Proceedings

FIFTY-SEVENTH

ANNUAL MEETING

of the

UNITED STATES LIVESTOCK
SANITARY ASSOCIATION

HADDON-HALL
Atlantic City, New Jersey
September 23-24-25, 1953
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United States Livestock Sanitary Association

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OFFICERS 1953-54

T. C. GREEN
President

R. A. HENDERSHOTT
Secretary-Treasurer

H. F. WILKINS
2nd Vice-President

I. G. HOWE
1st Vice-President

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3rd Vice-President
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A. K. Merriman, Springfield, Illinois
K. McKay, Davis, California
H. A. Milo, Harrisburg, Pennsylvania
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J. Traum, Greenport, Long Island, New York
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E. Tierkel, Atlanta, Georgia

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J. Green, Indianapolis, Indiana
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A. H. Quin, Kansas City, Kansas
L. A. Rosner, Jefferson City, Missouri
W. L. Sippel, Tifton, Georgia

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O. Hall, Ottawa, Ontario, Canada
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J. C. Nowlen, Sycamore, Illinois
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J. Henderson, Fort Worth, Texas
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C. E. Kord, Nashville, Tennessee
J. Traun, Greenport, Long Island, New York

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J. L. George, Lincoln, Nebraska
C. Gifford, Philadelphia, Pennsylvania
F. J. Kielholz, Philadelphia, Pennsylvania
W. D. Knox, Fort Atkinson, Wisconsin
R. Anderas, Kansas City, Kansas

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E. P. Anderson, Lincoln, Nebraska
R. A. Hendershott, Trenton, New Jersey
E. Reed, Omaha, Nebraska
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REPRESENTATIVE TO POULTRY BRANCH,
PRODUCTION AND MARKETING ADMINISTRATION
A. L. Brueckner, Baltimore, Maryland

REPRESENTATIVE TO THE NATIONAL BRUCELLOSIS COMMITTEE
R. W. Smith, Concord, New Hampshire

REPRESENTATIVE ON ADVISORY COMMITTEE ON VESICULAR EXANTHEMA TO SECRETARY OF AGRICULTURE, EZRA T. BENSON
R. A. Hendershott, Trenton, New Jersey

REPRESENTATIVES TO THE MEETING OF THE NATIONAL ASSOCIATION OF COMMISSIONERS SECRETARIES AND DIRECTORS OF AGRICULTURE

Representatives
R. A. Hendershott, Trenton, New Jersey
R. L. West, St. Paul, Minnesota
A. P. Schneider, Boise, Idaho

Alternates
W. L. Bendix, Richmond, Virginia
R. W. Smith, Concord, New Hampshire
H. F. Wilkins, Helena, Montana
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<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>
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<tr>
<td>2. Oct. 11-12, 1898</td>
<td>Omaha, Nebraska</td>
<td>*Mr. C. P. Johnson, Springfield, Ill.</td>
<td>*Mr. Taylor Riddle, Kansas</td>
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<tr>
<td>5. Oct. 8-9, 1901</td>
<td>Buffalo, New York</td>
<td>*Dr. E. P. Niles, Virginia</td>
<td>*Dr. F. T. Eisenman, Louisville, Ky.</td>
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<tr>
<td>8. Aug. 23-24, 1904</td>
<td>St. Louis, Mo.</td>
<td>Dr. J. C. Norton, Arizona</td>
<td>*Mr. Wm. P. Smith, Monticello, Illinois</td>
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<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>
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<td>27. Dec.</td>
<td>Chicago, Ill.</td>
<td>Dr. W. J. Butler, Helena, Montana</td>
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<td>31. Nov.</td>
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<td>Dr. L. Van Es, Lincoln, Nebraska</td>
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<td>50. Dec.</td>
<td>Chicago, Ill.</td>
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### RECORD OF PREVIOUS MEETINGS

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<th>SECRETARY</th>
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<tr>
<td>51. Dec. 3-4-5, 1947</td>
<td>Chicago, Ill.</td>
<td>Mr. Will J. Miller, Topeka, Kansas</td>
<td>Dr. R. A. Hendershott, Trenton, N. J.</td>
</tr>
<tr>
<td>53. 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>57. Sept. 23-24-25, 1953</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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<tr>
<td>58. Nov. 10-11-12, 1954</td>
<td>Omaha, Neb.</td>
<td>Dr. T. C. Green, Charleston, W. Va.</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 Livestock Sanitary Boards
‡Reprinted in 54th Annual Report
Because of the precarious condition of the Treasury of the Association, the Committee on Finance offered the following resolution as an amendment to the Constitution and By-Laws:

"BE IT RESOLVED, that the Association in annual meeting assembled authorizes an assessment of $2.00 for each member to take care of the immediate deficit, and the Secretary be instructed to bill immediately each member accordingly, and, furthermore

BE IT RESOLVED, that the initiation fee and annual dues for membership in this Association be increased to $5.00 and that this Resolution serve as notice for an amendment to the Constitution and By-Laws to this effect."\(^{(1)}\)

No action was subsequently taken on this proposal.

In 1923 the Committee on Policy reported as follows:\(^{(2)}\)

"In the endeavor to formulate a permanent policy to guide future activities of this Association, which it is proposed to submit for your consideration, the committee has become impressed with the immediate necessity of providing adequate financial means in order that the Association may continue to function. It is therefore, intended to submit the following amendment to the constitution:

1. "That the livestock sanitary department of each state shall be eligible for active membership and to be officially represented by the proper livestock sanitary official of that state. The annual dues for such membership shall be twenty-five dollars ($25.00). The annual dues for regular membership shall be two dollars ($2.00) as at present."

"For several years it has been observed that the Association has ceased to function along the lines of the specific purpose for which it was originally organized. This is probably accounted for by the too liberal interpretation of Section Two of the Constitution. As a result there has been a duplication of effort and purpose of this and other associations.

"Those actively engaged or interested in regulatory or livestock transmissible disease prevention and control measures have a right to rely upon this Association for information and guidance, irrespective of whether it applies to animals or animal products, such as meat and milk.

"It is, therefore, proposed to amend Section Two of our Constitution to read as follows:

"The purpose of this Association shall be the dissemination of information and the unification, so far as possible, of methods and regulations pertaining to the prevention, control and eradication of transmissible diseases of livestock including poultry.

"It is proposed to amend Section Four of the Constitution to read as follows:
"The official ranking officer representing the livestock sanitary departments of the various states, the Chief of the United States Bureau of Animal Industry, the Veterinary Director General of Canada and the elective officers of the Association shall constitute the Executive Committee.

"It is proposed to amend Section Two of the By-Laws to read as follows:

"The Executive Committee shall transact the necessary business of the Association and shall make recommendations covering the activities of the Association."

Dr. DeVine. I move its adoption.

President W. J. Butler. It is regularly moved and seconded that the report of the Policy Committee be accepted. All in favor say aye. Contrary no. It is so ordered.

No action was taken with respect to the amendments proposed in 1923. The Committee on Policy in 1924 reported as follows: (3)

"While the Committee has been at work during the past year all that can be reported at this time is progress, and the Chairman suggests in order to be able to accomplish during the next year what is intended to do that the scope of the work of the Committee be broadened and that it include a revision of the Constitution and By-Laws. It is necessary to have that privilege in order to be able to accomplish just exactly what the Committee desires,"

Dr. T. E. Munce, Chairman. It was moved, and seconded that the Committee on Policy be granted the privilege of undertaking a revision of the Constitution and By-Laws. The motion was put and carried unanimously.

The Committee on Revision of the Constitution and By-Laws (4) consisting of Dr. David S. White of Ohio, Dr. M. Jacob of Tennessee, Dr. Wm. J. Butler of Montana, Dr. John R. Mohler of Washington, D. C., and Dr. T. E. Munce of Pennsylvania presented the following recommendation.

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 a livestock sanitary science clearing house between this Association and the following: The livestock owner, the livestock sanitarian, the milk and meat hygienist, the veterinary practitioner, the transportation and stock yard companies, the milk and meat producing and distributing companies, and various other interested agencies. The word "live stock" 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, shall be eligible to official membership in this Association and be represented on the Executive Committee by the livestock sanitary executive official.

Any person engaged in livestock sanitary work for Federal, provincial, state, territory, county or municipal governments and any other person interested in livestock sanitation or milk and meat hygiene may be elected to individual membership.

**ARTICLE IV—Meetings**

The meetings of this Association shall be annual and special.

**ARTICLE V—Officers**

The officers of this Association shall be: President, First Vice-President, Second Vice-President, Third Vice-President, Secretary-Treasurer, and an Executive Committee.

The officers of this Association shall hold office for one year or until their successors have been duly elected and qualified.

**Executive Committee**

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, and the elective officers of this Association.

The Executive Committee shall constitute the administrative body of this Association and shall determine its activities and policies.

All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee.

The First Vice-President shall be ex-officio chairman of the Executive Committee.

The Executive Committee shall elect yearly a Secretary-Treasurer for the Association. The Secretary-Treasurer shall receive such salary and allowance as may be fixed by the Executive Committee.
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 re the conduct of any member; and shall have authority to accept or reject applications for individual membership properly placed before them. Three negative votes shall disqualify for such membership.

ARTICLE VI—PROGRAM COMMITTEE

The President, the Chairman of the Executive Committee and the Secretary-Treasurer shall constitute the Program Committee. It shall be the duty 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 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 Executive Committee. In the absence of the president he shall preside at the meetings of the Association. In the event of the absence, disability or resignation of the president he shall perform all the 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 Committee 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 to do so 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.

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 the previous annual meeting and provided further that the amendments has received the approval of the Executive Committee.

BY-LAWS

ARTICLE I—ORDER OF BUSINESS

Invocation.
Roll Call.
Reading of Minutes.
President’s Address.
Report of Secretary-Treasurer.
Report of Executive Committee.
Reports of Committees.
Unfinished Business.
New Business.
Reading of Papers, Discussions, etc.
Election and Installations 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 two dollars ($2.00), 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 Program Committee of this 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 two dollars ($2.00) per annum, payable in advance (on or before January 1st of each year) to the Secretary-Treasurer of this Association.

The dues for Federal, Dominion, Cuban, Mexican, and state official membership shall be twenty-five dollars ($25.00) each per annum, payable in advance (on or before January 1st of each year) to the Secretary-Treasurer of this Association.

**ARTICLE VI—NOMINATIONS**

Nominations for President and for the three Vice-Presidents shall be made from the floor. The nominations shall be made orally and shall not be closed until every member present has had an opportunity to present his candidate.

**ARTICLE VII—ELECTION OF OFFICERS**

A majority of all votes cast shall be necessary to elect the President. If no nominee receives a majority of the votes on the first ballot, the nominee who received the lowest number of votes shall be dropped and a new ballot shall be taken, and so on until a nominee receives a majority for President.

The votes for Vice-Presidents shall be cast on one ballot and the nominee receiving the greatest number of votes for Vice-President shall become First Vice-President; the nominee receiving the second highest number of votes
shall become Second Vice-President; and the nominee receiving the third highest number of votes shall become Third Vice-President.

In the event of but three nominations for Vice-President being made, or a tie vote, the rank shall be determined by the order in which the candidates were nominated.

The Secretary-Treasurer shall be elected in accordance with the provisions of Article V of the Constitution.

**ARTICLE VIII—STANDING COMMITTEES**

The standing committees of this Association shall be:
- Legislation.
- Resolutions.
- Tuberculosis.
- Texas Fever.
- Infectious Abortion.
- Transmissible Poultry Diseases.
- Transmissible Swine Diseases.
- Parasitic Diseases.
- Miscellaneous Transmissible Diseases.
- Unification of Laws and Regulations.
- Meat and Milk Hygiene.
- Policy.

