissue levels. Sulfisoxazole appears to have a particular field of usefulness in treatment of urinary tract infections while clinical reports indicate that it is also effective in selective systemic infections.

Sulfacetamine is administered perorally for systemic and urinary tract infections. It is rapidly excreted in the urine and soluble even in acid urine, a feature which minimizes risk of renal damage. Solutions and powdered formulations of sulfacetamine are increasingly used for topical application, especially to the eyes of animals, because the drug penetrates well and causes little or no irritation.

Phthalylsulfacetamide, like sulfapuranadine, is poorly absorbed when given by mouth. It is therefore indicated for treatment of selective bacterial infections of the gastrointestinal tract.

ANTIBIOTICS

In the antibiotic field, a mass of both clinical and research reports point to an ever widening scope of useful indications and we now have quite stable dosage scales for antibiotic treatment of infections in all species of animals. Penicillin, which has a relatively narrow bacterial spectrum, has been combined with dihydrostreptomycin and other antibiotics to broaden therapeutic coverage. The broad range antibiotics which include aureomycin, chloramphenicol and terramycin, as a whole, do not gain effectiveness through combinations and are rarely so used.

In brief summary, bacitracin implants are now widely sold and used as a growth stimulant for suckling pigs. Bacitracin has also proved highly effective in treatment
of swine dysentery. Terramycin and aureomycin are highly rated for the intravenous treatment of bovine shipping fever. Aureomycin shows some encouraging values in anaplasmosis for a marked or complete reduction of anaplasma in blood cells was noted after several heavy intravenous doses.

New antibiotics of the past year are neomycin and polymyxin.

Neomycin is produced by cultures of Streptomyces fradiae and supplied commercially as the water-soluble sulfate salt. Active against both Gram-positive and Gram-negative organisms, neomycin has been used chiefly for topical application to infected lesions and for intramammary infusions in mastitis, alone or in combination with other antibiotics. Some published data also point to good ratings for neomycin in treatment of intestinal infections.

Polymyxin, derived from cultures of Bacillus polymyxu, is usually supplied as water-soluble polymyxin B sulfate. Because of its unusually high bacteriostatic ratings over a wide range of Gram-negative pathogens, including Pseudomonas aeruginosa, this antibiotic promises to become much more widely used, especially for local application and for intrauterine therapy. It is poorly absorbed when given by mouth, painful and reactive when injected subcutaneously or intramuscularly.

Just prior to preparation of this report, we understand that a new antibiotic called magnamycin has been developed by the producers of terramycin. It is a broad spectrum antibiotic having certain bacteriostatic ranges not covered by terramycin.

**BIOLOGICAL PRODUCTS**

During this past year, several million doses of modified hog cholera virus-vaccines have been released under special license for field use, either alone or with a simultaneous, minimum dose of hog cholera antiserum. As with all new biological products, adverse results in individual herds are accorded wide publicity while the herds vaccinated without adverse results are seldom mentioned. A recent inquiry to the chief of the BAI brought the following reply:

"The new forms of hog cholera vaccine, modified live virus, rabbit origin and swine origin, are being well accepted as immunizing agents against hog cholera, according to reports received by the Bureau of Animal Industry, 60 to 90 days following use of the vaccines in the field. These reports reveal that results are quite satisfactory and that losses from all causes are around 1 per cent. Since these reports come from all parts of the country and from both veterinarians and swine owners, they are regarded as a fairly accurate cross-section of the results obtained following the use of the vaccines."

Very recently, Viracine, a modified live virus, hog cholera vaccine produced in tissue culture by the Cutter Laboratories, has been extensively tested for safety and immunizing ability in California and Iowa. As a result of these tests, a license to produce and market the product has been applied for with the Bureau of Animal Industry. In field usage a small simultaneous dose of antiserum is used with the 2 cc. dose of tissue culture Viracine.

Before closing this subject of immunizing agents against hog cholera, your committee calls attention of the membership to the drastic curtailment of hog cholera antiserum production precipitated by the hazards and quarantines of vesicular
exanthema. A famine of essential serum with consequent disastrous outbreaks of hog cholera is a possibility within the next year.

**SPECIFIC RECOMMENDATIONS**

Your committee respectfully calls your attention to the following specific subjects:

1. **Unlicensed Poultry Biological Products:** In 1951, one member of your committee called attention to the fact that two laboratories in Delaware had been established for manufacture of frozen intranasal and wing-web Newcastle and tracheitis vaccines for poultry. Some of these vaccines have been sold without label, without a serial number and without licensing by either federal or state governments. These unlicensed and noninspected vaccines have been bootlegged into New York, New Jersey, Pennsylvania and other eastern states.

   Within the past 30 months, no less than six of these nonlicensed laboratories have launched production and even more of them are in the offing unless coordinated action is taken by federal and state authorities.

   Both the Federated Farm Bureau and the National Poultry Advisory Council have called attention to the extreme hazards inherent in intrastate production of such vaccines for use on poultry and livestock.

   Your committee requests that the U. S. Livestock Sanitary Association exert all possible effort toward enactment of suitable state laws and regulations to prohibit intrastate production of biological products unless they meet the federal standards established for such products.

2. **Need for Parasite Research:** During the past decade, added millions of acres of grazing land have been planted to improved and permanent grasses. This has increased the menace of internal parasites many fold and the problem is increasingly serious. Your committee urges both federal and state departments of agriculture to obtain greatly increased appropriations both for research on more effective anthelmintics and improved control procedures for endoparasites of livestock.

   Note: The executive committee in session on Wednesday, October 29, 1952, on motion of one of its members duly seconded, voted to delete paragraph two of the recommendations of the committee which read as follows:

   2. **Anthrax Bacterin:** In that anthrax bacterin is of no real value in the field protection of animals exposed to anthrax and that its use creates a false sense of security and, further, that widely distributed losses from vaccination anthrax occurred this past year in healthy cattle receiving so called anthrax bacterin, your committee recommends that official licenses for production of anthrax bacterin shall be revoked.
THE ROLE OF ANIMAL DISEASE REPORTING IN PUBLIC HEALTH

L. Otis EMIX, Ph.D.¹

The Public Health Service and the State Health Departments, as you know, are concerned with the control and prevention of disease in man. Those diseases of man transmitted from domestic animals have been designated officially by the World Health Organization as the zoonoses. They constitute a long list including rabies, tuberculosis, brucellosis, anthrax, psittacosis, leptospirosis, and Q fever, to mention a few. Where the zoonoses have occurred in man, their epidemiologic investigation has led public health workers from man to the animals involved. Health departments felt, here, an obvious need for veterinarians' services. The public health veterinary specialty has evolved in response to this need, growing in pace with wider recognition of the importance of the zoonoses. Since the state veterinarians have the delegated authority to invoke the necessary measures to control any disease of animals, the public health veterinarian is the natural and logical liaison officer between the state health officer and the state veterinarian.

In the conduct of public health programs for the successful control of communicable diseases, an efficient morbidity reporting system has been found to be a veritable cornerstone. For the control of zoonoses there is an additional need for knowledge of the occurrence of disease in animals to complement human morbidity information. Let us examine briefly examples which illustrate how morbidity reporting has been useful in the control of disease.

An epidemic of typhoid fever among humans run concurrently in Chicago and New York City from November 1924 through January 1925. These outbreaks were discovered simultaneously when during the week ending December 5, routine morbidity reports suddenly exceeded the established normal levels for typhoid by several hundred per cent in both cities. City and state health authorities, with the assistance of the Public Health Service, investigated at once. The usual vehicles of typhoid were found to be clean, but shipments of oysters from Long Island were incriminated. The production of oysters was examined and the probable source of contamination was determined. Recommendations were made for improved sanitation and other measures which would protect the oyster industry and preserve the public health. A base line established from previous reporting distinguished these cases as an unexpected and abnormal increase.

Another example, from the zoonoses, is the well known investigation of widespread sporadic cases of anthrax in men. The source was found to be infected shaving brushes. Appropriate remedial measures were taken. A system of disease reporting with a national information center was necessary to detect this outbreak. An adequate system of reporting and follow-up would have been most useful during this year of widespread anthrax in animals, particularly swine.

Human morbidity is reported by the physician through established channels to the State health department. This information is submitted by the state to the

¹ Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta, Georgia.
national Office of Vital Statistics every Tuesday by telegraphic report. The data are summarized and promptly redistributed to the nation, for immediate use. County breakdowns are sent in by mail, along with corrections, for detailed tabulation and analysis. The mere collection of this information is just the beginning. I cannot begin to list all of the many things which are done routinely by the public health officer and his organization on the basis of these data. Local health officers use them to establish quarantine; public health nurses base their surveillance and routine visits on them; the probable existence of epidemic conditions requiring state or federal investigation and action is detected by analysis and examination of the summarized figures. It is clear that a satisfactory morbidity reporting system really becomes a complete disease intelligence service.

Human morbidity reporting has been developed for over 30 years in public health departments as one of their regular functions. In the area of animal diseases a number of types of reporting have been set up, usually for the reporting of a specific disease. In Europe, general systems of reporting animal diseases have been in operation for many years. No comprehensive system of reporting of animal diseases now exists in the United States although a number of exploratory projects are in operation in various States, some with emphasis on zoonoses, others encompassing all animal diseases.

I would like to highlight briefly one of these studies in which I have participated. The Indiana animal disease reporting study was developed as a cooperative project of the state health department and the office of the state veterinarian. Dr. John H. Scruggs, who was assigned from the Communicable Disease Center to Indiana at that time, did most of the spadework by describing and discussing the tentative program to the veterinary profession through the medium of local district meetings. My assistance was requested in the mechanics and design of the operation. A report form on a double postcard was mailed, to reach the veterinarian at the end of each 2 week reporting period. Detailed plans were made for machine processing of the data and routine summaries were designed for returning the information to the veterinarian. The program started on January 1, 1952. During the first 6 months, 85 per cent of the 450 practicing veterinarians returned at least one card, and they maintained an average return of 48.5 per cent through September. Nearly 15,000 cases of disease were reported in the 9 months, with more than half of these being diseases which had to be written in on the card.