The Executive Committee may create special committees as needed.

**ARTICLES IX—AMENDMENTS**

The By-Laws of this Association may be amended in the same manner as the Constitution.

Respectfully submitted,

(Signed) DAVID S. WHITE,
(Signed) M. JACOB,
(Signed) W. J. BUTLER,
(Signed) J. R. MOHLER,
(Signed) T. E. MUNCE, Chairman, Committee

Dr. T. E. Munce, Pennsylvania. I move that the rules be suspended and that the Constitution and By-Laws be adopted, to become effective at the end of this meeting.

Dr. Peter F. Bahnsen, Georgia. I second the motion.

The question was put and carried unanimously.

There were no proposals to amend the Constitution and By-Laws from 1925 until 1940 at which time the Committee on Revision of the Constitution and By-Laws under the chairmanship of Dr. H. E. Curry presented the following report. (6)
HISTORY OF CONSTITUTION AND BY-LAWS

ARTICLE I—NAME

"This Association shall be incorporated in the State of Delaware under the name of the 'United States Livestock Sanitary Association.' Its corporate officers herein after described shall comply with the laws of the United States governing corporations and of the state in which the Association is incorporated. It shall forever remain a non-profit organization in fact.

ARTICLE III

That the third paragraph of Article III be amended by inserting the clause between the words 'person' and "interested," association or organization represented by a designated individual."

No action was taken with respect to these two proposals.

Report of Committee on Revision of Constitution and By-Laws (6) Wm. Moore of Raleigh, North Carolina, chairman. Chairman Moore indicated that this Committee had no report to make and recommended that his Committee be abolished and that the functions of it be transferred to the Committee on Policy. A motion was made and passed that this action be taken.

REFERENCES

   1922 ................................................................. Page 137

   1923 ................................................................. Page 35

   1924 ................................................................. Page 129

   1925 ................................................................. Page 251-258

5. Forty-fourth Annual Meeting of the United States Livestock Sanitary Association. 1940 ................................................................. Page 212

ADDRESS OF WELCOME

W. H. ALLEN

Secretary for Agriculture, Trenton, New Jersey.

Mr. President and Members of the Association: I imagine that you don't care for an extended welcome. I assure you we are all happy and pleased to have you come to the Garden State of New Jersey to hold your meeting. I suppose some of you who flew in or who took the train or drove sort of wonder why New Jersey should be called the Garden State, because it seems that the roads and the railroad tracks and even the air do not really give you a true picture of our State.

We have quite an interesting agriculture. We are a small State, with only about 20,000 commercial farmers in the State. Nevertheless, our gross income per acre runs about five times that of the average for the United States. I believe it is the highest income per acre of any state in the Union.

We have quite a diversification of agriculture. Our biggest and most important enterprise is the poultry industry, and secondly the livestock industry, principally the production of milk, then fruit and vegetables.

Our State has a slogan, Mr. President, which says, "New Jersey is a good place to live, work and play." I don't suppose you had the play in mind when you brought your Association to Atlantic City, but Atlantic City is known as the World's playground. I think that as you see our Boardwalk, some five miles long, starting out in front of this hotel and extending both north and south, and when you realize that we have about 150 miles of seashore, you can appreciate that especially during the vacation period we have a tremendous number of people who take advantage of our seashore; in fact, our vacation population jumps up about 5 million people.

So, recreation is supposed to be one of our major industries of the State. We try to make it congenial and enjoyable for everybody, both for those who live here as well as those who join us. We sometimes think that maybe the local population takes advantage of it.

Our State has no income tax and no sales tax, which indicates that it is a pretty good place to live. However, we are much concerned sometimes because, as one man put it, we run our State government on what you might call play; that is, a man can live in New Jersey if he lives a sort of spiritual life, and it won't cost him anything. (Laughter)

Our income comes from race tracks, liquor and cigarettes, and, if you are unfortunate enough to die, we take an inheritance tax; otherwise, there are no taxes in the State. So, it is a pretty good State to live in, and we find a great many people from Philadelphia and New York trying to crowd in on us. (Laughter)
In regard to work, from the veterinary standpoint I can say particularly that this is a nice place to work, even if some of the local veterinarians might try to discourage you from joining us and domiciling in this State. Our livestock industry, consisting principally of dairy farms, are fewer and fewer each year, but larger and larger herds. Our population of milking cows in the State has stayed about the same for the last fifty years, but every year there are fewer and fewer farms, and as a result most of our dairy farms are large enough so that they can afford and do appreciate the importance of veterinary work, and they call upon the veterinarians to quite a degree.

We also are developing quite a livestock industry, particularly in beef cattle, sheep and hogs. I think that probably is due to some of these newer active programs of price control that are encouraging a great many of our farmers in the eastern part of the State to put on greater acreages of grain. As a result we are seeing creeping into larger importance the growing of sheep, swine and beef cattle.

We do have very fine beef herds. Last week I attended a sale where about 100 animals were sold, and the average was a little over $4,000 per animal. So, you see, it is a very high type of livestock industry, and one that does require and does appreciate the science of the veterinarian to keep the animals in good health.

Lastly, the poultry industry in our State is our largest industry. I think it is a challenge to the Association in that poultry seems to have been neglected. I believe from the standpoint of being able to secure men in the veterinary profession who will appreciate the poultry industry sufficiently to enjoy that practice, probably our poultry industry not only in New Jersey but throughout the United States is now where the livestock industry was possibly at the turn of the century.

I believe there is a tremendously big field for the veterinary profession in the poultry industry, due primarily to the fact that our poultry industry centers around very large operations. They have been unfortunate in not being able to secure the services of veterinarians to the extent that I think the industry should enjoy. I was very happy to hear the last report and to note that your Association is giving considerable thought to an industry that is so important to New Jersey.

Again I want to say that I certainly appreciate the honor of being able to welcome you to New Jersey, and I assure you that you are most welcome. I hope you enjoy yourselves, and that you will find your meetings not only interesting but very constructive, thank you very much.
RESPONSE TO WELCOME

R. W. Smith
Concord, New Hampshire

Dr. R. W. Smith: Mr. President, Members of the United States Livestock Sanitary Association, and Secretary of Agriculture Allen: I note on the program that I am to respond also to the Mayor of Atlantic City, where we are now in session. I had hoped that the Mayor would be here, because having finished an eight-year stretch as Mayor of my own city of Laconia, New Hampshire, I had a few quips that I wanted to shoot to His Honor the Mayor of Atlantic City.

This situation this morning reminds me of a similar occasion in Chicago, when I was to respond to the Governor of Illinois or his representative. I was quite busy that morning and I followed the program. I came into the hall about fifteen minutes before I was scheduled to speak, and a man was just finishing his address. I leaned over to the man next to me and said, "Who is the man who is speaking?" He said, "Don't you know? That's the representative of the Governor of Illinois."

I turned around and watched him go out the door, and then I responded to his address, which I hadn't heard. (Laughter)

However, Secretary Hendershott, as you are the only official representative of the State of New Jersey left here in the room, I want to say that the members of this Association appreciate your gracious invitation to come here to the great Garden State of New Jersey, so-called, and to Atlantic City, which we know is the playground at least on the eastern coast.

We question your judgment, however, in the dates that were selected. If we were to meet here in September, why couldn't it have been last week, when all the American beauties representing every state were here? (Laughter) Why couldn't you have had the vision when selecting the dates that you have had in other matters pertaining to our Association, and allowed some of us poor fellows the opportunity of seeing American youth at its best? (Laughter)

However, you did arrange for us to have a half day off to go to the race track yesterday. The Secretary of Agriculture referred to the funds that New Jersey receives from the race track, liquor and tobacco industries. I looked around yesterday afternoon, and I noted quite a few of our members contributing to the welfare of the State of New Jersey. (Laughter) I know we all had a good time.

The Secretary of Agriculture of the State of New Jersey has given us a pretty good briefing on New Jersey's agriculture. If he were still here I would have told him that his Director of Animal Industry in this State has
briefed us for many years, until now we know that the State of New Jersey is one of the greatest little states agriculturally in our Union. I say that in all sincerity.

This city is the greatest playground on the eastern seaboard, and if the Mayor were here I also would tell him that the millions of people who come here each year contribute to the economic welfare of the agriculture of the United States just as much as you and I contributed to the track yesterday afternoon.

I have said before, and I repeat, that I believe it was Swift and Company who in one of their booklets stated (and of course they were referring to the livestock industry) that 80 per cent of the livestock consumed in the United States is raised west of the Mississippi River; but they also went on to say that 80 per cent of that livestock is consumed east of the Mississippi River. And somewhere down the line I found the statement (and I believe it is authentic, and it surprised me a little) that 42 per cent by weight of the red meat in this country is produced by the dairy cow and her offspring.

With that picture before us, it is very easy to understand that the livestock industry of this country, the health of which is our responsibility, could not prosper nor continue if it were not for the great recreational areas such as Atlantic City and the great industrial areas up and down the Atlantic Seaboard and in the eastern states as well as the western states. There would be no thriving livestock industry in the west; and by the same measuring stick, if it were not for the livestock industry of our country, there would be no recreation. So, it follows that one can succeed only as the other succeeds.

Again I am reminded that this country's population is growing very rapidly. I believe Dr. Garrett stated last year that it is carefully estimated that by 1975 we will have 200 million people in the United States. That is only twenty-two years from now. Some of our agricultural economists are a little worried inasmuch as there are no real frontiers left in the United States to be conquered; but you and I know that millions and millions of dollars worth of livestock can be conserved through the prevention of the livestock diseases that take the great toll they do, through the work that Livestock, Inc. is doing in conserving livestock through better methods of handling and marketing of livestock products, and through the Department of Agriculture in each of the states in the United States, and in the vegetable line with pests and parasites that prey upon agricultural commodities other than livestock.

So, looking ahead to the feeding of 200 million people, the responsibility of the members of this great Association is unlimited. Down through the years we have met the challenge, and you and I have no doubt but that those who are here today, and those who will follow in our footsteps in the years to come, will meet the challenge, and that this Association, which is now some 57 years old, will continue to fight for the control and eradication of the con-
agious and infectious diseases that may at any time threaten the industry which means so much to the prosperity of the people of the United States.

As an example, within the past year a disease of swine made its appearance outside the State of California, where it had existed for twenty years. You will recall that last year in Louisville the matter was discussed pro and con, and at that time no states had proper legislation relative to cooking garbage, which is so essential to the eradication of this particular disease.

During the past twelve or fourteen months that disease has spread to forty-two states. Also, during that period, because of the enthusiasm and foresightedness of the regulatory officials and others in the Bureau of Animal Industry, and those engaged in disease eradication, forty-one states have passed adequate laws requiring the cooking of all garbage.

I am not here to discuss that matter further. May I say only that it is my personal opinion that we have been many years too late in taking this forward step. We could argue it if it became necessary, because we are not the only country that has the problem of cooking garbage. We could well go to the North of us and learn a good lesson along this line—one that would be very beneficial to us indeed.

I do not wish to take any more time in my response to the welcome by the Secretary of Agriculture. Dr. Hendershott, I am quite sure that we as an Association made no mistake when we accepted your invitation to come to the Garden State for our convention this year. Certainly Atlantic City and the surrounding territory do not tell the whole story regarding the agriculture of New Jersey.

Our Secretary did a god job presenting the facts relative to your State. I do not think he mentioned the fact that there is only one other state in the Union where cows produce more milk per cow than does New Jersey; that state is California. If I am correctly informed, it is pretty much nip and tuck between those two States.

We appreciate your invitation to us to come here for our convention, and we value your advice and services to this organization.

Thank you. (Applause)

SECRETARY HENDERSHOTT: I do want to reply to Rob Smith. I know that he feels we should be criticized for not having this meeting a week earlier, when the American beauty contest was on; but if you look over this audience you will see a lot of gray and bald heads here. We have lost enough members through sudden death during the past year, and we have no desire to lose any more through sudden death nor to be a party to it. (Laughter)

Bob said he is physically in prime condition; however, I know that he isn't under forty, and I question very much whether he could have made any response to the address of welcome had the meeting been held last week. (Laughter)

Beyond that, we have serious business to consider; and while we are in convention, and certainly what went on here last week could not in any way
be construed as being serious business that might be interpreted as being the
business of this Association—to my mind that comes under the heading of
decided pleasure. You had an opportunity to come a week earlier and see
some of it. Personally, I have been in this State for twenty-six years, and I
have yet to see a beauty contest. Maybe when I get as old as Bob and need
a little recharging of batteries, I will come here and take it in. (Laughter)

To the young men who attend our meetings, may I say that I hope they
increase in numbers. We would not have had them in attendance at our
sessions had we met last week. So, I defend myself in passing up the real
week of the entire season in Atlantic City, in asking you to come here a
week after the beauties have departed.

While I am on my feet I would like to report that several committees
are going to meet tonight. Several committees met yesterday. That was a
little irregular, since the convention did not open until this morning. We hold
that the public at large is entitled to engage in a discussion of the formulat-
on of committee reports, so again our committees will hold forth this
evening on this floor. Any of you are at liberty to attend the committee
meetings, to sit in and engage in a discussion of the committee's report
and any subjects under consideration by the committee, after which all
committees will go into executive session to formulate their reports.

It should be clearly understood that all members of the Association and
all visitors, anyone interested in livestock disease control, are invited and
couraged to attend the committee meetings this evening and to listen to and
participate in the discussions that take place during the formulation of the
material that will go into the committee reports.

I am happy to see so many of you here. I hope you will enjoy the bathing
that is provided. I told you in a letter that bathing is never better than in
September. You will find that the time to bathe in the ocean is when the
temperature of the water is one or two degrees higher than that of the air.

If you want to go outside and bake on the beach, any time is satisfactory
for that as long as the sun is out, and sometimes even when it is cloudy you
can get sunburned, as I know from experience. Don’t hesitate to go in
swimming in the ocean if you brought your swimming togs with you. I
think Wilkins' son has been in every morning so far, and can attest to what
I have said.

I am glad to see so many in attendance, and I do hope you enjoy some
of the sights in this vicinity, and the Boardwalk, and the other many things
available to you here in Atlantic City. (Applause)
During the past year, livestock sanitary officials of the United States and Canada have been confronted with conditions and problems in connection with control and eradication of animal diseases which, if permitted to follow their natural courses, would certainly have been very damaging to the livestock industry of both countries. True it is that in both countries considerable damage has been done to certain sections of the livestock industry by, we might say, explosively infectious diseases of viral origin. However, the damage done was only a tiny fraction of what very likely would have occurred in the absence of comprehensive measures of control, to the detriment not only of the livestock industry, but also to the detriment of the public well-being and health.

Here in the United States where a continuous offensive is being waged against non-exotic diseases, such as brucellosis, tuberculosis, and a host of other diseases common to animals but in many cases transmissible to man, often with disastrous results, you have been confronted with a very serious and explosively infectious disease of swine, namely, vesicular exanthema—a disease of swine sufficiently serious to warrant the adoption of most radical measures for control and eradication. We trust the measures and procedures presently operating will bring about the desired results.

Also, during the past year, the livestock industry of the United States, and to a much lesser degree that of Canada, has again been menaced by an outbreak of foot and mouth disease in Mexico. It is very reassuring to us in Canada to know that all possible will be done to control this outbreak and prevent the disease being carried into the United States. It is fully appreciated that the recent outbreak of foot and mouth disease in Mexico has caused considerable concern and anxiety to the livestock industry of the United States, and also, saddled with extra work and worry, those officials who are, when all is said and done, responsible for the well-being of your multi-billion dollar livestock industry which certainly would not exist, at least not in its present dimensions, without the safeguards which have been established and operated in the past and present to prevent the introduction of, to control, and to eradicate animal diseases which are damaging or destructive to livestock and, hence, of prime economic importance. As most of you gentlemen present are aware, the work in connection with the establishment, legally, the operation and
enforcement of regulatory requirements aimed at the control and eradication of serious animal diseases, and the protection of public health, is contentious, exacting, arduous, frequently unpleasant, and at times, dangerous. These conditions have a very important bearing on the difficulties experienced in securing adequate numbers of suitable veterinarians, as public servants, to properly take care of these duties.

To us in Canada, it is very reassuring to know that along the entire length of our southern boundary, which is some 4,000 miles in length, there is a neighbour nation, the responsible officials of which are well aware of the unsatisfactory disease conditions existing in many countries with which trade relations are maintained, and also are well aware of the ruin which would speedily overtake the United States’ multi-billion dollar livestock industry, and very likely that of Canada also, if the regulatory requirements governing importations of livestock, livestock products, and other products and materials capable of conveying the causative agents of destructive animal diseases, were relaxed or not rigidly enforced, as they presently are. We, in Canada, have cause to know just how rigidly regulatory requirements governing the entry to the United States of livestock, etc., from other countries are enforced.

For us in Canada whose duties include the administration and enforcement of the regulations made under the authority of the Animal Contagious Diseases and the Meat and Canned Foods Acts, the past year has been an extremely busy one. In addition to our planned activities, which include nationwide control and eradication of such non-exotic animal diseases as tuberculosis, brucellosis, Newcastle disease, fowl typhoid; investigational work in connection with reports of the suspected presence of other named diseases; duties in connection with exports and imports, (duties in connection with the latter having been greatly increased owing to the great numbers of immigrants arriving in Canada from foreign lands where serious animal diseases are present); providing inspection services for some 150 packing plants and other establishments operating throughout Canada under our supervision; we have been, during the past year, confronted with two rather serious outbreaks of disease—rabies and hog cholera.

In the outbreak of rabies, which had its real beginnings some fifteen or sixteen months ago. the Northwest and Yukon Territories and the northern parts of the four western provinces were involved. Rabies has existed among wolves and foxes of the far northern regions of Canada for at least six years, and probably for many years previous to that time. This outbreak and spread of rabies was brought about by the following conditions: (1) overpopulation of wolves and foxes in northern areas due to low prices obtainable for the pelts, resulting in very few of these animals being taken by trappers during the past few years; (2) abundance of food in the form of small game such as rabbits, etc., in the northern timbered areas of the western provinces—this had the effect of attracting disease-carrying predators from further north.

During the earlier days of this outbreak, considerable alarm and hysteria was generated by stories regarding depredations and destruction caused by
rabid predators in the areas involved. It will, of course, be understood such stories, in being retold, did not lose any of their force and effect. However, a number of domestic animals, from available information estimated to be between forty and fifty, including dogs, cattle, horses, sheep and swine, were attacked and in some cases killed by rabid wolves or foxes during the period June, 1952 up to June of the present year.

The outbreak was dealt with as follows. The areas involved were placed under quarantine, as applying to dogs, to restrict movement; dogs were required to be tied up or otherwise kept under control; and stray or ownerless dogs ordered destroyed. Concurrently, our Departmental veterinarians, assisted by the Royal Canadian Mounted Police, together with Territorial and Provincial officials, commenced a program of vaccination of all dogs which could be reached in the areas involved. With the program of vaccination, a program of education of the people was inaugurated by lectures and talks given by our Departmental veterinarians, by radio broadcasts, by posters and the press. Our quarantine, at first, was applied to that area of Canada north of the 57th parallel, north latitude. Later, we found it necessary to move the quarantine line farther south to include that part of British Columbia north of the 53rd parallel, north latitude; the entire province of Alberta; that portion of Saskatchewan from north to south lying west of range 16; and north of the 55th parallel, north latitude, in both Saskatchewan and Manitoba.

During the period, June, 1952 to June, 1953, almost 100,000 doses of anti-rabies vaccine were issued by the Department and used by our veterinarians and their assistants, almost entirely on dogs in the danger areas. A small number of cats, and horses used for saddle and pack purposes, in these areas were also protected with vaccine.

In conjunction with the vaccination and educational programs, the Provincial and Territorial officials concerned put on a vigorous campaign with poison, traps and firearms to reduce the predator population. The results of that campaign appear to have been quite satisfactory. We have reports of an abnormally large crop of deer and moose offspring in certain districts. We also have reports of a tremendous increase in the numbers of field mice in areas where the fox and coyote population has been depleted. The number of predators, known to have been destroyed, is as follows: foxes—29,697; coyotes—12,232; wolves—1,110; lynx—1,177; skunks—133; bears—312; cougars—8; wolverines—1; and badgers—7. No doubt many more were destroyed but not found.

During the period indicated above, 555 specimens from animals suspected of being affected with rabies were submitted to our Departamental laboratories for examination. The results were as follows: rabies was confirmed in 145 of the specimens submitted; of these, 16 did not show Negri bodies, but the presence of rabies virus was confirmed by animal inoculation. Positive laboratory findings by animal species are as follows: dogs—45; cats—8; coyotes—18; foxes—43; wolves—7; cattle—8; lynx—3; bears—1; moose—1; caribou—1; swine—4; sheep—2; rabbits—1; weasels—1; and beavers—2.
In addition to our work in the northern and western areas, to allay public alarm and as a safeguard against rabies being introduced by skunks, coyotes, etc., from adjoining parts of the United States where no effective natural barriers exist, we had the dogs in a twelve mile wide strip across Manitoba and most of Saskatchewan adjoining the International Boundary line vaccinated against rabies. At the present time, all is reasonably quiet on our northern and western fronts.

Concerning the outbreak of Hog Cholera. This occurred in Ontario. Investigation indicated the disease had been present in an atypical or mild form for approximately a couple of weeks before it was brought to the attention of our Departmental veterinarians as of May 16th, 1953. The first premises known to be infected were placed under close quarantine, and the affected swine and contacts destroyed and buried the same day.

Finding the infected swine had passed through a community auction sales barn some two or three weeks previous to May 16th, it was obvious the infection would be scattered far and wide throughout Ontario. The outlook was decidedly serious. However, radical measures to control and eradicate this outbreak were put into operation immediately as follows:—All community auction sales establishments in Ontario were immediately placed under close quarantine, cleaned and disinfected under supervision; movement of swine through these establishments was prohibited; swine on hand were moved under permit to packing plants under Departmental veterinary supervision for immediate slaughter; the entire southwestern part of Ontario, consisting of 29 counties, was placed under quarantine with respect to swine movement which was not permitted for any purpose from the quarantined area; however, swine were permitted to be moved into the quarantined area for slaughter purposes only at approved establishments; movement of swine through stockyards was restricted to those being consigned to an approved establishment for immediate slaughter; concurrently, all available Departmental veterinarians in Ontario were placed on the work of tracing and quarantining all possible contacts, farm to farm inspections of swine; supervising destruction of diseased swine and their contacts wherever found, cleansing and disinfection of infected premises, and conducting an educational campaign regarding Hog Cholera among the people concerned by talks at meetings of farmers, radio broadcasts, and issuance of daily bulletins by the Departmental Information Service regarding the situation and progress made; as an additional safeguard to prevent spread of infection, all swine within a radius of one mile from any infected premises were treated with anti-hog cholera serum. We received splendid co-operation and assistance from the Ontario Provincial Department of Agriculture, and from the Ontario Provincial Police.

The procedures, outlined above, placed the outbreak under complete control almost at once, and resulted in eradication in just thirty-two days from the date the disease was reported. The disease appeared on two premises after June 18th. However, that was expected as the two small herds affected
had been under surveillance—suspected of harboring the disease. In all, 54 premises were involved; 2,949 infected, or suspected of being infected, swine were destroyed; and compensation awarded to owners amounted to $72,047.50.