Upon the request of Dr. James H. Steele, of Communicable Disease Center, in May of this year, a tentative outline was drawn defining the role of an animal morbidity intelligence service when operated cooperatively by a state health department and the livestock regulatory agency. Seven points were listed as essential for its full and successful operation:

1. A public health veterinarian should be on the staff of the state health department. He would maintain liaison with cooperating agencies and act as coordinator of the disease reporting service with the disease control program.

2. The chief executive of the livestock regulatory agency of the state should be conversant with all phases of the program and have the means to administer such control measures as may be indicated.
3. The program should have the written approval of the state veterinary medical association.

4. A definite plan for collection, summary, analysis and dissemination of the data must be made before such a program is started.

5. A report of unusual numbers of any disease, either by phone or card, should automatically activate a definite investigative procedure.

6. Critical evaluation of all phases of the program should be made at regular periodic intervals.

7. It should be understood that animal disease intelligence and control is, in general, a logical function of the livestock regulatory agency and that the program outlined herein is a demonstration program which may be expanded into a general program which would include all animal diseases of both public health and economic importance.

It was further suggested that such a program, when extended to include all animal diseases, might still operate on a cooperative basis, particularly where a state livestock regulatory agency does not have mechanical facilities and the services of a trained statistician, both of which are necessary to the program.

Since May, progress has been made in working toward the initiation of a general animal disease intelligence service at a national level. The Bureau of the Budget has recognized that such a program is desirable for three federal agencies, in particular: the Bureau of Animal Industry, the Public Health Service, and the Federal Civil Defense Administration. Several conferences have been held to discuss the interests, responsibilities, development, and expansion of the project. At the last inter-agency conference, on August 26, it was agreed by members of these three agencies that the Public Health Service should continue with its developmental studies in 1953. Also, it was recommended that the emphasis be redirected toward a more general system of animal disease intelligence. Accordingly we are doing everything we can to develop the program for the benefit and use of all concerned.

An animal morbidity reporting system, similar to the one in Indiana is being adopted in the States of Ohio, Georgia and possibly several others in 1953. The reporting form in use in Indiana this year has been revised to provide more flexibility. They are not in print yet so I have provided you with mimeograph facsimiles of the card and added explanations.

Seven diseases are printed on all cards, namely, rabies, erysipelas, leptospirosis, encephalomyelitis, anthrax, swine brucellosis and psittacosis. In the eight blank spaces, each State will add the diseases it specifically wishes to have reported. On the left is the remainder to the veterinarian, which is more or less an abstract of the intent of the service. I quote "Some diseases of animals are communicable to man and constitute a direct threat to public health. Others are a direct menace to the economic health of the producer and of indirect concern to public health through reduced production. These diseases may become of epizootic or epidemic importance under the right circumstances. Proper control measures, based on reliable reporting, will be a big step toward disease prevention. The diseases considered most likely to occur in this state have been listed. Extra spaces have been provided for you to write in others of importance but less frequent occurrence. Your voluntary coopera-
tion is needed. This form has been designed to conserve your time and effort. Its completion and prompt return will facilitate the prompt preparation of summary reports which you will receive at regular intervals. Report directly by telephone when immediate action by the livestock sanitary official or the public health officer is needed." The practicing veterinarian can provide most of the disease prevention service his clients will require, if he, in turn, is supplied with timely reports of disease conditions in his own County, State and Nation.

Efficient technical and mechanical operational procedures are necessary to implement the functional utility of such a system. Each state has its own particular problems of disease prevalence as well as methods of operation. Accordingly, the service in any specific state should be molded around the general basic concepts of animal disease control and modified to fit the situation.

The final point, I think you will agree, is the keystone to the success of any animal disease intelligence service. As pointed out before, collected figures are but the beginning of the service. Reports must be used first as tools for the epizootiological and epidemiological investigations of animal disease. They may also provide information from which better descriptions of disease can be made to provide our base lines, or they may indicate fields requiring research. The suspected or apparent presence of unusual numbers of cases of a disease should automatically start a definite procedure of investigation. Such a procedure should include: verification of the diagnosis and the number of cases through the reporting veterinarian; the collection of specimens for laboratory confirmation, if indicated; as adequately detailed a history of the situation as is readily available; an immediate report of the findings to the responsible individuals in the health, defense, and livestock sanitary organizations of the state. The cooperation of these individuals and organizations should continue as may be indicated in the pursuit of further knowledge or as may be necessary for the implementation of control procedures.

The general thesis of the usefulness of such an animal disease intelligence service is widely accepted. Its specific application to complement human morbidity reporting in the cooperative prevention and control of the zoonoses is becoming more apparent. However, we are still in the developmental stages of exploring the different ways of handling various facets of operation, of modifying methods upon the basis of experience and of slowly expanding as experimental methods become acceptable tools.

Remember, the Public Health Service and the state health departments are interested primarily in the zoonoses. Organizations and individuals having economic interest in animal disease control will benefit directly from the work of the state.
Some diseases of animals are communicable to man and constitute a direct threat to public health. Others are a direct menace to the economic health of the producer and of indirect concern to public health through reduced production. These diseases may become of epizootic or epidemic importance under the right circumstances. Proper control measures, based on reliable reporting, will be a big step toward disease prevention.

The diseases considered most likely to occur in this state have been listed. Extra spaces have been provided for you to write in others of importance but less frequent occurrence.

Your voluntary cooperation is needed. This form has been designed to conserve your time and effort. Its completion and prompt return will facilitate the prompt preparation of summary reports which you will receive at regular intervals.

*Report directly by telephone* when immediate action by the livestock sanitary official or the public health officer is needed.

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**Reminder to the Veterinarian**

<table>
<thead>
<tr>
<th>CLINICAL DISEASE</th>
<th>ANIMAL</th>
<th>CASES</th>
<th>PREMISES</th>
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<td>Dog</td>
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<tr>
<td>Psittacosis</td>
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livestock regulatory agencies and the Bureau of Animal Industry. The Federal Civil Defense Administration has a different interest. You are aware of the potential threats of biological warfare and the peculiar suitability of certain agents to attack man and animals simultaneously. In fact, in the event of an attack with any pathogen, the rapid detection and proper reporting of the event will be the key to successful intelligence and control. The complete, unreserved cooperation of every individual and organization might, at such a time, mean survival. Both economy and efficiency can be provided by the development of one coordinated system of animal disease intelligence to meet the needs of everyone concerned.

C. E. A. Winslow has described our objective very aptly in his definition of public health as "The art and science of preventing disease, prolonging life and promoting physical and mental efficiency through organized community effort."
REPORT OF THE COMMITTEE ON MORBIDITY AND MORTALITY

C. E. WICKTOR, Los Angeles, California, Chairman; C. G. BRADT, Ithaca, New York; RAYMOND FAGAN, Kansas City, Kansas; R. C. NEWTON, Chicago, Illinois; R. S. ROBINSON, Pierre, South Dakota; A. P. SCHNEIDER, Boise, Idaho; C. R. SCHROEDER, Pearl River, New York

The long time objectives of this committee, as set forth in a previous report, are:

1. Assist the United States Bureau of Animal Industry in establishing a system for the collection and dissemination of obtainable livestock morbidity and mortality statistics, in cooperation with state livestock sanitary officials.

2. Expedite publication and distribution of:
   a. A manual on nomenclature
   b. A manual on the diagnosis and epidemiology of economic and transmissible diseases of animals.

3. Prepare the practicing veterinarian and the veterinary student, through all available means and agencies, to give freely honest and complete reports to the chief livestock sanitary officials on veterinary morbidity and mortality within their states.

4. Continue to encourage support of and interest in the program for gathering vital statistics. To this end, the Committee has recommended that colleges of veterinary medicine consider the incorporation of a course of vital statistics in the curriculum to acquaint the veterinary student with the part he will play as the initial source of morbidity and mortality data, to imbue him with his obligation, and to teach him to interpret properly and evaluate statistical data which will be made available to him as a result of his effort.

In the intervening years this committee has had much encouragement by verbal acclaim, but no real fundamental cooperation. A national reporting agency has not been established. The manuals on nomenclature and diagnosis and epidemiology are not ready for publication.

Much publicity has been secured and has made veterinarians and stockmen alike conscious of the need for a veterinary morbidity and mortality report. This has been accomplished through talks and reports at various veterinary and livestock meetings. Publicity given by the public health services for the need of such a report is worthy of acknowledgment. Various veterinary colleges are stressing to students the importance of prompt disease reporting to regulatory officers.

Officials of civil defense are extremely exercised over the lack of a national morbidity and mortality report of animals. The lack of such a report when engaged in defense against bacterial warfare is such a handicap that failure of successful prosecution can readily be envisioned.

This Committee on Morbidity and Mortality firmly believes that it is essential to establish a uniform veterinary morbidity and mortality report, a list of diseases to be reported, and the period to be covered by such reports. On this premise we have drafted: (1) a basic list of reportable diseases, (2) a uniform reporting form
for veterinarians, and (3) a uniform reporting form for state regulatory officials which is to be sent to the national reporting agency.

The basic list of reportable diseases is as follows:

**To be reported immediately by telephone or telegraph**

- Contagious pleuropneumonia, foot and mouth disease, fowl pest, rabies, rinderpest, scabies, Texas fever, vesicular exanthema, and vesicular stomatitis.

**To be reported on a prescribed form each week, including those listed above**

- Anaplasmosis, anthrax, atrophic rhinitis, blackleg, bovine bacillary hemoglobinuria, coccidiosis, contagious ecthyma, dourine, equine encephalomyelitis, glanders, hog cholera, hyperkeratosis, infectious equine anemia, Johne’s disease, leptospirosis, listeriosis, malignant catarrhal fever, psittacosis, swine erysipelas, trichomoniasis, tularemia, and vibriosis.

You will note that brucellosis and tuberculosis are omitted from this list. The reason being that they were usually and legally reported in a different manner.

This basic list was selected from a composite list of reportable diseases from various states. All contagious and communicable diseases of animals should be reported and those regulatory officials interested in parasitic and metabolic diseases may add them to the basic list if they so desire. As time goes on and the need arises, more diseases could be added to the basic list of the national report. However, those diseases here mentioned should not be deleted even if they have never been recognized in a particular state.

Our committee agreed that for convenience a double postal card would best serve as the reporting form to be used by veterinarians. One-half of the postal card contains the list of reportable diseases and the other half is the report which is to be filled in and returned to the state regulatory official. We have endeavored to keep this as simple as possible so veterinarians will not be burdened with a complicated form. The state regulatory officer is to send this reporting form each week to the veterinarian who, in turn, is to fill it in and return it immediately to the state regulatory officer.

**Local Reporting Form**

First half of double postal card:

*(IDAHO) STATE DEPARTMENT OF AGRICULTURE DIVISION OF ANIMAL INDUSTRY (ADDRESS)*

*Report immediately by telephone or wire* the occurrence or suspected occurrence of any of the following diseases and also include them on this report:
- Contagious pleuropneumonia, foot-and-mouth disease, fowl pest, rabies, rinderpest, scabies, Texas fever, vesicular exanthema, and vesicular stomatitis.

*Report weekly* on the occurrence of these diseases:
- Anaplasmosis, anthrax, atrophic rhinitis, blackleg, bovine bacillary hemoglobinuria, coccidiosis, contagious ecthyma, dourine, equine encephalomyelitis, glanders, hog cholera, hyperkeratosis, infectious equine anemia, Johne’s disease, leptospirosis, listeriosis, malignant catarrhal fever, psittacosis, swine erysipelas, trichomoniasis, tularemia, and vibriosis.
The veterinarian's name and address appear on the reverse side of this card.

Second half of double postal card:

**ANIMAL DISEASE REPORT—Week Ending** 19

<table>
<thead>
<tr>
<th>DISEASE</th>
<th>SPECIES</th>
<th>COUNTY</th>
<th>NO. OF PLACES</th>
<th>TOTAL ANIMALS</th>
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</table>

Veterinarian Address

The state regulatory official's address appears on the reverse side of this card.

The composite report of the state regulatory officer is to contain all information submitted by the veterinarians, with the exception of the county in which the disease occurred. This report is to be submitted to the national reporting agency as near the first of every month as possible. Diseases which veterinarians reported immediately by telephone or telegraph to the state regulatory officer should also be reported to the national reporting agency by the state regulatory officer, with the possible exception of rabies in states where the disease is extremely prevalent. The state regulatory officer should also include in his monthly report those diseases which he reported by telephone or telegraph.

The reason for telephoning or telegraphing the occurrence of some diseases to the national reporting agency is so that other regulatory officers may be notified immediately and thereby hasten the control of these diseases. The rapid transit of livestock is an excellent means of quickly scattering diseases into several states, as was so clearly demonstrated in the recent vesicular exanthema outbreak.

Another very essential feature of this plan is that all veterinarians who cooperate in supplying morbidity and mortality information will receive each month a copy of the summarized data from their state regulatory officer.

This committee agrees that the secretary of the United States Livestock Sanitary Association can be of valuable assistance to the United States Bureau of Animal Industry and state regulatory officials in the prompt establishment of this proposed plan for gathering useful livestock morbidity and mortality data. It agrees that the secretary is an excellent person to assemble the national report. The reports submitted by him a few months ago on the prevalence of anthrax and vesicular exanthema are shining examples of what he could do for a national reporting
**State Reporting Form**

(IDAHO) STATE DEPARTMENT OF AGRICULTURE DIVISION OF ANIMAL INDUSTRY

ADDRESS

VETERINARY MORBIDITY AND MORTALITY REPORT

Month of ________________ 19__

<table>
<thead>
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<th>DISEASE</th>
<th>SPECIES</th>
<th>NO. OF PLACES</th>
<th>TOT. ANIMALS ON PREMISES</th>
<th>NUMBER OF ANIMALS</th>
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<td></td>
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<td>Morbidity  Mortality</td>
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</table>
system. With this end in view, we recommend that the United States Livestock Sanitary Association accept the United States Bureau of Animal Industry or the Secretary of the United States Livestock Sanitary Association as the national reporting agency. This committee also stands ready to furnish any helpful service required.

The principal duties of the national reporting officer will be to compile the reports from state regulatory officials, distribute a composite report to the state regulatory officials, the Chief of the United States Bureau of Animal Industry and such other parties as he deems advisable, and issue bulletins on the occurrence of diseases reported to him by telephone or telegraph.

It is the unanimous thought that whatever system is finally adopted it should be kept simple and workable yet sufficiently informative to be of public value and usefulness.

No vast appropriation increases are being sought. Economy operation in line with rendered service is foremost in the minds of the Committee members. It is believed that in most states these morbidity and mortality statistics can be assembled, summarized, and reported under present budgets by existing personnel. This may also be true at the national level. No new bureau is being advocated. Existing agencies, both state and national, should be able to assume this extra assignment, we believe, without undue stress or impairment of the services now being performed.

This committee urges that all state regulatory officials make plans at once to explain the proposed program to veterinarians and veterinary groups in their respective states and endeavor to secure the practitioners' wholehearted support and cooperation. This accomplished, and with reporting forms printed and ready for mailing the latter part of December, we shall have a national morbidity and mortality reporting system under way, beginning with the month of January 1953.
REPORT OF THE COMMITTEE ON RESOLUTIONS

H. F. WILKINS, Helena, Montana, Chairman; J. S. BARBER, Providence, Rhode Island; J. S. CAMPBELL, Little Rock, Arkansas; G. H. GOOD, Cheyenne, Wyoming; D. H. RICKS, Oklahoma City, Oklahoma; M. N. RIEMENSCHNEIDER, Denver, Colorado.

Resolved by the United States Livestock Sanitary Association in its 56th Annual Meeting Assembled in Louisville, Kentucky, October 29, 1952:

1. That we extend our thanks to the management and employees of the Hotel Seelbach for the good service rendered our Association throughout this meeting and our appreciation of the many courtesies shown our members, all of which has contributed much to the pleasure of attendance.

2. That we commend our fellow members, Dr. E. L. Breeck and Dr. T. J. Stearns, for the excellent local arrangements made for this meeting, the entertainment of the ladies, and the many kindesses and demonstrations of true southern hospitality.

3. That we particularly extend our thanks and appreciation to the Jefferson County Kentucky Veterinary Medical Association for their assistance to Dr. Breeck for making possible the delightful party given the Chief Livestock Sanitary Officials of the various states and others.

4. That the Association extend our thanks and appreciation to the Louisville Chamber of Commerce for the invaluable aid and assistance given in carrying out the registration program and for the many other courtesies and considerations.

5. That the members of the United States Livestock Sanitary Association express their appreciation to Churchill Downs, Inc. for their generosity and also for their thoughtfulness in remembering the membership in the sixth race on October 29th.

6. That the U. S. Livestock Sanitary Association convey its sincere thanks and appreciation to each speaker on the program, and to each member of the several committees, for their services in the preparation and presentation of the program of the Association.

7. That our secretary, Dr. R. A. Hendershott, be especially thanked and commended for his excellent and untiring efforts in behalf of the Association, his effective liaison with public health and other interested groups, and for the transmission of vital information to the Chief Livestock Sanitary officials during this trying year in the prevention, control, and eradication of destructive livestock diseases.

RESOLUTION RE VESICULAR EXANTHEMA AND GARBAGE

WHEREAS, the disease known as vesicular exanthema of swine, which has existed in the State of California since 1932, has recently escaped from the confines of that state to at least 25 other states; and

WHEREAS, the spread of the disease into the swine herds of many of the states is a threat to the swine industry of the nation; and

WHEREAS, two vigorous attempts at eradication by full employment of the slaughter method in California were apparently unsuccessful; and

WHEREAS, subsequent outbreaks of the disease in California were dealt with by
rigid quarantines and restrictive shipping regulations, which also apparently failed of success; and

WHEREAS, it is believed by all veterinary authorities informed on the subject that raw garbage is one of the main sources of vesicular exanthema of swine and it is known to carry foot-and-mouth disease, hog cholera, trichinosis and other viral, bacterial and parasitic diseases; and

WHEREAS, it is apparent from the California experience with the disease that the slaughter method alone, unimplemented by vigorous and positive attack on the source of the disease will fail; and

WHEREAS, it appears evident that if the constituted authorities expect to prevent the disease from becoming established in the United States and if the swine raisers of the nation desire to free their droves from the ravages of vesicular exanthema, and the hazard of foot-and-mouth and other viral, bacterial and parasitic disease; therefore be it

Resolved, that the United States Livestock Sanitary Association go on record as condemning the commercial feeding of raw garbage to swine, and as urging all of the states to require by law that all garbage fed to swine be cooked or processed under adequate regulation and supervision as an alternative to its discontinuance as a feed for livestock; and be it

Further resolved, by the United States Livestock Sanitary Association that it is recommended to the Secretary of Agriculture and the Bureau of Animal Industry that consideration be given to the promulgation of regulations designed to prevent the interstate movement of garbage intended as a food for livestock (unless the same is sterilized in a manner prescribed by the U. S. Bureau of Animal Industry or the U. S. Public Health Service and authorization is first received in writing from the state in which said garbage is to be fed authorizing importation and processing) and be it

Further Resolved, that the inter and intrastate movement of garbage be prohibited except under certain specified conditions as:

1. a. For sanitary land fill operations or incineration by specific permit only, in order to prevent ordinary dumping wherein vectors may spread disease by mechanical or carrier-state means.

b. For manufacture into fertilizer, but only where the process is shown to be effective in killing the viruses of foot and mouth, vesicular exanthema and agents of other diseases and the plant is licensed.

c. For movement to licensed centralizing cooking vats where adequate mechanical recording controls may be maintained. The raw garbage shall not be transported to these plants in the same trucks which pick up the cooked material for distribution to the individual hog farm, unless complete sterilization can be obtained of the truck, including attention to the personnel and equipment.