It is well worth noting here that we had approximately 100 veterinarians, including veterinary practitioners, on the job within a day or so; also, all infected swine were traced back through trucker-dealers to auction sales barns. There was no spread of disease from farm to farm. In most cases, the same day on which infected or suspected of being infected swine were discovered, they were destroyed and buried. The veterinarians, under the supervision of Dr. G. H. Collacutt, really did a magnificently efficient job.

The foregoing brief outline of these two outbreaks of disease, the methods employed in dealing with them, and the results, are perhaps somewhat off the beam as material in a President’s address. However, I considered this an opportune time to point out what may be done in the line of disease control and eradication, when prompt and comprehensive action can be taken under centralized authority, without time-consuming conferences, securing authority to act, or interference of any sort. Hog cholera can, of course, be eradicated, as we have demonstrated, even when the disease has had several weeks to develop in the midst of a hog raising district, as in southwestern Ontario. Of course, our requirements in connection with routine cleansing and disinfection of railway livestock cars and livestock carrying trucks is a very important factor in preventing the spread of disease. The former requirement has been in operation for many years in Canada, the latter for approximately eighteen months.

As to the source of the virus which caused the outbreak of hog cholera in Ontario last May, it has not been definitely established. However, the disease being fairly widespread in the United States, and the intercourse between the two countries being what it is, we are not surprised the disease appears in Canada once in a while. It is rather surprising it does not appear more often. Sure it is that so long as hog cholera exists, as it does in the United States, the swine industry of Canada is under a continuous menace. That is also true in connection with vesicular exanthema of swine.

We, in Canada, are very glad to know that progress is being made in the United States toward improved sanitary practices in connection with the swine industry, particularly in the matter of requiring that garbage fed to swine must be cooked. That is a step in the right direction. But is that enough? It seems to me that this might be the time to give consideration to launching a blitzkrieg on hog cholera, and finish off vesicular exanthema concurrently. We are all well aware that such an undertaking would present great problems, and particularly in other fields than that of the actual work of eradication, for which we know the veterinarians of the United States possess the know-how and with plenty of that commodity to spare.

I do not propose here and now to offer either criticism or advice concerning procedures followed or proposed for dealing with brucellosis in the United States; to do so would be very presumptuous on my part. However, I would
like to make a comment or two in that connection. The sneak attack of the Japanese on Pearl Harbor, back in 1941, caused you people of the United States to forget all your differences, political and otherwise. You put your brains and brawn into the work of defeating the enemy. In so doing, the United States astonished the entire world with the efficiency and speed with which she built up crushing military power. I recall hearing a certain United States Senator, during a speech made in the early months of 1942, announce that "Japan is doomed." Those words were prophetic. Now, I believe if you people really get together and put but a tiny fraction of the co-operation, brains and brawn which you exhibited when really aroused, into a co-ordinated effort against brucellosis, that plague would soon be liquidated. Personally, I am a firm believer in the value of building up disease-resistant herds by the controlled vaccination of young cattle, and the taking out of circulation or liquidation of infected adults. However, we should never lose sight of the fact we are dealing with the other fellow's property, and while every effort should be made to protect public health, that of course, should be done with the least possible inconvenience and expense to the livestock industry. The livestock owner should not be baffled, confused, and hamstrung in his operations by a multiplicity of rules and regulations governing movement of livestock. Uniformity and simplicity, in accordance with sound sanitary procedures, should always be the aim of the veterinary sanitarian in formulating and enforcing procedures in connection with control of disease.

I do not propose to make any comments on the situation in the United States concerning bovine tuberculosis or tuberculosis of other animals. As you are aware, the Bureau of Animal Industry, Washington, D. C., issues a very comprehensive monthly summary of activities in connection with bovine tuberculosis. I believe it is available to all.

The situation with respect to bovine tuberculosis in Canada is quite encouraging, although it has been necessary to divert substantial numbers of Departmental veterinarians, during the past two or three years, from duties in connection with eradication of bovine tuberculosis to controlling and eradicating more serious diseases. With the exception of the province of Alberta which is in the process of being so established, all of Canada can now be considered a restricted area for the eradication of bovine tuberculosis, with most of the important cattle raising areas classed as "accredited"; that is, the incidence of tuberculosis reduced to one-half of one per cent or less, in most cases much less. Retesting of cattle in restricted areas, before their three or six year accreditation lapses, has produced very gratifying results. In a number of areas recently retested, no trace of disease has been found. In all others retested, infection was found to be almost non-existent. Details of all activities, in which the Health of Animals Branch was engaged during the past fiscal year, are included in our annual report for the fiscal year ended March 31st, 1953. This report will be available very shortly.

Perhaps it is not strictly in order to mention or refer to a matter which has been the subject of some controversy during recent years—the matter
of representation of livestock associations on the Executive Board. That matter was discussed and argued to my knowledge at the last several annual meetings. However, in so far as I am aware, the matter has not been as yet satisfactorily resolved. I have had correspondence since our last meeting with several officials representing various segments of the livestock industry. In all cases, these officials expressed their desire to co-operate with the United States Livestock Sanitary Association. I believe many of these gentlemen are doing so. However, there is no doubt in my mind that a number of the officials of livestock associations, in some cases at least of national scope and importance, believe their associations should be represented on the Executive Board. With that belief, I am in accordance. Further, I do not think the prestige or efficiency of the Association would be damaged in any way, rather the reverse, by admitting representatives of the livestock industry to membership on the Executive Board, providing the number admitted was not so great as to make the Board unwieldy. I believe there have already been proposals made along this line, and I trust all concerned will be able to get together on this matter and formulate and establish working arrangements which will be satisfactory to both professional and non-professional members of this Association. After all is said and done, the members of the livestock industry should be, and I believe are, our best friends. They own the livestock and are in a position to offer expert advice concerning the economic angles or aspects of any proposals or programs designed to control and eradicate diseases of livestock. Those of us who are directly concerned with disease control and eradication are quite well aware that if we could disregard entirely economic and other important factors, the actual control and eradication of almost any animal disease would be comparatively simple.

Now, a remark or so concerning the Executive Board of this Association.

It appears to me the Executive Board should be, if possible, allotted more time and better (at least, roomier) accommodations than at times in the past, for their deliberations and business. There has been a tendency to rush proceedings on account of the time factor. That is conducive to hastily arrived at decisions and perhaps neglect of important items.

I have very little more to say at this time, except to offer my apologies for not having been in a position to take a more active part in the affairs of this Association during the past year. However, I can honestly state that circumstances over which I had very little, or no control, prevented me from attending certain meetings here in the United States, arranged by organizations other than the United States Livestock Sanitary Association, but of concern to all veterinarians engaged in livestock sanitary and regulatory work. I was able to send a representative to one of these meetings. However, I believe our alert and redoubtable Secretary, Dr. R. A. Hendershott, was in attendance at those meetings, the agenda and results of which, I believe, have been recorded.

I believe you will find the program arranged for this meeting interesting and informative, as it has always been to my knowledge. There should be
a great deal of very timely information in the reports and papers to be presented. You will note there have been twenty or more different Committees appointed to bring in reports on matters of concern. You will note, also, the program is an extremely heavy one to deal with in the space of three days, so I would ask that all concerned do all possible to expedite the business of this meeting.

Finally, as the outgoing President of the Association, I wish the Officers and Members of this Association to know that the honor you conferred upon me when you elected me as your President was, and is, most deeply appreciated by myself and by my colleagues in Canada, where this high honor, bestowed on myself, is, I believe, rightly interpreted in Canada as a token of the esteem in which the veterinary profession of Canada is held by this Association. During my career I have felt very highly honored on a number of occasions, such as when I received my sheepskin as a veterinarian and simultaneously received my commission as a full Lieutenant in His Majesty’s Land Forces; my first Command in the Field; subsequent promotions in rank; selection as Assistant to the Veterinary Director General; finally, promotion to that office. The honor conferred by electing me as your President for the usual term of one year is classed with those other honors mentioned here. In conclusion, I wish you all to know, since I commenced attending your meetings beginning in the Autumn of 1947, I have derived no little pleasure and benefit from the contacts and friends made among the members of this Association, which, in bringing together annually, so much talent representing such wide professional and other fields of activity, renders invaluable service to the livestock industry and veterinarians representing all segments of the profession.
REPORT OF THE SECRETARY

R. A. HENDERSHOTT, Trenton, N. J.

During the year we here in the United States have been troubled, as I presume most of you know, with vesicular exanthema in swine. A year ago, when we met, the disease had been present since June and had traversed about forty of the forty-eight states. Since that time we have had many meetings relative to it, and a lot of action has taken place during the course of the year.

The disease has been eradicated or eliminated from the swine population of many of our states. I might say, too, that most of the states received infection through shipments of western swine that picked up infection or that were exposed either in loading yards, railroad yard pens where animals were unloaded for feed, water and rest, or were exposed to infection in railway cars and trucks that had not been cleaned and disinfected.

I pointed out a year ago the wise move of the Canadian officials in demanding that vehicles moving livestock be cleaned and disinfected with the discharge of the livestock at terminal points. This year we have tried to get such action from our Bureau of Animal Industry, and during the course of the year the Secretary of Agriculture, Ezra Taft Benson, requested that an advisory committee be formed, to sit with and advise him in regard to the control of this disease.

The Executive Committee of the United States Livestock Sanitary Association selected the Secretary to serve the Association as its representative on this advisory committee. Two meetings of the advisory committee group were held, one in January and the other in April. At those meetings members were appointed on the advisory committee from the National Grange, the American Farm Bureau Federation, the American Veterinary Medical Association, a representative of the railroads, a representative of the Meat Packing Industry and the American Meat Institute; and so we had quite a comprehensive committee, with broad coverage. I might say that appointed to this advisory committee were garbage feeders and grain feeding farmers.

At our first meeting the regulations of the Bureau of Animal Industry were reviewed, and it was requested that the Bureau prepare an informative pamphlet on vesicular exanthema, means of spread, and so on, and the damage that might be done to the livestock industry through the feeding of raw garbage. This pamphlet was prepared and distributed rather early after the meeting.

A new regulation or order came out from the Department of Agriculture as a result of the conference with the advisory committee, and we operated under that order for a number of months.
A second meeting was held in April, at which time we reviewed the progress that had been made up to that time in the eradication of vesicular exanthema. At the second meeting there were a number of additions as far as membership of the group was concerned. For example, at the first meeting I was the only regulatory veterinarian outside the Bureau who was present. At the second meeting Dr. Garrett of Iowa and Dr. Bendix of Virginia were present, and in the course of the discussion relative to the cleaning and disinfection of vehicles hauling swine, the question of the point at which these vehicles should be cleaned and disinfected was under discussion, also the question of time when the vehicles should be cleaned and disinfected.

The discussion centered principally around the cleaning and disinfection of trucks and railway cars. A number of our railroads run into a definite central point, and many of those railroads do not have cleaning and disinfection facilities available in the vicinity of the unloading point. The question was how far from the point of unloading we should permit a vehicle to travel before it is cleaned and disinfected.

Also, the question of whether they should be cleaned and disinfected prior to loading or after unloading came up, and these became questions of time and distance. It was left with the authorities in the Bureau of Animal Industry to consider the remarks made and to develop a regulation covering the so-called question of time and distance.

How they ever interpreted our remarks to mean or to provide that they come out with a regulation that vehicles be cleaned and disinfected only after they had traveled with swine a distance of more than 200 miles is beyond my comprehension, because that was not in the discussion at all. Many of us were rather astounded to find the report of the BAI recommending that swine that move for a distance up to 200 miles be exempt from cleaning and disinfection, whereas vehicles moving swine 201 miles would have to be cleaned and disinfected. Sometimes one wonders whether we are thinking about disease control and eradication when we come up with some of these ideas.

So, that matter has yet to be straightened out. Many of us believe that we understand why a distance of 200 miles was selected out of thin air for exemption from cleaning and disinfection. Obviously, if infectious disease is prevalent, the movement of a hog into a truck and taking it off exposes that truck, and in my opinion that vehicle should be cleaned and disinfected after it is used.

I also tried to get them to promulgate a regulation for the cleaning and disinfection of all vehicles hauling all types of livestock, but I guess it is a little bit premature for that type of regulation. We don’t seem to have the authority nor the fortitude to do some of the things you fellows above the border do, and I rather envy you the way you handle things in that connection. Certainly your regulation covering the cleaning and disinfection of vehicles is far superior to anything we have down here, and all we can do is hope that in the not too distant future we too will have the fortitude
REPORT OF THE SECRETARY-TREASURER

...to demand that vehicles carrying livestock of any species must be cleaned and disinfected at the point of unloading. We spend a great deal of effort in establishing disease free animal populations and then permit these animals to be transported in non-disinfected conveyances wherein they may be exposed to disease producing agents.

During the year we have added several new committees to our list of Association committees. One is the Committee on Stockyards, Markets and Transportation, the feeling being that we have a lot of business which should be settled between members of this particular type of industry and the Livestock Sanitary Association. The membership of this Committee, we feel, was well chosen. They will report this morning, and I hope will lay the foundation of the very important work that will be carried on during the next year. As the work of this committee will of necessity be that of education, appreciation of the problems confronting the livestock industry and likely result in major changes in operating methods I would suggest that with a few additions it be continued with the present personnel.

There is a subcommittee of our National Committee on the Eradication of Hog Cholera, set up to prepare a pamphlet on "What is Known About Hog Cholera." We have some very active members on this subcommittee, and they have worked very hard during the past year in the preparation of such a report.

I hope that shortly it will be in shape so that we can put it in the hands of the printer and have it distributed throughout the United States, with the idea in mind that it will keep our farmers better informed with regard to this virus disease and the methods at hand for its control and eradication.

It also fell to my lot, because our representative on the National Brucellosis Committee was unable to attend their meetings in Chicago, to attend in his stead. We had two meetings in Chicago, one last fall and the second one last May. That report is to be given this morning, too.

While I am on my feet I might give you the report of that Committee because we would like to pick up a little time this morning, in that we have an additional paper on vesicular stomatitis in swine which we would like to include in the program.

At the first meeting a seven-point program was developed. I might brief you a little bit on what the National Brucellosis Committee is.

Back in March 1949 we had a meeting in Washington which was sort of a terminal meeting of prior regional meetings on brucellosis. It fell to my lot to serve as chairman of the meeting and I recommended that a committee be formulated, representing all phases of the industry and animal and human health, to sit down and work out a program, particularly one looking toward the advancement of brucellosis eradication in the United States.

I don't recall offhand all the members of that particular Committee, but they were many and varied. Among them were the range and semi-range people, commercial beef breeders, U. S. Public Health Service, the AMA,
the AVMA, and allied organizations. They met and appointed Bill Knox, of Fort Atkinson, Wisconsin, as their temporary secretary.

Later on it developed that there was considerable work to be done by this Committee, and they needed some finances to carry on their Committee work. Then Livestock Conservation, Inc. was reorganized and had a live-wire secretary who was really getting some publicity out on some other work, and it was determined that Livestock Conservation, Inc. might be a good place to transfer the duties of the National Brucellosis Committee. This was accomplished, and we now have a subcommittee of the National Brucellosis Committee in Livestock Conservation, Inc.

They have presented to Livestock Conservation, Inc. a seven-point program on brucellosis which consists of the following:

1. Prepare a monthly press and radio release.
2. Assemble available promotional literature and research reports.
3. Prepare a promotional brochure.
4. Promote specific magazine articles to be edited by members of National Brucellosis Committee in cooperation with Committee on Education.
5. Survey—Secure Dr. Kuttler's regular report on testing, vaccinations and ring test.
6. Establish a Speakers Bureau, and secure definite commitments from directors of National Brucellosis Committee, qualified personnel of member organizations, state and federal agencies, etc., who will make themselves available for speaking engagements in different sections of the country.
7. Poster promotion.

They divided the group into a number of subgroups. One was supposed to solicit contributions from industry, and they raised something like $3,400 or more which was far short of the goal set. This money was turned over to Livestock, Inc.

The question came up about how they were going to proceed, and it was rather interesting for me to sit in at their first meeting and hear them talking about getting out advertising material all over the United States, trying to promote a brucellosis eradication program. Nobody had thought to get information relative to where we stood, nation-wide, with regard to brucellosis eradication. I pointed out to them that east of the Mississippi I didn't think we needed much in the way of a booster for the brucellosis eradication program, that we were handling about all the work in the eastern states that we could possibly handle with the personnel available to us and the money available to use in those states, but I did think they should survey the entire United States and find out where their services could be used to advantage in the advancement of the brucellosis eradication program, and devote their effort in that particular direction.

At the second meeting in the spring a very interesting session was held, and we had reports from some of the range and semi-range states relative to the advancement that had been made in those areas in advancing the program of brucellosis eradication.
A subcommittee was formed to try to iron out some of the differences that seemed to be cropping up with respect to the use of lay personnel in the program of vaccination of calves in range and semi-range areas, in those particular States where there was a scarcity of veterinary personnel to handle the work.

They had asked me to serve on the subcommittee, and that subcommittee made a report somewhat as follows:

1. That veterinarians should perform the services necessary for the eradication of brucellosis whenever possible.

2. That there are some areas particularly in the range states where it is not possible to get veterinarians to vaccinate all the calves.

3. That since the promiscuous use of brucella vaccine without official records is undesirable and interferes with the sale of these animals and thereby discourages vaccination and the eradication of brucellosis.

4. That therefore, in such areas where veterinarians are not able to vaccinate all the calves, technicians should be authorized to do official vaccination after proper training and under the strict supervision of regularly employed veterinarians. Such technicians will be authorized to do official calf vaccination only after receiving written approval to do so from the state livestock sanitary official, and while working under the supervision of a veterinarian as outlined in this report.

5. That such technicians shall be under the direct supervision of a veterinarian, which means that the technician shall be observed regularly while performing their duty at least once a week so that the supervising veterinarian can determine whether or not the technician is performing his duties in a satisfactory manner.

6. That all state livestock sanitary officials are requested to accept cattle vaccinated as calves by technicians under supervision as outlined above as official vaccinates when they are so certified by the livestock sanitary official of the state of origin.

7. That all such plans for the use of technicians be discussed thoroughly with the state veterinary medical associations concerned before they are initiated or announced.

8. That these technicians who are operating under the direct supervision of a regularly employed veterinarian shall be paid by the state or federal governments as are the supervising veterinarians. If state and federal funds are not available, steps should be taken promptly to correct this situation.

There was considerable discussion relative to this particular setup, and Dr. Van Houweling of the AVMA office was a member of the Committee and helped in the formulation of this recommendation.

It must be recognized and understood that in some range and semi-range areas we would not get animals vaccinated as calves if we endeavored to demand that all the vaccinations be performed by an approved and accredited veterinarian. Our main object and approach to this problem was that pri-
marily we want calves vaccinated. We would prefer to have them vaccinated by an approved and accredited veterinarian if the services were available and he could be employed to do it, but there are some areas where they are not in sufficient numbers to take care of the work, so some other method must be devised.

It is our feeling that the state regulatory officials should accept animals vaccinated in any state, provided they are official vaccinates permanently identified, and are approved by the livestock sanitary official of the state of origin.

I might say, too, that the livestock conservation group are very active in getting out information and promoting the brucellosis eradication project. They have put out a number of press releases. They have some colored brochures which they distribute. Dr. John R. Pickard is a member of our Association, and he is the Executive Secretary of Livestock, Inc., and a live-wire devoting full time to the work of their organization. Brucellosis has obtained a very good share of his effort and time for the little bit of money that they put into it.

I think they put in something like $3,500 into Livestock, Inc., and I am sure they have already received $10,000 worth of services from that group for their $3,500.
REPORT OF THE AUDITING COMMITTEE

A. K. MERRIMAN, Springfield, Illinois, Chairman, T. C. GREEN, Charleston, West Virginia, JAS. HAY, Columbus, Ohio.

PRESIDENT CHILDS: Gentlemen, we will open the final morning program. First will be the report of the Auditing Committee. Dr. T. C. Green, are you ready to report?

DR. T. C. GREEN: Mr. President and gentlemen, I have been requested by Dr. Merriman, Chairman of the Auditing Committee, to report for him because he had to leave this morning.

The Committee met and examined the records of the Secretary-Treasurer and found them to be in good order.

PRESIDENT CHILDS: Thank you, Dr. Green. The report will be referred to the Executive Committee for action.
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. Gustave A. Kay aged 75 died at his home in Dallas, Texas on February 10, 1953. Graduate of Chicago Veterinary College in 1902 he entered practice in Iowa. In 1906 he entered the service of the United States Bureau of Animal Industry serving in the Meat Inspection Division, Foot and Mouth Disease eradication and hog cholera control programs. He retired from the bureau in 1942 and since retirement was employed by the Texas Livestock Sanitary Board as veterinarian.

Dr. Harry B. Leonard age 73 died in Albany, New York March 16, 1953. Graduated from Cincinnati Veterinary College in 1905, he spent his veterinary life in the United States Bureau of Animal Industry. The last thirty years prior to retirement, he was inspector in charge of tuberculosis eradication in New York State.


He was prominent in disease control work in the bureau having served as Assistant Chief of the Field Inspection Division of which he became Chief in 1931. In 1941 he was advanced to Assistant Chief of the Bureau. He served on a number of committees of our Association and was familiar and active in all of the co-operative disease control programs.

In 1951 Doctor Fladness received the Department of Agriculture service award which read, “For your many and valuable contributions to agriculture through your outstanding and inspirational leadership in planning and directing livestock disease control and eradication functions of the Bureau, which have added immeasurably to the nation’s economy and the Department’s prestige in this country and abroad.”

Dr. James George Jervis aged 62 of Langley Prairie, British Columbia died on May 8, 1953. A graduate of Ontario Veterinary College he divided his time between general practice and veterinarian in the Health of Animals Division. He was past president of the British Columbia Veterinary Association.

Dr. Lester E. Patton aged 64 of Albuquerque, New Mexico died June 16, 1953. Graduated from Ohio State University in 1911, Doctor Patton spent his life in general practice.

Dr. Hilton O. von Rosenberg aged 55 of Detroit, Michigan died July 25,
MEMORIAL SERVICE

1953 following a years illness. Graduated in 1920 from the Texas Agricultural and Mechanical College he was employed by Parke, Davis and Company during practically all of his veterinary life.

I respectfully request all present to arise and remain standing to participate in a silent prayer for the peaceful repose of the souls of these deceased members.

SILENT PRAYER

Thank you, ladies and gentlemen, for your respectful participation.

My friends, I find myself inadequate on this occasion to conduct this service in the manner which it deserves. One of these men, Dr. Leonard, was a student of mine for three years, and the remainder of his life a dependable friend.

Another man, Dr. Fladness, was always cooperative and helpful during the twelve years I was state veterinarian of Indiana.

These two just mentioned with the others of this list have left us an inheritance wherein we are debtors to them for many things we cherish in our present lives.