And be it further resolved that:

2. Prohibit the interstate movement of hogs fed raw garbage. Require certificates from official agency of state of origin certifying to the fact that the animals were not fed raw garbage.

3. Prohibit the slaughter in any Federal Meat Inspection establishment of hogs which are not accompanied by a certificate indicating that they have not been fed
raw garbage. Except:
   a. hogs may be slaughtered in specified plants where all meat will be processed and bones removed and tanked. This should be done only in specified plants.
4. Prohibit on an intrastate basis essentials of items 1, 2, and 3 above.

RESOLUTION RE: SCRAPIE

WHEREAS, the disease of sheep and goats known as scrapie has just been diagnosed for the first time in the United States, and
WHEREAS, this new disease causes a fatal neurosis of sheep and goats, and
WHEREAS, if it is not immediately eradicated, will spread and cause irreparable damage to the sheep and goat industries of the United States, and
WHEREAS, this disease, because of its unusually long incubation period, presents a problem not comparable with any other disease of livestock, and does not lend itself to quarantine or other methods of control, and
WHEREAS, there is no known cure for scrapie,
Therefore be it resolved that the United States Livestock Sanitary Association go on record in the interest of protection of the sheep and goat industries, by urging the Secretary of the United States Department of Agriculture to agree with our request to enter into an immediate cooperative arrangement to share with California, or any other state, the cost involved in the eradication of scrapie.
It is further resolved that information regarding this disease in California be forthwith transmitted to all states and to the National Wool Growers Association.

In accord with the request of the Executive Committee of the United States Livestock Sanitary Association as expressed in executive session in Louisville, Ky. at 6 P. M. on Wednesday, October 29, 1952 the following telegram was sent to Honorable Charles P. Brannan, Secretary of the United States Department of Agriculture.

"It is our unanimous opinion that Scrapie, a virus disease of sheep which has just been diagnosed for the first time in the United States is a threat to the livestock industry. It would be economically unwise and ultimately prove to be extremely costly if the disease is permitted to become established among the sheep in this nation. Therefore, in the interest of protecting the sheep industry, it is our sincere hope and we strongly urge you will agree to our urgent request to enter into immediate cooperative arrangement in the cost involved in the eradication of scrapie. We are prompted to make this plea to you as the Executive Committee of the United States Livestock Sanitary Association, because of the unusually long incubation period involved in the disease presenting a problem not comparable with any other disease of livestock and not lending itself to inspection and quarantine methods, and the fact that there is no known treatment, immediate action is necessary."

Following receipt of our telegram, the Secretary of Agriculture, Honorable Charles P. Brannan issued the following order on October 31, 1952.

"Secretary of Agriculture Charles P. Brannan today proclaimed a state of emergency arising from the existence of a disease of sheep known as "scrapie", now existing in California. This emergency proclamation will permit the United States Department of Agriculture to take aggressive measures in cooperation with
state authorities directed toward the eradication of the disease, including indemnity payments for diseased animals that must be destroyed. Details of the program will be announced as soon as they are completed.

"Scrapie", an infectious virus disease, has caused serious losses in the British Isles for many years. Canada and Australia have slaughtered all infected and exposed sheep in apparently successful campaigns to eradicate the disease. It was first diagnosed in Canada in 1945, appearing again in July 1951 and in August 1952. The disease is chronic and has a long incubation period. It spreads slowly among affected flocks but finally becomes very destructive. No successful treatment has yet been found.

In expressing to Secretary Brannan the opinion of the United States Livestock Sanitary Association, Dr. R. A. Hendershott, secretary and treasurer of the Association said, "It would be economically unwise and ultimately prove to be extremely costly if this disease is permitted to become established among the sheep of this nation. Therefore, in the interest of protecting the sheep industry, it is our sincere hope and we strongly urge you will agree to our urgent request to enter into immediate cooperative arrangements in the eradication of scrapie. We are prompted to make this plea... because of the unusually long incubation period involved in this disease presenting a problem not comparable with any other disease of livestock and not lending itself to inspection and quarantine methods and the fact that there is no known treatment."
REPORT OF THE COMMITTEE ON RABIES

L. E. Starr, Atlanta, Georgia, Chairman; T. O. Brandenburg, Bismarck, North Dakota; A. L. Brueckner, College Park, Maryland; H. R. Cox, Pearl River, New York; R. A. Mays, Columbia, South Carolina; H. A. Milo, Harrisburg, Pennsylvania; H. W. Schoening, Washington, D. C.; E. S. Tierkel, Atlanta, Georgia; R. R. Younce, Salem, Oregon

The rabies situation with respect to the variety of species of animals involved, the number of human cases, and geographical distribution is, on the whole, unchanged from that of 1951.

Dog rabies appears to be on the decline because these animals are in the vast majority domesticated, therefore, under control and subject to immunization. Adequate immunization, 70 to 80 per cent, plus control or destruction of non-immunized dogs will prevent a serious outbreak in these animals within the controlled area. To be effective immunization must be maintained constantly over wide areas. Considering the number of owners involved and the large dog population, this is a very difficult problem. According to a dog census in a number of rural counties in Georgia, the ratio of the dog and human population is 1 to 4 plus, respectively. The necessity for annual immunization is a very decided deterrent to the maintenance of an adequate reservoir of immune animals.

Rabies in wild animals, particularly the fox in most of the area east of the Mississippi River, in Texas and southern California, and the skunk in a wide belt extending from Texas to the Canadian border, is even more serious than in dogs. These animals are wild; therefore, not subject to control or immunization. They are predatory and by nature of their tooth structure are capable of inflicting serious flesh wounds. Once rabies becomes established in wildlife, the only known method of control or eradication is by thinning the host population to the extent that animal to animal contact is minimized.

Wherever the infection is prevalent in wildlife, the incidence of rabies in domestic animals, particularly cattle, horses, mules, and hogs is usually high. A notable example of this is the recent experience in Pennsylvania. In 1951, 91 cattle and 108 foxes died of rabies; in 1952 through October 75 cattle and 131 foxes. Death of cattle with rabies in infected areas constitutes a serious menace to the agricultural economy. Since domestic animals acquire the infection entirely as the result of exposure by wild animals and dogs, it can only be prevented by controlling the disease in these animals by destruction, by immunization, or by both. Controlled experimental studies are in progress in Georgia to determine the safety and immunizing properties of chick embryo live virus vaccine in cattle.

Vampire bat rabies is a serious problem both to animals and man in Mexico and Central America. It is progressing north and is now in the state of Chihuahua, about 100 miles south of the United States border. If conditions are favorable for propagation of the vampire bat in southern and southwestern United States, we may reasonably expect invasion by these animals.

Live virus antirabic vaccine of chick embryo origin has been granted a regular
license by the United States Bureau of Animal Industry. Extensive field trials involving approximately 3,400 cattle in vampire bat territory in Honduras indicate that the product is safe to use in cattle and that it offers satisfactory protection against rabies. Controlled field trial studies have been conducted in Georgia and New York with a limited number of cattle, approximately 600 head, and 500 head in New York.

Approximately 70,000 dogs have been immunized in Georgia with avianized live virus antirabic vaccine since May 1949. Almost all have been in areas in which rabies has been endemic in dogs and foxes for many years. Except for 10 or 12 individual dogs, none of these animals has been reimmunized to date. There have been seven confirmed cases of rabies in the immunized dogs, six of which had been immunized annually at least twice with killed virus vaccine. Many other states, notably New York and Virginia, are using this product quite extensively. Mass immunization programs have been put on in 20 counties in Georgia with live virus vaccine. All these counties are in an endemic area. In most of them 70 per cent or more of the total dogs have been immunized.

Controlled experimental studies indicate that the live virus vaccine confers a satisfactory immunity in dogs for at least two years and probably longer.

There are no new developments of importance with respect to killed virus antirabic vaccines. Annual immunization is recommended whenever a killed virus vaccine is used.

Postexposure immunization, so-called Pasteur treatment, is commonly practiced in man, dogs, cattle, and occasionally in cats in areas in which rabies is prevalent.

In most instances killed virus vaccine is used, but of late the live virus product
is being quite widely employed. Limited controlled experimental data indicate that postexposure immunization is of questionable value except when hyperimmune serum and vaccine is used. Even then, serum must be administered within 48 hours following exposure. A period of about 20 days must elapse before protective antibodies are formed in amounts adequate to provide reasonable protection. Hyperimmune serum bridges this gap by providing immediate protection for 10 to 15 days duration. Unfortunately, hyperimmune serum is not available commercially but is limited to experimental study in man. The Georgia Department of Public Health has treated 58 human patients and six dogs prophylactically with serum and vaccine with no fatalities. Serum has been issued for six additional human cases on whom the records are not complete. This method has been used to a limited extent by other state health departments.

There are a number of problems which have not been solved.

The Committee recommends: That further controlled experiments be conducted to determine the minimum age at which dogs should be immunized; the efficacy of immunization of cattle; the efficacy of postexposure treatment; comparative studies on the efficacy of the various types of antirabic vaccines, and the duration of immunity induced.

That studies be continued to determine the most effective methods of control of rabies in wild animals, particularly foxes and skunks.

That indemnity be paid for cases of domestic animals that die of rabies when confirmed by laboratory diagnosis.

That all the states make intensive efforts toward eventual eradication of rabies.

That this association through its legislative committee make every reasonable effort to secure the passage by Congress of a Bill adopted by this association in 1951 to enable the United States Bureau of Animal Industry to engage in rabies control as it pertains to all animals.

INCIDENCE OF RABIES IN THE UNITED STATES
CALENDAR YEAR 1951

Statistics on the number of cases of rabies in the United States in the calendar year 1951 have been collected by the Bureau of Animal Industry of the U. S. Department of Agriculture.

There were 8,022 cases reported. There were 5,194 cases in dogs, 821 in cattle, 34 in horses, 35 in sheep, 53 in swine, 480 in cats, 4 in goats, 1,387 miscellaneous, and 14 in man.