These men gave much in toil and sacrifice that we might share in the fruits of their labor. While this inheritance gives privileges and makes advancement easier, it also imposes responsibilities which we must regard as sacred trusts for the future, never to be exploited nor wasted, but to be enriched and passed on to future generations.

They have gone from this earth to the higher realms of immortality. We will cherish their lives for their faithful service, their public and private virtues, and in our hearts build a monument, precious to their memory and comparable to their noble spirits.

Our fate is to follow them, and when we do, may we meet again on that beautiful isle of somewhere, not made with hands, eternal in the heavens.
REPORT OF THE COMMITTEE ON CONSTITUTION AND BY-LAWS


DR. SMITH: The Committee on Constitution and By-Laws, as you know, has had somewhat of a rough time during the past four or five years. Tempers have flared in many instances, much conversation has echoed around the halls, and there are already two proposals before the Executive Committee. Now we are coming in with a third proposal which we hope will satisfy all parties.

In all discussions we have at our annual meetings we get a little angry, but we don't get angry to the point that we don't carry on the work as it should be carried on and we return the following year and take up the problems that confront us.

These amendments have the approval of the entire Committee on Constitutions and By-Laws. The Committee was canvassed early in the summer and each member has given this a great deal of thought, I assure you.

Your Committee on Constitution and By-laws recommends that the following amendments to the Constitution of this Association be given due consideration as provided for under the Constitution:

1. Amend Article III, line 20 of the Constitution by adding a comma after Puerto Rico, delete (and) and insert the Virgin Islands and Los Angeles County, California, so that Article III as amended will read as follows:

   ARTICLE III — MEMBERSHIPS

   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, the Virgin Islands and Los Angeles County, California shall be eligible to official membership in this Association and be represented on the Executive Committee by the livestock sanitary executive official.

   Any person engaged in livestock sanitary work for federal, provincial, state, territory, county or municipal governments and any other person interested in livestock sanitation or milk and meat hygiene may be elected to individual membership.

2. Amend Article V, line 41 of the Constitution by deleting the sixth word (and) and inserting in its place a comma, and adding after Virgin Islands, Los Angeles County, California and eight delegates-at-large so that said Article V as amended will read as follows:
ARTICLE V — OFFICERS

The officers of this Association shall be the President, First Vice President, Second Vice-President, Third Vice President, Secretary-Treasurer, and 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 U. S. Bureau of Animal Industry, the Veterinary Director-General of Canada, the executive regulatory officer of Cuba and Mexico. The Territories, Puerto Rico, The Virgin Islands, Los Angeles County, California, eight delegates at large and the elected officers of this Association.

The Executive Committee shall constitute the administrative body of the Association and shall determine its activities and policies. All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee.

The First Vice President shall be ex-officio Chairman of the Executive Committee. The Executive Committee shall elect yearly a Secretary-Treasurer for the Association. The Secretary-Treasurer shall receive such salary and allowance as may be fixed by the Executive Committee.

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 by it in writing relative to the conduct of any member, and shall have authority to accept or reject applications for individual membership properly placed before them. Three negative votes shall disqualify for such membership.

3. Further amend the Constitution by adding a new section after Article VIII, labeled Article IX, “Nominating Committee”:

Nominating Committee: The Nominating Committee shall consist of five members of the Association, and shall be selected, one each from the regional districts as designated by the United States Department of Agriculture Extension Service, and one member-at-large. The name and address of each member shall be printed in the Proceedings of the annual meeting.

4. Further amend the Constitution by adding a second section labeled Article X reading as follows:

Article X: It shall be the duty of the Nominating Committee to canvass the membership of this Association and select eight delegates-at-large, as provided for in amendment No. 2. Said delegates must be selected from and represent the livestock industry. No district, as designated and provided for in amendment No. 3, shall be entitled to more than two delegates. Said delegates shall be elected by the General Assembly at the same time and place as other officers of this Association are elected."
The procedure that must be followed under our Constitution is that these amendments be referred to the Executive Committee for consideration; they must then lie over for one year, and be acted upon (either passed or rejected) at our next annual meeting.

For your information I shall read Article VIII as it now stands in our Constitution, referring to 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."

Mr. President, I ask that the report of the Committee on Constitution and By-laws be referred to the Executive Committee.

PRESIDENT CHILDS: This important report is before you for discussion. There being no discussion the report is referred to the Executive Committee and we shall adjourn until 1:30.
REPORT OF THE COMMITTEE ON LAWS AND REGULATIONS


This committee has endeavored for many years to bring about the adoption of a uniform set of regulations governing the interstate movement of livestock. In fact, in reviewing the old reports it was a matter for discussion over forty years ago. During the life of the Association, very sincere and concerted efforts have been made from time to time to bring about the preparation and adoption of uniform interstate regulations but never until 1944 was a definite move made and approved by the Association.

At the 53rd Annual Meeting held in Columbus, Ohio, in 1949, Dr. H. U. Garrett, Chairman of the Laws and Regulations Committee, made a very exhaustive study of the rules and regulations governing the interstate movement of livestock as promulgated by all states. His findings led him and his committee to believe that complete uniformity of regulations was practically impossible because of the varied conditions affecting different states, especially the importing and exporting states, and because of the varied opinions of regulatory officials of standard disease-control programs. It was further brought out that too many state veterinarians are in office for too short a time because of politics and inadequate salaries for them actually to become thoroughly versed in disease control. It was the belief of that committee that a standard could be compiled setting forth the maximum state requirements so that any individual desiring to ship livestock to any place in the United States could do so if such livestock were prepared in accordance with these maximum requirements. Since the regulations of many states did not have requirements equal to the maximum, it was suggested that downward deviations from the maximum could be shown under the names of the states in Circular 1. This report was discussed at great length and with considerable feeling, with the result that it was held over for reconsideration at the next meeting.

It was recommended by the Committee on Laws and Regulations, and approved by the Executive Committee, at the meeting held in Kansas City in 1951 that Circular 1 Revised be published and that the compilation of maximum requirements as adopted by the Association in Phoenix, Arizona, in 1950, be revised so as to bring current state requirements up to date and that the maximum requirements be published in the forepart of Circular 1, and that the downward deviations of the various states be printed alphabetically under the roster of states.
In that report it was further recommended that future committees on laws and regulations prepare and present annually for the consideration of this association a uniform interstate regulation covering one or more species of animal, including poultry.

At this time your committee on Laws and Regulations feels that it is making progress toward the preparation of standard regulations which will fulfill the requirements of most states and that a "Standard Regulation" is more applicable than the maximum, as the maximum requirement in some instances may be that of only one or a very few states.

Instead of setting up the maximum requirements as the standard we believe it would be more appropriate to compile a standard regulation which can be modified from year to year, or at least every two years preceding the publication of Circular 1, so that it will more closely meet current disease problems and the accepted methods of control and eradication. Your committee believes that the respective states can then prepare their deviations from this standard regulation, for publication in Circular 1, which we propose to be known as:

**STANDARD REGULATION GOVERNING THE INTERSTATE MOVEMENT OF LIVESTOCK, DOGS, PETS, POULTRY, BIRDS, WILD ANIMALS AND BIOLOGICS: AND SANITARY STANDARDS GOVERNING THE CLEANING AND DISINFECTION OF CARS, TRUCKS AND CONVEYANCES USED FOR TRANSPORTATION OF ANIMALS AND POULTRY**

**READ MODIFICATION OF STANDARD REGULATION UNDER STATE OF DESTINATION**

**SECTION I — GENERAL**

A. No animal, including poultry or birds of any species, that is affected with or that has recently been exposed to, any infectious, contagious, or communicable disease or that originates from a quarantined area, shall be shipped or in any manner transported or moved into the state until written permission for such entry is first obtained from the livestock sanitary official of the state of destination, except those animals affected with such diseases which are approved for interstate shipment by the United States Bureau of Animal Industry for immediate slaughter.

B. A copy of the approved official health certificate shall be forwarded immediately by air mail, or the most rapid means available, to the livestock sanitary official of the state of destination.

C. All livestock imported into the state shall be accompanied by an official health certificate or permit, or both, which must be attached to the waybill or shall be in the possession of the driver of the vehicle or person in charge of the livestock.

D. Requirements for the exhibition of livestock must for the present be secured by contacting the livestock sanitary official of the state in which the animals are to be exhibited.
E. All animals covered by these regulations originating from public stock yards or which may be assembled at public stock yards or any concentration point from sources of unknown origin shall be required to meet regulations of state of destination before being released.

F. Livestock entering the state without a proper health certificate or a permit, or both, when required, shall be held in quarantine at owner's risk and expense until released by the livestock sanitary official.

G. Who may inspect: Accredited, licensed graduate veterinarians who are approved by the livestock sanitary official of the state of origin and veterinarians in the employ of the United States Bureau of Animal Industry.

H. Who may approve: All health certificates shall bear the approval of the livestock sanitary official of the state of origin.

SECTION II — OFFICIAL HEALTH CERTIFICATE

A. An official health certificate is a legible record covering the requirements of the state of destination, accomplished on a pink colored official form of a standard size from the state of origin and approved by the livestock sanitary official of the state of origin, or an equivalent form from the United States Bureau of Animal Industry, and issued by a licensed, graduate, accredited veterinarian who is approved by the proper livestock sanitary official of the state of origin and the proper official of the United States Bureau of Animal Industry.

B. The health certificate shall contain the names of and addresses of the consignor, the origin of the animals, the final destination of the animals and the consignee's address with an accurate description or identification of the livestock and shall also indicate the health status of the animals involved including results of required tests as well as dates and vaccination, if any. Health certificates shall be void thirty (30) days after date of inspection and issuance. No health certificate shall be issued unless it can be issued to comply in all respects with requirements of the state of destination, unless specifically otherwise authorized in writing.

C. All brucellosis agglutination tests of animals which are intended for interstate movement shall be made in (1) state or federal laboratories, (2) laboratories approved by the proper livestock sanitary official of the state of origin, or (3) commercial laboratories operated under the supervision of the United States Bureau of Animal Industry and approved by state of origin.

SECTION III — PERMITS

A. Request for permits shall be directed to the chief livestock sanitary official of the state of destination and shall set forth the following information: number and kind of animals; origin of shipment; proposed date of shipment; proposed destination; proposed arrival date; and intended purpose of shipment.

B. All animals entering the state under permit shall be consigned to a
natural person who is a resident of the state or to a legal entity authorized by law to do business within the state.

C. All permits shall be void fifteen (15) days after date of issuance.

SECTION IV — DUTIES OF CARRIERS

A. Owners and operators of common carriers, trucks, and other conveyances are forbidden to move any livestock into or within the state or through the state except in compliance with the provisions set forth in these regulations.

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

C. Owners and operators of railway cars, trucks, and other conveyances that have been used for the movement of any livestock infected with or exposed to any infectious, contagious or communicable disease shall be required to have such cars, trucks, and other conveyances thoroughly cleaned and disinfected under official supervision, before further use is permissible, for the transportation of livestock.

LIVESTOCK

(General Rules under Sections I, II, III, and IV apply to all subsequent sections)

SECTION V — CATTLE

Tuberculosis

Cattle for dairy and breeding purposes may enter the state if:

- They originate in an accredited tuberculosis-free herd, or in qualified negative herds in modified accredited tuberculosis-free areas, the last herd test of which was made within (12) months prior to shipment.

Brucellosis

Cattle for dairy and breeding purposes may enter the State if:

(a) They originate directly from officially certified brucellosis-free herds.

(b) They have passed a negative agglutination blood test within thirty days of date of shipment.

(c) They are strictly feeder cattle of the beef breeds originating directly from herds, not under quarantine for brucellosis, in modified-certified brucellosis-free areas.

(d) Steers, spayed heifers and calves under six (6) months of age.

(e) They are officially calfhood vaccinated animals under 24 months of age and properly identified.

(f) They are for immediate slaughter, consigned to a recognized slaughtering center or public stockyard where federal inspection is main-
tained, they may enter the state without a health certificate or a negative test for tuberculosis and brucellosis and shall be considered as under quarantine until slaughtered.

**Scabies**

No cattle affected with or exposed to scabies shall be shipped, trailed driven, or otherwise transported or moved into another state for any purpose.

**Immediate Slaughter**

Cattle for immediate slaughter, consigned to a recognized slaughtering center or public stockyard where federal inspection is maintained, may enter the state without a health certificate or a negative test for tuberculosis and brucellosis and shall be considered as under quarantine until slaughtered.

**Section VI — Dogs**

All dogs to be transported or moved into the state for any purpose shall be admitted only when accompanied by a health certificate stating the animal is free from all infectious diseases, did not originate within an area under quarantine for rabies or an area where rabies is known to exist, even though not quarantined, has not been exposed to rabies, and has been vaccinated against rabies and identified by proper identification tag and certificate not more than twelve (12) months prior to shipment.

**Section VII — Goats**

Goats for dairy and breeding purposes, may enter the state provided they are accompanied by a health certificate showing they come from a certified brucellosis-free herd, are negative to the agglutination test for brucellosis within thirty (30) days of date of entry, and are clinically free from all other infectious and communicable diseases. The health certificate shall contain a full description of each animal, giving age, color, and markings.

Goats for immediate slaughter: Apparently healthy goats may be moved into the state when consigned directly to a recognized public stockyard or a slaughtering establishment or slaughtering center, that is approved and designated by the bureau of animal industry, United States Department of Agriculture and the livestock sanitary official of the state of destination.

**Section VIII — Horses, Mules, and Asses**

These animals may be transported or moved into the state when accompanied by an official health certificate.

**Section IX — Poultry**

Chickens, turkeys, or other poultry over five (5) months of age intended for breeding purposes shall not be shipped or in any manner moved into the
state unless they have passed a standard intradermic tuberculin test and a negative agglutination test for pullorum disease under the supervision of the livestock sanitary official within thirty (30) days preceding date of importation or have originated from flocks authoritatively participating in such pullorum control and eradication phase of the National Poultry Improvement Plan or National Turkey Improvement Plan as may be adopted in state of origin.

Hatching eggs shall not be transported into the state unless they are shipped from a hatchery or a premises under the supervision of the poultry disease control authorities of the state of origin and their pullorum classification is "pullorum passed" or better.

**SECTION X — SHEEP**

A. General. All sheep entering the state for purposes other than immediate slaughter shall be accompanied by a health certificate indicating they are free from scabies, lice, foot rot, and all other infectious or communicable diseases, and have not been exposed to such diseases. If the sheep originate from a state known to have scabies, they shall be accompanied by a permit from the state of destination, which shall be attached to the health certificate, which health certificate shall show the sheep to have been dipped once in a wettable benzene hexachloride (BHC) or lindane containing gamma isomer concentrate of not less than 0.06 per cent within ten (10) days prior to date of importation or to have been dipped twice in lime and sulphur with the dippings ten (10) to fourteen (14) days apart and the last dipping within ten (10) days prior to date of importation. All such dippings shall be under state or federal supervision.

B. Feeder lambs. Lambs may be shipped or moved into the state for feeding purposes, provided they are accompanied by a health certificate indicating they originated from a state free of scabies and are free from infectious diseases or recent exposure thereto.

**SECTION XI — SWINE**

A. General. All swine transported or moved interstate shall be accompanied by a health certificate showing that the premises of origin and the swine have been given a veterinary inspection just prior to shipment and that the swine have not been fed raw garbage and have not been affected with or exposed to vesicular exanthema or other contagious or communicable diseases.

B. Feeder swine. Swine for feeding purposes may enter the state providing they are accompanied by the health certificate as required in paragraph A and in addition thereto indicate such swine shall have been vaccinated with anti-hog cholera serum and virus not less than thirty (30) days prior to date of entry or a modified hog cholera virus with anti-hog cholera serum as recommended by the biological manufacturer not less than fifteen (15) days prior to date of entry, or serum alone just prior to shipment.
C. Breeding swine. Swine for breeding purposes may enter the state providing they comply with paragraphs A and B and in addition thereto originated in a brucellosis-free herd and are negative to the brucellosis agglutination test within thirty (30) days of date of entry.

"The requirements in the Standard Regulation qualify most shipments for interstate movement. However, the amended requirements of the state of destination must be consulted and complied with in every respect before health certificates are issued."

Your Committee recommends:

1. The adoption and printing of the proposed Standard Regulation as set forth in this report in the front of Circular I.

2. That the new committee be composed of veterinary members from the east, southeast, south, southwest, central and western states, the Bureau and three livestock men who are active in this problem.

3. That regional meetings of representatives from the various regions be held between national meetings and their suggestions forwarded to the Chairman.
DISCUSSION OF HEALTH REQUIREMENT ON BRUCELLA VACCINATES IN REPORT OF THE COMMITTEE ON LAWS AND REGULATIONS

PRESIDENT CHILDS: Dr. Wilkins wishes to be recognized for the purpose of amending the report of the Committee on Laws and Regulations.

DR. WILKINS: Mr. President and members of the Association, when we made the report of the Committee on Laws and Regulations we left out (to be put in at a later time during this meeting) regulations governing the interstate movement of cattle regarding brucellosis. I have the following amendment to present:

Cattle for dairy and breeding purposes may enter the state if:

A. They originate directly from officially certified brucellosis-free herds.

B. They have passed a negative agglutination blood test within thirty days of shipment.

C. They are strictly feeder cattle of the beef breeds originating directly from herds not under quarantine for brucellosis in modified certified brucellosis-free areas.

D. Steers, spayed heifers, and calves under eight months of age.

E. They are officially calf vaccinated animals under thirty months of age and properly identified.

F. Cattle for immediate slaughter, consigned to a recognized slaughtering center or public stockyard where federal inspection is maintained, may enter the state without a health certificate or a negative test for tuberculosis and brucellosis, and shall be considered as under quarantine until slaughtered.

DR. WEST: Mr. President, in order to keep the record straight, I would like to point out that our present regulations, which have not been amended, provide for the movement of cattle inter-herd—from herd to herd—vaccinated animals until they are 24 months of age. The regulations also provide that vaccinated animals may remain in the herd, regardless of titer, until 30 months of age.

However, this is a movement interstate which would be tantamount to movement from herd to herd. It is true that yesterday this organization heard the report of the Committee on Brucellosis, which included a proposed interstate regulation to be promulgated by the Secretary of Agriculture, which provided exactly what Dr. Wilkens’ proposal provides—that animals be moved interstate until 30 months of age, if vaccinated, without a test.

As Chairman of the Committee I made an introductory statement that this did not intend to imply that state regulations should be altered to provide for a change to 30 months of age.

The report of the Committee made just now by Dr. Wilkins, as I under-
DISCUSSION OF LAWS AND REGULATIONS

stand it, is a proposed standard regulation, and it is my opinion that it is not consistent with the action taken by this organization in previous years, which is still on the books, so to speak, namely, that vaccinated animals may be moved inter-herd on a brucellosis basis only if they are negative after 24 months of age.

SECRETARY HENDERSHOTT: Why don’t you make a motion that we change it back to where it belongs, Ralph?

DR. WEST: I don’t think this is the proper place to do it. This must be considered by the Executive Committee. I wanted to make this statement for the benefit of the Assembly as a whole. I don’t believe the Assembly can change the report.

Dr. Hendershott corrects me and states that the General Assembly has the right to vote an amendment or to take action recommending an amendment to a report.

Therefore, I will move that this organization recommend that the figure “30” be amended to “24” when it applies to the interstate movement of vaccinated cattle.

SECRETARY HENDERSHOTT: I second that motion.

(The motion was put to a vote and was carried.)

DR. WEST: I understand from the vote that there are some persons in this group who wish to discuss this matter. I haven’t heard your interpretation, but in my opinion there is a division of opinion here sufficient so that you can’t declare the motion carried. I believe it would be proper to call for discussion on the motion before it is put.

DR. WILKINS: Mr. President, we are not offering this as a standard for all states to abide by. This is part of our standard regulations, from which any state may deviate. This does meet the requirements of a good many states, to my knowledge, particularly the western states, and those states which would not care to go along with the 30-month qualification could modify their regulations to comply with whatever theirs may be, whether it is 18 months or 24 months.

We have some states that will not accept vaccinates over 18 months of age without a negative test. This is no different from any other phase of the standard regulations, from which deviations may be made. I can’t see that there is anything to be accomplished in changing this from 30 to 24 months. It will just increase the deviations in the various states. I would like to see the 30 months prevail.

SECRETARY HENDERSHOTT: I heartily agree with my friend from Montana in his statement supporting this. That same statement can be used in support of the present regulation.

For a number of years, as Dr. West stated, we debated this subject matter, and heretofore, in our Brucellosis Committee reports, as you all know, we provided that for the inter-herd and interstate movement, animals that had been vaccinated officially as calves could move in interstate commerce up to
24 months of age regardless of their reaction. We also provided for the maintenance up to 30 months of age of calf-vaccinated animals showing titers, within the herd in which they were vaccinated.

I think that is a sound regulation. We have been living by it for a number of years. I have had an ingrown fear from the time we met in Memphis, at a regional meeting on brucellosis, that, as they say about the Ford automobile, you start in with a cheap automobile, and it nickels and dimes you to death. We start in with a regulation, and then we start to appease and to give, until from a disease control standpoint, the regulation is exactly opposite to that for which the regulation was written.

This proposal of Dr. Wilkins is a matter of appeasing and giving, in my opinion. We extended to 30 months the deadline for the retention of vaccinated suspects and positives in the herds where they had been vaccinated, and I think that was not unsound. Now we find ourselves confronted with the proposal that we extend to 30 months the freedom of movement of such animals in interstate commerce. There are other proposals that would extend that time up to 36 months, and some even up to 48 months. I presume that if we continue we will extend it to the life of the animal.

I think it is about time we stopped this appeasing program. We have had a regulation on our books for years that provided for the interherd movement at 24 months. I think it has been working adequately for all concerned. I don’t see any sense in making a change and extending it to 30 months.

As far as deviations are concerned, we can make deviations as we did before, from 24 months, just as easily as we can from 30 months. I would exhort you to return to our old regulation. Let’s have our interherd movement up to 24 months of age, and beyond that time move only on a negative test. Within the herd the maintenance of calf-vaccinated reactors up to 30 months of age depending on the stage of pregnancy is not too bad. To expect a purchaser to relieve you of such animals is carrying it too far.

DR. GREEN: Mr. President, I fail to follow my good friend Dr. Wilkins. He seems to have a one-sided rule. He tells those of us who are not in favor of the 30-month limitation that we can make deviations. By the same token, it would seem to me that those who want to accept cattle carrying a titer up to 30 months could also make deviations. It would appear to me that we should leave the rule as it is, and if in his State or in other states they want to accept cattle carrying a titer up to 30 months of age, that is their privilege. They can make their deviation in that direction.

PRESIDENT CHILDS: It seems to be the aim of this Association (and we hope it will be carried out) to establish uniformity and simplicity as far as possible in handling these matters. I think this might well go back to the Executive Committee for ruling and adjustment.

We have a very heavy agenda this morning, and in order to get through on time we will have to hasten along. If you will accept my ruling on this, I will rule that this will be presented to the Executive Committee.
DR. WEST: Mr. President, there is a motion before the house, a recommendation from this General Assembly to the Executive Committee. I think it is only fair to give both sides of the General Assembly a chance to express their views.