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

Table 1 gives the number of cases reported in each State by species.

The map on page 325 shows the distribution of the cases by States.

1 Data received from Alaska, Hawaii, and Puerto Rico are given on page 3.
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<th>STATE</th>
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<td>9</td>
<td>1 Fox</td>
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<td>3</td>
<td>— Fox</td>
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<tr>
<td>California</td>
<td>33</td>
<td>—</td>
<td>—</td>
<td>5</td>
<td>— Coyote 1</td>
</tr>
<tr>
<td>Colorado</td>
<td>3</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>— Species* 12</td>
</tr>
<tr>
<td>Connecticut</td>
<td>—</td>
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<tr>
<td>Delaware</td>
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<td>58</td>
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<td>1</td>
<td>— Species* 148</td>
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<tr>
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<td>32</td>
<td>— Various</td>
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<td>2</td>
<td>— Species* 24</td>
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<tr>
<td>New Hampshire</td>
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<tr>
<td>New Jersey</td>
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</tr>
</tbody>
</table>

**TABLE 1**

Rabies in the United States by States during the year 1951

**STATE** | **MISS.** | **HORSES** | **SHEEP** | **CATTLE** | **MAN** | **TOTAL**
---|---|---|---|---|---|---
Alabama | 263 | 17 | 1 | 2 | 9 | 1 | Fox | 63 | 2 | 358
Arizona | 12 | — | — | — | — | 1 | — | Coyote | 1 | 14
Arkansas | 141 | 12 | — | — | 3 | — | Fox | 8 | — | 166
California | 33 | 4 | — | — | 5 | — | Various | Species* | 12 | 54
Colorado | 3 | — | — | — | 2 | — | — | — | 5 | 0
Connecticut | — | — | — | — | — | — | — | — | 0 | 0
Delaware | — | — | — | — | — | — | — | — | 0 | 0
District of | — | — | — | — | — | — | — | — | 0 | 0
Columbia | — | — | — | — | — | — | — | — | 0 | 0
Florida | 37 | 5 | 4 | 6 | 2 | — | Fox | 3 | — | 0
Georgia | 224 | 35 | — | 1 | 13 | — | Raccoon | 8 | 66 | 333
Idaho | — | — | — | — | — | — | — | — | 0 | 0
Illinois | 127 | 20 | 1 | 1 | 22 | — | Various | Species* | 18 | 189
Indiana | 427 | 20 | 3 | 6 | 21 | — | Fox | — | 0 | 493
Iowa | 165 | 84 | 2 | 3 | 14 | 20 | Various | Species* | 122 | 411
Kansas | 8 | — | — | — | 3 | — | Skunks | 2 | 14 | 41
Kentucky | 434 | 58 | 3 | 2 | 43 | — | Skunk | 1 | 583
Louisiana | 239 | 2 | — | — | 12 | — | Fox | 1 | 1 | 255
Maine | — | — | — | — | — | — | — | — | 0 | 0
Maryland | 1 | — | — | — | — | — | — | — | 0 | 0
Massachusetts | — | — | — | — | — | — | — | — | 0 | 0
Michigan | 95 | 9 | 1 | — | 18 | — | Skunks | 5 | 128
Minnesota | 34 | 37 | 2 | 1 | 6 | 18 | — | Various | Species* | 148 | 246
Mississippi | 145 | 8 | — | — | 4 | 1 | 1 | Fox | 7 | 166
Missouri | 440 | 11 | — | — | 32 | — | Various | Species* | 24 | 508
Montana | 11 | — | — | — | 2 | — | — | — | 13 | 43
Nebraska | 15 | 3 | — | — | 16 | — | Skunk | 8 | — | 0
Nevada | — | — | — | — | — | — | — | — | 0 | 0
New Hampshire | — | — | — | — | — | — | — | — | 0 | 0
New Jersey | — | — | — | — | — | — | — | — | 0 | 0
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<tr>
<th>STATE</th>
<th>DOGS</th>
<th>CATS</th>
<th>HORSES</th>
<th>SHEEP</th>
<th>SHEE</th>
<th>CATS</th>
<th>GOATS</th>
<th>MISCELLANEOUS</th>
<th>MAN</th>
<th>TOTAL</th>
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<td>New Mexico</td>
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<td>—</td>
<td>—</td>
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<td>—</td>
<td>—</td>
<td>Racoon 20</td>
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<td>214</td>
<td>3</td>
<td>13</td>
<td>3</td>
<td>51</td>
<td>—</td>
<td>Skunk 3</td>
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<td>539</td>
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<td>New York City</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Fox 183</td>
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<td>—</td>
<td>—</td>
<td>10</td>
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<td>5</td>
<td>2</td>
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<td>Various Species* 31</td>
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<td>—</td>
<td>—</td>
<td>—</td>
<td>4</td>
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<td>Civet cat 1</td>
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<td>Oregon</td>
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<td>—</td>
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<td>18</td>
<td>91</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>—</td>
<td>Various Species* 114</td>
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<td>Rhode Island</td>
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<td>1</td>
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<td>Skunk 48</td>
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<td>2</td>
<td>13</td>
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<td>—</td>
<td>Badger 2</td>
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<td>1</td>
<td>15</td>
<td>—</td>
<td>Fox 31</td>
<td>Skunk 1</td>
<td>—</td>
<td>369</td>
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<td>Texas</td>
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<td>51</td>
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<td>1</td>
<td>18</td>
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<td>—</td>
<td>—</td>
<td>Rabbit 1</td>
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<td>2</td>
<td>—</td>
<td>Rat 1</td>
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<td>West Virginia</td>
<td>144</td>
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<td>—</td>
<td>6</td>
<td>—</td>
<td>Fox 5</td>
<td>Opossum 1</td>
<td>—</td>
<td>158</td>
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<td>Wisconsin</td>
<td>11</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>—</td>
<td>Fox 1</td>
<td>Skunk 13</td>
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<td>—</td>
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<td>—</td>
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<td>Squirrel 1</td>
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<td><strong>Total</strong></td>
<td>5,194</td>
<td>821</td>
<td>34</td>
<td>35</td>
<td>53</td>
<td>480</td>
<td>4</td>
<td>1,387</td>
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* Includes skunks, raccoons, oxen, muskrats, gophers, rats, mice, beaver, weasels, wildcats, foxes, groundhogs, squirrels, mink, badgers, opossums, wolves, civet cats, woodchucks.

1 Mule

Alaska reports 3 dogs.

Hawaii reports that rabies has never occurred in the Territory.

Puerto Rico reports 10 dogs, 12 cattle, 5 horses, 2 swine, 3 goats, and 41 mongooses.
NOMINATION AND ELECTION OF OFFICERS

THE REPORT OF THE NOMINATING COMMITTEE

DR. R. W. SMITH, New Hampshire; T. B. CLOWER, Georgia; G. H. GOOD, Wyoming

DR. SMITH: Mr. President, your Nominating Committee, composed of Dr. Good, Dr. Clower and myself, have entertained the suggestions of any members who might wish to contact us since we were appointed, and we wish to place in nomination for President Dr. T. Childs, of Toronto, Canada.

First Vice President, T. C. Green, Charleston, West Virginia.
Second Vice President, I. G. Howe, New York.
Third Vice President, H. F. Wilkins, Montana.

PRESIDENT WEST: Thank you, Dr. Smith. Are there any nominations from the floor for President of this Association? If not, a motion that nominations for President be closed is in order.

DR. SMITH: I so move, Mr. President, and I move also that the Secretary cast one vote, which shall be the vote of the assembly, for Dr. T. Childs of Toronto, Canada, as President of this Association for the ensuing year.

[The motion was severally seconded, was put to a vote, and was carried unanimously.]

PRESIDENT WEST: Dr. Childs is elected.

SECRETARY HENDERSHOTT: It is my pleasure, as instructed by you, to cast the unanimous ballot of this Association for Dr. T. Childs for the office of President for the ensuing year.

PRESIDENT WEST: Are there any other nominations from the floor for First Vice President?

DR. SMITH: If there are no further nominations, Mr. President, I move that nominations be closed and that the Secretary cast one ballot, which shall be the unanimous vote of the convention, for T. C. Green as First Vice President.

[The motion was severally seconded, was put to a vote, and was carried unanimously.]

SECRETARY HENDERSHOTT: As instructed by you, I hereby cast the unanimous ballot of the Association for Dr. T. C. Green as First Vice President for the ensuing year.

PRESIDENT WEST: Are there any other nominations from the floor for the office of Second Vice President?

DR. SMITH: If there are no further nominations, sir, I would move that the nominations be closed, and that the Secretary cast one ballot, which shall be the unanimous ballot of the Association, for I. G. Howe of Albany, New York, as Second Vice President for the ensuing year.

[The motion was severally seconded, was put to a vote, and was carried unanimously.]

SECRETARY HENDERSHOTT: Again as directed by the assembly, I herewith cast the ballot of the Association for Dr. I. G. Howe of Albany, New York, as Second Vice President of the Association for the ensuing year.
PRESIDENT WEST: Are there any other nominations from the floor for Third Vice President?

DR. SMITH: If there are no further nominations, I would move that nominations be closed, and that Dr. H. F. Wilkins of Montana be elected unanimously as Third Vice President of the Association.

[The motion was severally seconded, was put to a vote, and was carried unanimously.]

SECRETARY HENDERSHOTT: As instructed by you, it is a pleasure for me to cast the unanimous ballot of this Association for Dr. H. F. Wilkins of Helena, Montana, as Third Vice President for the ensuing year.

PRESIDENT WEST: I would like to announce, if it is not common knowledge, that the Executive Committee elected our worthy Secretary, Dr. R. A. Hendershott, for another term of one year, if he can stand it that long.
INSTALLATION OF OFFICERS

PRESIDENT. R. L. WEST: We will now install the incoming officers. I will ask Dr. Hall and Dr. Kuttler to escort our incoming President to the rostrum.

Is Dr. Green in the room? Dr. Anderson, will you please escort Dr. Green to the rostrum.

Dr. Howe is not here. I have been informed that Dr. Wilkins is not able to come up alone, so I will send our Secretary to bring him up. [Laughter]

I would like to announce at this time that Dr. Howe, one of our very faithful and hard-working members, has been seriously ill. He is now recovering very satisfactorily, it is reported, and we have every hope that he will be with us a year from now and capable of taking up the duties of the Second Vice President.

Dr. Childs, it is with great pleasure that I herewith turn over to you the office of President of this Association. I don’t have a gavel to give you, but the best thing I can give you is the wish that you will have as pleasant an administration as I have had. Congratulations. [Applause]

Dr. Green, at the request of President Childs I will also install you as First Vice President. I know that you are deserving of it. We have been associated together for many years, and I know that this Association could have picked no finer man to hold the office of First Vice President. [Applause]

Dr. Wilkins, as Third Vice President, what I have just said to Dr. Green applies to you, too. I am very, very pleased at your election, and I congratulate you. [Applause]

[Dr. T. Childs assumed the presidency.]

PRESIDENT CHILDS: I am very appreciative of the honor you have conferred upon me. It was altogether unexpected. I know I will have a very difficult road to travel to measure up to the performance of my predecessor, but I can assure you that I will do my best.

I will do the best I can to bring about uniformity if such does not exist, and I believe it does, in that prevention, control and eradication of animal diseases may be carried on. In these matters we have had some success in our country to the north. I know that in any work of that nature which will be beneficial to the livestock industry of the North American continent, I will receive the full support of my government and my department, and I will do the best I possibly can.

Thank you. [Applause]

Dr. T. C. GREEN: Mr. President and Gentlemen of the Association: I hardly have words to express my appreciation for this honor. To me this is the first step toward an honor that I have looked forward to for a great many years. If I am successful in attaining the final goal, I shall consider it the greatest honor of my lifetime.

It has always been a pleasure to me to meet and work with this group. I have regarded it as one of the most important groups of its kind in the world, and I like to be with this kind of organization. I assure you that when my time comes, if it falls my lot to render you a service, I will do so to the best of my ability.

Thank you. [Applause]
DR. H. F. WILKINS: I, too, feel highly honored to think that I might be looked upon as a potential President of this Association. I can't conceive of any honor coming to any regulatory official which would be greater than that of President of this great Association.

Thank you. [Applause]

R. A. HENDERSHOTT: Gentlemen before we adjourn I wish to report that the executive committee voted to continue consideration of the study of proposed amendments to the constitution presented at the 1951 meeting in Kansas City.

DR. R. W. SMITH: Mr. President, if there is no further business, I move that the assembly adjourn.

[The meeting adjourned sine die at 1 p.m.]
CONSTITUTION AND BY-LAWS
OF THE
UNITED STATES LIVESTOCK SANITARY ASSOCIATION

ARTICLE I—NAME
The name of this Association shall be "The United States Livestock Sanitary Association."

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

ARTICLE III—MEMBERSHIP
There shall be two kinds of members—Official and Individual. The livestock sanitary departments of each state also the United States, and the Canadian, Cuban and Mexican governments, The Territories, Puerto Rico and the Virgin Islands shall be eligible to official membership in this Association and be represented on the Executive Committee by the livestock sanitary executive official. Any person engaged in livestock sanitary work for federal, provincial, state, territorial, county or municipal governments and any other person interested in livestock sanitation or milk and meat hygiene may be elected to individual membership.

ARTICLE IV—MEETINGS
The meetings of this Association shall be annual and special.

ARTICLE V—OFFICERS
The officers of this Association shall be: President, First Vice-President, Second Vice-President, Third Vice-President, Secretary-Treasurer, and an Executive Committee. The officers of this Association shall hold office for one year or until their successors have been duly elected and qualified.

EXECUTIVE COMMITTEE
The Executive Committee shall be composed of the executive officer representing the livestock sanitary departments of the various States and Territories, the Chief
of the United States Bureau of Animal Industry, the Veterinary Director General
of Canada, the executive regulatory officer of Cuba and Mexico, The Territories,
Puerto Rico and the Virgin Islands, and the elective officers of this Association.

The Executive Committee shall constitute the administrative body of this Asso-
ciation and shall determine its activities and policies.

All recommendations and reports of officers and committees shall be referred for
consideration to the Executive Committee.

The First Vice-President shall be ex-officio chairman of the Executive Committee.

The Executive Committee shall elect yearly a Secretary-Treasurer for the Asso-
ciation. The Secretary-Treasurer shall receive such salary and allowance as may be
fixed by the Executive Committee.

The Executive Committee shall cause to be audited annually or oftener if deemed
necessary, the receipts and disbursements of the Secretary-Treasurer, and shall
have authority to hear and determine all complaints filed before it in writing rela-
tive to the conduct of any member; and shall have authority to accept or reject
applications for individual membership properly placed before them. Three nega-
tive votes shall disqualify for such membership.

ARTICLE VI—PROGRAM COMMITTEE

The President, the Chairman of the Executive Committee and the Secretary-
Treasurer and the Chairman of the respective committees shall constitute the Pro-
gram Committee. It shall be the duty of the officers of the Program Committee to
make the necessary arrangements and provide the program for the annual and
special meetings.

ARTICLE VII—DUTIES OF OFFICERS

1. President: It shall be the duty of the president to preside at all meetings of
this Association; to appoint all committees excepting the Executive and Officer
Fraction of the Program Committees; to call special meetings of the Association
whenever he considers the holding of such meetings necessary for the good of the
livestock industry or upon the written request of five members of the Executive
Committee. The president shall be an ex-officio member of all committees.

2. First Vice-President: The first vice-president shall be chairman of the Execu-
tive Committee. In the absence of the president, he shall preside at the meetings of
the Association. In the event of the absence, disability or resignation of the presi-
dent he shall perform all duties of the president. He shall be an ex-officio member
of the Executive and Program Committees.

3. Second Vice-President: The second vice-president shall assume the duties of
the president in the event of the absence, disability or resignation of the president
and first vice-president. He shall assume the chairmanship of the Executive Com-
mitee in the event of the absence, disability or resignation of the first vice-president.

He shall be an ex-officio member of the Executive Committee.

4. Third Vice-President: The third vice-president shall assume the duties of the
president in the event of the absence, disability or resignation of the president, first
vice-president and second vice-president. He shall assume the chairmanship of the
Executive Committee in the event of the absence, disability or resignation of the
first and second vice-presidents. He shall be an ex-officio member of the Executive Committee.

5. Secretary-Treasurer: The Secretary-Treasurer shall keep an accurate record of the proceedings of the Association. Whenever authorized so to do by the Executive Committee he shall publish said proceedings and distribute them to the members of the Association. The Secretary-Treasurer shall also keep an accurate record of the proceedings of the Executive Committee and shall furnish a copy to each member of said Executive Committee. He shall forward to each Executive Committee member a copy of each regulation approved by the Association.

He shall keep an accurate account of all Association moneys received and disbursed. He shall also present to the Chairman of the Executive Committee a list giving the name, occupation and address of each applicant for individual membership for the approval of the Executive Committee. He shall perform such other duties as may be authorized and prescribed by the Executive Committee. He shall be ex-officio secretary of the Executive Committee, also an ex-officio member and secretary of the Program Committee. He shall be bonded for not less than ten thousand dollars.

ARTICLE VIII—Amendments
The constitution of this Association may be amended by a two-thirds vote of the members of the Association present and voting at an annual meeting, provided that the specific amendment to be acted upon shall have been presented in writing at a previous annual meeting and further provided that the amendment has received the approval of the Executive Committee.

BY-LAWS

ARTICLE I—Order of Business

Registration.
Call to Order.
Report of Secretary-Treasurer.
President's Address.
Reading of Papers.
Committee Reports.
Discussion.
Unfinished Business.
New Business.
Nomination and Election of Officers.
Adjournment.

A suspension of the By-laws may be made by a two-thirds majority for the purpose of changing the order of business or to facilitate important business.

ARTICLE II—Applications for Membership
Applications for individual membership shall be made in writing to the Secretary-Treasurer. The application shall give the name, occupation and address of the applicant and shall be accompanied by a fee of three dollars ($3.00), which amount
shall include the membership dues for one year. Applications shall be presented in proper form to the Secretary-Treasurer, who shall in turn submit them to the Executive Committee.

An individual member may be expelled for cause by the Executive Committee.

**ARTICLE III—Meetings**

The annual meetings shall unless otherwise determined not less than thirty (30) days in advance by a majority of the members of the Executive Committee, be held at Chicago, Illinois, during the time of the International Livestock Exposition. The place for holding the meetings in Chicago as well as the duration of said meetings shall be determined by the Officer Members of the Program Committee of the Association. The place for holding special meetings shall be determined by the President with due regard to the wishes of the members of the Executive Committee, the subject matter to be considered, accessibility, and the information to be obtained. The notice of time and place of holding a special meeting shall be mailed to the members at least thirty days prior to the date fixed for the special meeting.

**ARTICLE IV—Quorum**

Twenty-five members of the Association shall constitute a quorum. Five members of the Executive Committee shall constitute a quorum.

**ARTICLE V—Dues**

The dues for individual membership in this Association shall be three dollars ($3.00) per annum, payable in advance (on or before January 1st of each year) to the Secretary-Treasurer of the Association. The dues for official memberships shall be fifty dollars ($50.00) each per annum, payable in advance (on or before January 1st each year) to the Secretary-Treasurer of this Association.
ACTIVE MEMBERS, 1953

ALABAMA

Clark, Franklin A.
Cloyd, Grover D.
Cooper, George Wm.
Crawford, M. L.
Heath, M. K.
Hwang, Jen
Ingram, George
Lauderdale, B. N.
Leibold, A. A.
Milligan, John
Poitevint, C. H.
Sugg, R. S.
Taylor, Julian B.

Fulmor, James N.
Hage, Theodore, J.
Haims, Phil
Hart, George H.
Howarth, Jack A.
Hurt, L. M.
Hurt, Ross H.
Jasper, Donald E.
Kelly, Arthur L.
Lash, Elmer
Lindley, Dean C.
Ludwig, H. T.
McKay, Kenneth G.
Murphy, George H.
Pellissier, Frank L.
Railsback, Guy A.
Rosenwald, A. S.
Schaaf, Kermit
Schalm, O. W.
Schmerhorn, R. J.
Sheffield, E. F.
Sheldon, Jere W.
Tietze Jr., Albert L.
Traum, J.
Weeks, Hubert L.
Wicktor, C. E.
Wood, F. W.
Young, W. A.

ARIZONA

Beloat, John R.
Cowden, E. Ray
Davis, Houston
Dysart, Nat M.
Evans, J. C.
Francy, Robert E.
Jacobs, John M.
Lightle, W. T.
Mariassy, Bella
McFadden, Arden
Micuda, John
Mikkelsen, C. E.
Mikkelsen, V.
Miller, Cecil H.
Miller, Donald
Spurlock & Wetzler Livestock Co.

ARKANSAS

Franks, C. C.
John, Lewis L.
Wilkinson, Richard H.

CALIFORNIA

Balch, Roscoe K.
Bouton, Jay H.
Boynton, Wm. H.
Bunker, V. C.
California Cattlemen's Ass'n.
Cameron, Hugh S.
Casselberry, N. H.
Dunlap, Mary K.

CONNECTICUT

DELAWARE

Francis, David W.
Kakavas, James C.
Seeger, Karl C.
White, Howard J.
Woodhouse, Clarence A.

**DISTRICT OF COLUMBIA**

Brandly, Paul J.
Fladness, S. O.
Giltner, L. T.
Gooding, C. L.
Helvig, R. J.
Herl, O. E.
Kester, W. O.
Kuttler, A. K.
Lee, Aubrey M.
Lieberman, James
Lowe, Clifton D.
Martin, J. J.
McCallam, J. A.
Miller, Albert R.
Pier, B. C.
Ranney, A. F.
Schneider, M. D.
Schoening, H. W.
Schwartz, Benjamin
Shahan, M. S.
Shalkop, Wm. T.
Simms, B. T.
Spindler, Lloyd A.
Tellejohn, A. L.
Wight, A. E.
Williams, James E.

**FLORIDA**

Acree, J. A.
Du Puis, John G., Jr.
Fish, James G.
Habecker, I. N.
Johnson, V. C.
Sanders, D. A.
Scatterday, James E.
Swanson, L. E.
Wilbur, Bert R.

**GEORGIA**

Arnandez, Jules L.
Bahnsen, Peter F.
Bateman, Osgood M.
Clower, T. B.
Cooperrider, Donald E.
Jones, Thomas J.
Kleckner, Albert L.
Langer, Peter H.
Mikel, C. J.
Mosher, L. A.
Robinson, Virgil B.
Scruggs, John H.
Sippel, Wm. L.
Starr, L. E.
Steene, James H.
Sutton, J. M.
Tierkel, Ernest S.

**IDAHO**

Blain, O. I.
Hill, Fred J.
Meyers, T. R.
Schneider, A. P.
Stucki, J. Wendell
Wallentine, Van Ness D.

**ILLINOIS**

Aitken, W. A.
Alberts, J. O.
Atalason, Allan C.
Beamer, Paul D.
Blye, C. E.
Boley, L. E.
Bott, A. E.
Brewer, N. R.
Bryan, H. S.
Butzow, Robert F.
Caldwell, Harry
Campbell, O. L.
Case, John P.
Cunkelman, J. W.
Curtis, Homer C.
Davenport, L. R.
Davison, A. H.
Delmore, John L.
Dunk, Milton R.
Dykstra, L. A.
Fredrickson, Luther E.
Fidler, C. E.
Fortenberry, J. D.
Ganey, David R.
Grace, Oliver D.
Graham, Robert
Hardenbergh, J. G.
Hayter, O. T.
Hensley, A. P.
The Holmes Serum Co.
Hostetler, Clarence B.
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<td>Davis &amp; Mannasmith</td>
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<td>Hubbard, Earl D.</td>
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Huff, T. B.
Iowa Farm Serum Co.
Jones, Guy S.
Jones, Lloyd D.
Killinger, Arden H.
Lee, C. D.
Merchant, I. A.
Molgard, P. C.
Munce, Thomas W.
Munger, Grant B.
Nicol, H. Stanley
Peterson, Fred W.
Plager, Wilbur L.
Salsbury, John G.
Salsbury, Joseph E.
Schwarte, L. H.
Smith, Lester R.
Torrey, J. P.

KANSAS

Barr, Herb J.
Boley, Ernest L.
Bower, Chas. W.
Curts, L. M.
Dykstra, R. R.
Pagan, Raymond
Foltz, Vernon D.
Gough, W. James
Harwood, N. D.
Kennedy, J. L.
Kushner, A.
Leasure, E. E.
Meeks, R. B.
Menges, Robert W.
Montgomery, Geo. A.
Pellette, Dudley B.
Robinson, W. G.
Roderick, Lee M.
Scott, Joseph P.
Twiehaus, Marvin J.

KENTUCKY

Bohannon, V. D.
Breeck, L. L.
Clark, Julius G.
Clarkson, S. Louis
Coshow, E. E.
Davis, Horace N.
Doll, E. R.
Eastin, Charles E.
Finlay, John W.

Fleming, H. F.
Forssee, W. T.
Glockner, William C.
Guard, Samuel R.
Hull, F. E.
Irwin, Walter G.
Lackey, Otho M.
Magner, James
McBride, L. L.
Nunn, J. Lindsay
Stearns, T. J.

LOUISIANA

Oglesby, W. T.
Saulmon, E. E.
Smith, Fred H.

MAINE

Buzzell, Francis G.
Houle, Germain
Witter, J. F.

MARYLAND

Barker, Howard C.
Brueckner, A. L.
Burns, Kenneth F.
Collins, J. H.
Cotton, Cornelia
Fish, Ralph C.
Grey, Charles G.
Habermann, Robt. T.
Hastings, J. Walter, Sr.
Heemstra, Louis C.
Hinshaw, W. R.
Hummon, O. J.
Johnson, Howard W.
Lowe, L. Robert
MacDonald, A. D.
Manthei, Chester A.
Mingle, C. K.
Peck, Arthur H.
Poelma, L. J.
Ramsberg, J. Homer
Snyder, Rudolph
Thorp, W. T. S.
Zwickey, R. E.

MASSACHUSETTS

Aldrich, E. M.
Hitchner, S. B.
Moore, Stevenson, Jr.
Thibeault, Cornelius
Van Roekel, Henry

MICHIGAN
Clark, C. F.
Cunningham, Charles H.
Dunne, Howard W.
Eads, F. E.
Higgins, W. A.
Lohman, Andrew G.
Newman, John P.
Reed, Glen W.
Schlingman, A. S.
Smith, C. B.
Sorenson, Oscar J., Jr.
Stafseth, H. J.
Van Tilborg, E. J.
Von Rosenberg, H. O.

MINNESOTA
Anderson, A. M.
Anderson, Robert J.
Bartlett, David E.
Beebe, W. L.
Braunworth, Elmer H.
Butler, Homer C.
Campbell, John N.
Driver, Fred C.
Failing, George S.
Fenstermacher, R.
Finson, James J.
Fisher, V. E.
Fitch, James A.
Gale, Charles
Griffiths, Henry J.
Kernkamp, Howard C. H.
Mather, George W.
Morgan, O. B.
Pomeroy, B. S.
Railback, Lee T.
Roepke, Martin H.
Sautter, Jay H.
Schlottauer, Carl F.
Spurrell, Francis A.
West, Ralph L.
Wilbur, John L., Jr.

MONTANA
Brawner, H. L.
Brewster, Lyman
Cronen, G. W.
Fisher, B. O.
Hadlow, W. J.
Iteaiba, Pete
Jasmin, A. M.
Joneschild, E. M.
Kilpatrick, J. W.
Marsh, Hadleigh
McNamara, Clifford J.
Miser, R. Robert J.
Myceksikays, Myroslaw

MISSOURI
Allied Laboratories Inc.
American Hereford Association
Anderes, Robert L.

Atkinson, Joe W.
Beckman, C. Herman
Brown, John William
Cahill, E. A., Jr.
Campbell, C. L.
Case, Arthur A.
Casier, Phillip D.
Chenoweth, J. W., Jr.
Conrad, M. D.
Cuff, Raymond
Darby, C. W.
Davis, True, Jr.
Dunlap, Glenn L.
Durant, A. J.
Edwards, Thomas A.
Elder, Cecil
Frank, George A.
Frank, Nathan
Gentry, F. D.
Graham, Guy G.
Hopkins, L. T.
Kilgore, R. L.
Lockhart, Ashe
Lubbehusen, R. E.
McDougle, H. C.
Murdock, F. M.
Price, Edmund R.
Quinn, A. H.
Ragsdale, A. C.
Rosner, L. A.
Schofield, William C.
Vezev, Stanley A.
Wank, Carl A.
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Whiting, J. A.
Wilke, T. E.
Orcutt, Bruce
Raser, Howard
Roelnisch, Harold W.
Safford, John W.
Sanders, C. T.
Stineburg, C. E.
Timmons, R. C.
Tunnicliff, E. A.
Wilkins, H. F.
Wipf, J. D. Conrad
Witt, LeVerne E.

NEBRASKA
Alford, Simon W.
Bachman, Wilbur
Bjornson, C. B.
Boulier, L. J.
Breed, Frank
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Drach, Amor C.
Emrich, C. O.
Gesellchen, V. W.
Grose, H.
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Kjar, H. A.
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Warner, C. J.
Williams, Guy H.

Wright, Clay
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NEW HAMPSHIRE
Allen, Fred E.
Christie, Andrew
Fessenden, Paul E.
Hill, Richard L.
Simmons, Eric W.

NEW JERSEY
Batte, Edward G.
Beaudette, F. R.
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Cebulka, Peter R.
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Gallardo, Eliseo
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Hendershott, R. A.
Herron, James M.
McDaniels, J. S.
Melini, Nolo
Mennen, William G.
Metzger, H. J.
Michaud, Laurent
Mourey, Lou C., Jr.
Neuberger, Harry H.
Nilsson, L. S., Jr.
Porteus, J. R.
Probasco, Robert E. L.
Sacks, Sander A.
Siegmund, Otto H.
Sussman, O.
Thoms, Joseph C.
Tudor, David C.
Welsh, Mark
Zeitz, David
Zeissig, Alexander
Zurbrugg, John T.

NEW MEXICO
Benner, J. W.
Hammond, Lee R.
Hoover, Thos. B. (Mrs.)
Kemper, Harry E.
Mitchell, Albert K.
ACTIVE MEMBERS 1963

NEW YORK
Baker, Donald W.
Barnes, Lowell R.
Beard, Stanley D.
Bolton, Robert
Bottorff, C. A.
Bradt, C. G.
Cleveland, E. C. & H. J.
Corwin, Louis A.
Cox, Herald R.
Danielson, I. S.
Danksy, Simon P.
Dutchess, Charles E.
Eichorn, Adolph
Fanslau, Charles
Fincher, M. G.
Geisler, R. E.
Green, D. F.
Gregory, Emory
Hagan, W. A.
Harvey, Max J.
Hills, J. V.
Hollenbeck, David I.
Holstein-Friesian World
Hopson, George H.
Johnson, Samuel A.
Kemen, M. J., Sr.
Kern, Clyde L.
Kiser, Jackson S.
Leonard, Harry B.
Levine, P. P.
Lyon, B. M.
Markham, Floyd S.
Marks, Herbert R.
McAuliff, J. L.
Metzger, Robert W.
Murphy, Jas. M.
Park, S. E.
Percival, Richard C.
Petersen, E. H.
Poppensiek, George C.
Roberts, David J.
Sargent, William P., Jr.
Schroeder, Charles R.
Sexton, Anna M.
Snook, George W.
Stephenson, C. Guy

NORTH CAROLINA
Barber, Clifford W.
Hines, Martin P.
Rich, John

NORTH DAKOTA
Bolin, Fonsoe M.
Eveleth, D. F.
Miles, James V.
Naaden, Thore

OHIO
Blackman, Charles L.
Cass, Jules S.
Cavanaugh, J. F.
Coates, Max S.
Edgington, Bruce H.
Eggleston, J. R.
Embree, W. J.
Fogle, Allan E.
Fogle, C. W. & Thompson, O. C.
Geyer, Harry
Greenlee, Allan M.
Haberman, Fred O.
Harwood, Paul D.
Hay, James R.
Helwig, J. H.
Hempy, Walter B.
Jones, Charles F.
Ketner, F. G.
King, Nelson B.
Knudson, R. L.
Koutz, Fleetwood R.
Kreider, W. E.
Krill, Walter R.
Madden, A. G., Jr.
McWilliams, K. E.
Miller, Clair I.
Moore, Earl N.
Noonan, Henry P.
Phillips, Marvin S.
Robinson, Charles E.
Sheeran, H. D.
Smiley, Ray S.
Smith, Franklin C.
Smith, R. Q.
Stansbury, J. L.
Theobald, A. R.
Thomas, Daniel L., Jr.
Wolfe, John E.

OKLAHOMA
Benn, Robert K.
Easley, Glynden T.
Harnden, E. E.
Jewell, H. J.
Malle, A. L.
Moe, Lewis H.
Simms, B. T., Jr.
Surface, R. C.

OREGON
Ballard, Frank L.
Beagle, Arthur G.
Bone, Jesse F.
Brandt, P. M.
Minar, Jackson
Muth, O. H.
Searns, H. I.
Younce, R. R.

Pennsylvania
Balsh, Andrew
Barshinger, F. L.
Beck, John D.
Bishop, C. P.
Brown, J. Robert
Bunn, Carl E. E.
Dankenbring, Ray
Deubler, Jas. A.
Elsea, R. L.
Epperly, Howell C.
Galbraith, William T.
Gifford, Claude W.
Gordon, Stephen, Jr.
Hill, B. L.
Hollister, Amos P.
Horn, Richard C.
Hower, Carlton R.
Kern, Richard A.
Logan, W. E.
Manziano, Clarence F.
Martin, H. M.
McKinley, Raymond E.
McLaughlin, Charles H.
Milo, Howard A.
Newman, Edward P., Jr.
Newsham, Richard C.
Oppenlander, G. Frederick
Ragsdale, H. L.
Rager, Charles W.
Schall, J. Hubley
Scheidy, S. F.
Schneider, J. E.
Seitz, P. H.
Slick, Joseph D.
Snoke, Paul C.
J. F. Stokes Machine Co.
Strickler, John J.
Stubbs, E. L.
Swope, Robert E.
Thomas, John Joseph
Thompson, James F., Jr.
Tuckerman, Edwin D.

Rhode Island
Barber, J. S.

South Carolina
Guess, J. B., Jr.

South Dakota
Davis, M. M.
Harshfield, G. S.
Sioux Falls Stock Yards Co.
Waddell, William F.

Tennessee
Andersen, Andrew C. P.
Fry, H. L.
Greene, W. O.
Simms, Wm. F.
Woolf, F. P.

Texas
Anderson, Dan J.
Boney, W. A., Jr.
Boughton, I. B.
Bridwell, J. S.
Carpenter, Henry D.
Cauthen, George E.
Cox, A. B.
Crawford, F. W.
Darby, H. L.
Davidson, Duval
Delaplane, John P.
Dunn, Ralph C.
Grumbles, L. C.
Hamilton, Frank G.
ACTIVE MEMBERS 1963

WEST VIRGINIA

Jaggi, Fred P., Jr.
Jennings, William E.
Keesee, Paul
Kleberg, Richard M., Jr.
Kleberg, Robert J., Jr.
Layton, C. F.
Lenert, August A.
Ljungdahl, Wm.
Marsteller, R. P.
McCainish, John N.
Mitchell, Joe C.
Morgan, Clyde O.
Neal, Fred C.
Northway, J. K.
Rupel, I. Walker
Sartwelle, James W.
Scroggs, Virgil H.
Turk, R. D.

DAILEY, J. S.
Dodd, C. C.
Dunn, R. H.
Knight, E. D.
Koblegard, Thorn F.
Mc Intosh, F. F. & Son
Munro, David Austin
Nelson, Oscar
Oliveboy Stock Farms
Olson, Norman O.
Sites, Austin L. & Son
Underwood, C. I.
White, Edward T.

VERMONT

Binns, Wayne
Manning, J. E.
Melvin, F. H.
Miner, Merthyr L.
Ogden Livestock Auction Co.
Sevy, Claude

BALDWIN, David H.
Basque, James F.
Conklin, C. T.
Norton, H. W., Jr.

VIRGINIA

Barton, R. A.
Batchelder, Ray M.
Beller, Jerome
Clarkson, M. R.
Cole, T. W.
Foley, O. F.
Jenne, Herbert J.
Johnson, E. P.
Todd, Frank A.
Winter, Asa

WASHINGTON

Hanks, John Jr.
Mac Kintosh, P. G.
Wegner, E. E.,

American Scientific Lab., Inc.
Bailey, Jack Williams
Beach, B. A.
Berggren, John R.
Berman, David T.
Curtis, C. R.
Curtis, J. Robert
Ellis, C. C.
Eriksen, Sivert
Ferguson, T. H.
Johnson, Walter M.
Kasa Kaitas, William
Knox, W. D.
Mack, J. F.
McNutt, S. H.
Morse, E. V.
Pabst, David
Patton, J. A.
Phelps, John L.
Piper, H. B.
Val-Lo-Will Farms
Van de Sand, C. F.
Winner, William R.
Wisnicky, Walter
Woelfer, E. A.

GOOD, G. H.
Kingman, H. E.
Olson, Harry
Prier, James E.
Wyoming Woolgrowers Ass’n.

WISCONSIN

WEST VIRGINIA

WYOMING
ARGENTINA
Rosenbush, Carlos
Rosenbush, Francisco

AUSTRALIA
Hunt, Stephen

BRAZIL
Lombardo, Agostinho

CANADA
Bain, Alexander, F.
Cameron, A. E.
Carlson, E. E.
Chance, B. K. deP.
Childs, T.
Christie, Victor V.
Couture, J. N. L.
Davidson, W. B.
Dunn, J.
Fasken, J. W.
Girard, J. U. George
Gunn, W. R.
Hall, Orlan
Hanson, Morris
Hetherington, C. K.
Hoey, W. J.
Holstein-Friesian Ass'n.
Jervis, J. G.
Jones, T. Lloyd
Kennedy, C.
Knapp, H. E.
Labelle, G. T.
Labelle, Gustave
Lay, R. H.
Legrow, W. R.
McClenaghan, R. J.
Mitchell, C. A.
Moynihan, W.
Moynihan, Walter A.
Nundal, Elford L.
Panisset, Maurice
Rose, Gordon A.
Saint, F. F.
Savage, Alfred
Schofield, Frank W.

CUBA
Llibre, Manuel Harrada

ENGLAND
Crawford, M.
Pool, W. A.

GREECE
Christodoulou, Theofanis
Tarlatzis, Costas

INDIA
Johnson, Harald N.

ISRAEL
Komarov, A.

MEXICO
Camargo N. Fernando

NETHERLAND
De Blieck, L.

NORWAY
Naerland, G.

PERU
Sinclair, Luke R.

SWITZERLAND
Hess, Emil
Kaplan, Martin M.
Leemann, W.

THAILAND
Chaiyasitiyuthaparn, Piya

TURKEY
Baskaya, Hasan

URUGUAY
Szyfres, B.
Trenchi, Hebert
FIFTY-SEVENTH
ANNUAL MEETING
Will be held on
Sept. 23-24-25-1953
in
HADDON-HALL
Atlantic City, New Jersey