I call for a vote on the motion as originally made, that the Executive Committee be instructed to change the figure “30” to “24” in this report. The motion has been made and seconded, and I believe it should be put.

PRESIDENT CHILDS: Very well. We will vote again on the motion.
(The motion was put to a vote and was carried, Dr. Wilkins voting “no”.)
REPORT OF THE COMMITTEE ON LEGISLATION


Mr. President and Members of the Association: Your Committee on Legislation met last night. We wish to report that no matters of pending legislation have been brought to our attention. We know of none that we wish to report to you at this time.

However, we do wish to commend the Bureau of Animal Industry and the regulatory officials of the several states, together with their good people back home, for the prompt and efficient way in which they maneuvered legislation through their legislatures relative to the cooking of garbage here in the United States. (Applause)

I am informed that, out of the forty-eight states, forty-one have legislation covering this subject. Most of the legislation is the same in each state. Either they have legislation or proper regulations requiring the cooking of all garbage.

It seems to this Committee that this has been a long time coming, and it is a forward step, and demonstrates what can be done if we really get down to business.

We have made a few recommendations to the Resolutions Committee, and I am sure they will be presented later on in the meeting.

Thank you.
REPORT OF THE NORTHEASTERN STATES
REGULATORY OFFICIALS' MEETING

JEAN V. SMITH, Hartford, Connecticut

It is a pleasure to report for the Northeastern States Regulatory Livestock Officials. This group was organized in October 1951. We have held several special meetings since that time. When we organized it was planned to hold at least one meeting a year, generally between the time the AVMA held its convention and the time of our Livestock Sanitary Association meeting.

During the past year we in the Northeast have been particularly involved in vesicular exanthema, and the problems of one state have been very similar to the problems of another state. We have found it very helpful to get together and discuss our problems pertaining to the control and eradication of this disease.

In the future, if some similar condition develops, or even just our ordinary problems, no doubt they will be discussed at length in these meetings.

In June we held a meeting in New York, and we had the pleasure of having Dr. Mulhern with us. After he listened to our problems and what we were doing to overcome them, he gave us a very enlightening picture concerning the development of the work in the control of vesicular exanthema. Dr. Brueckner of Maryland is Chairman and I am Secretary. We don't have any Treasurer because we don't have enough money up in the Northeast. (Laughter) It is hoped that this little group can stay together and that the officials can meet at various intervals and discuss their problems, and in that way make it easier for us when we come to the National meetings.

Thank you.
REPORT OF THE MEETING OF THE ELEVEN WESTERN STATES SANITARY OFFICIALS CONFERENCE AT THE NEW HOUSE HOTEL, SALT LAKE CITY, MAY 6 AND 7, 1953

The organizational meeting was attended by regulatory officials of ten states at which time the following officers were elected:

Dr. A. P. Schneider, Idaho, President
Dr. K. J. Peterson, Oregon, Vice-President
Dr. M. N. Riemenschneider, Colorado, Secretary-Treasurer

The organization anticipates holding annual meetings to better meet the Livestock problems of special interest and significance to the area.

Dr. R. A. Alexander, Veterinary Director, Union of South Africa, gave a very timely and informative talk on bluetongue. Dr. Alexander discussed other disease problems of his country, including anaplasmosis.

Dr. H. G. Stoenner, U. S. Public Health Research Laboratory, Hamilton, Montana, discussed the results of their research on Leptospirosis. Dr. Stoenner contributed a great deal to the discussions on anaplasmosis.
REPORT OF REPRESENTATIVE TO THE POULTRY BRANCH
PRODUCTION AND MARKETING ADMINISTRATION

A. L. Brueckner, College Park, Maryland

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. A list of the names of those present at the meeting is attached.

1. Review of progress in USDA'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 con-
duct 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 U. S. 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 individuals 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 Dr. Allen M. Greenlee that has been made in the past year.

6. **Next Group Meeting.** 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.

The following persons attended the meeting:

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<tr>
<td>Dr. Carl H. Koonz</td>
<td>Institute of American Poultry Industries</td>
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<td>Mr. Jack Shoemaker</td>
<td>Natl. Poultry Producers Federation</td>
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<tr>
<td>Mr. Herbert Beyers</td>
<td>Pacific Dairy &amp; Poultry Association</td>
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<td>Mr. Hollis Shomo</td>
<td>Assn. of State and Territorial Health Officers</td>
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<td>Mr. Victor Pringle</td>
<td>Poultry and Egg National Board</td>
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Mr. W. D. Termohlen, Director of the Poultry Branch, Production and Marketing Administration, U. S. Department of Agriculture, was Chairman of the meeting.

1. Review of progress in U. S. Dept. of Agriculture's poultry programs. Mr. H. G. F. Hamann, Chief, Inspection and Grading Division, Poultry Branch reviewed the progress and growth of the grading and inspection programs. Growth in the inspection service was illustrated by showing that the inspection of poultry had increased almost 61 per cent from July 1, 1951 to January 1, 1953. The total number of plants using the inspection service on January 1, 1953 was 226. The number of veterinarians employed on the same date was 256, and the number of post mortem lay inspectors was 68. It was pointed out during this discussion that all the veterinarians employed in the Inspection Service are Federal employees. The uses, limitations, and training of lay inspectors were reviewed and the high quality of personnel applying for lay inspectors jobs was pointed out.

Between July 1, 1951 and January 1, 1953, the grading of poultry and poultry products increased approximately 25 per cent. Some of the graders in the Grading Service are Federal employees, while others remain on company payrolls and are licensed by the Administrator of the Production and Marketing Administration.

W. Termohlen announced that Dr. Roy Willie, formerly a Regional Supervisor in the Poultry Inspection Service, was brought to the Washington office of the Poultry Branch as Assistant Chief of the Inspection and Grading Division. One of his major responsibilities lies in the field of Sanitation as it pertains to both poultry and egg processing plants.

2. Report of the activities of public health groups in connection with poultry processing, sanitation, and inspection. Dr. James Lieberman, U. S. Public Health Service, pointed out that at the last meeting of the 14-man liaison committee, utilized by the Public Health Service, interest in the early
issuance of the Standard Sanitation Code was expressed. It was further explained that the 14-man liaison committee, which is composed of 7 representatives, was appointed to cooperate in the development of the Standard Sanitation Code at the request of the Institute of American Poultry Industries. This request was made last July. Previously (in 1948), the Association of State and Territorial Health Officers had suggested that such a code be developed.

Mr. A. H. Fletcher, New Jersey State Department of Health, stated that at the last meeting of the Conference of State Sanitary Engineers, interest was expressed in the Standard Sanitation Code being developed by the U. S. Public Health Service. A paper entitled “Poultry Grading From the Standpoint of the Public Health Officer” was delivered at the last meeting of the Conference.

Dr. J. L. Cherry, Dover, Delaware, presented a letter received by him from the Executive Secretary of the American Veterinary Medical Association authorizing him to represent that Association and to present their position in regard to the formal education for lay food inspectors. Their position in this respect was mimeographed and attached to the letter addressed to Dr. Cherry. It reads as follows:

"1. Definition of the function of the lay inspector conducting ante- and post-mortem inspections of food animals including poultry. To sort animals, including poultry, their carcasses and parts for the final judgement of the veterinarian, that is, to sort the abnormal from the normal. The normal may be passed without restriction, but the decision on disposition of the abnormal shall be left to the judgment of the veterinarian.

2. The training of the Lay Inspector.

The consensus was that no particular academic education shall be required; however, a level of intelligence comparable to that possessed by a person with a high school education will assure that the incumbent is able to understand and follow instructions. A well organized-on-the-job training shall be required combining both demonstration and conference methods."

It was pointed out by Mr. Hamann that this is practically the exact procedure now followed by the Inspection Section of the Inspection and Grading Division.

W. D. Termohlen, pointed out that the Poultry Branch has been conducting sanitation schools for people from processing plants using the Branch's sanitation program. Increased interest in the problem of waste disposal, particularly as it relates to sewage and stream pollution, was indicated. In this connection, it was stated that the Poultry Branch hopes to conduct additional research in this field.

would be available, Dr. Liebman remarked that the U. S. Public Health Service is aiming for July, 1953, as the time the Code will be sent to the printing office. However, it was pointed out that many things could happen between now and July to change the picture in this respect. A working draft of the code will be ready within a week to be circularized for review and suggestions by authorities in the field. Copies of this draft will also be circulated to a selected, representative group within the poultry industry for comments and suggestions. At this point, it was explained that the complete standard code being produced by the U. S. Public Health Service would be in two parts—one on sanitation, and one on inspection for wholesomeness. The sanitation section is the one in which most groups are primarily interested. It was the objective of the U. S. Public Health Service to prepare the final code in two sections.

In explaining further provisions of the standard code, it was stated that the disposal of waste was provided for. Such provisions in the code will be consistent with the latest and best practices now being used and with the latest available research results.

The question arose as to where States and municipalities could get qualified people to deal with part 2 of the standard code (inspection for wholesomeness). It was agreed by the Group that this was going to be a difficult problem. Dr. Lieberman stated that there were three ways the code could be used: (1) A community could adopt the whole code, carrying out the provisions in both parts; or (2) they could adopt the sanitation part of the code and use the U. S. Department of Agriculture’s Inspection Service in conjunction with it; or (3) if they could not adopt the inspection part of the code, they could at least adopt the sanitation section.

In connection with the discussion of the standard code, the Group felt that such a code would help to eliminate trade barriers and promote the free exchange of food products between areas. They felt that special effort should be given to notifying even the smaller municipalities of the coming availability of the Standard Code. In this connection, it was brought out that State and municipal health authorities had been notified of the standard code’s coming availability and had been asked to abstain from writing codes of their own until it was available.

4. Educational materials pertaining to poultry inspection and grading.

Mr. M. W. Buster, Chief, Marketing Services Division, Poultry Branch, reviewed the publications and educational materials produced and to be produced by the Branch. These materials included grading and marketing bulletins, regulations, quality and consumer charts, grading manuals, and others. Recommendations pertaining to the production of materials such as these were requested. The Group felt that more advertisement should be given the inspection mark and what it stands for.

The Group was asked for an opinion as to the value of a proposed equipment and facilities workshop for manufacturers, U. S. Department of Agricul-
ture representatives, poultry industry people, and other interested parties. The reaction of the Group was favorable to this type of school, provided it was well organized and conducted.

5. Report on contacts made with the National Research Council in conducting a study on poultry inspection.

Dr. E. H. Matzen, Chief, Research Division, Poultry Branch, reported that the Council had not as yet been approached on this particular problem. Background information, however, has been obtained since the last meeting of this Advisory Group. Since there is no immediate prospect for funds for this project, Dr. Matzen felt it would be a good idea to wait until the report of a study made by the National Research Council on Milk Ordinances was available and could be appraised before deciding whether or not this study on poultry should be undertaken.

Mr. Fletcher, stated that the National Research Council was suggested for the research regarding the requirements for a program of inspection for wholesomeness of poultry because it seems desirable to have such work done by an independent agency having an excellent reputation for presenting unbiased results. He stated that among other things, such a study should give consideration to the following: Is an inspection program needed? What factors should be given consideration in providing an effective program? What are the personnel requirements? In brief, he thought that an attempt should be made to set up minimum standards for wholesomeness, personnel, personnel training, and for supervising and checking the effectiveness of such a program. He pointed out further that such a study should be carefully considered from all angles before it is set up.

In connection with the proposed research project on poultry inspection, it was suggested that Dr. Lieberman and Dr. Matzen get together and discuss the proposed study, on an exploratory basis, and report back to the Advisory Group.

6. Psittacosis in turkeys.

Dr. J. V. Irons, Texas Department of Health, was unable to attend this meeting and give his report on this subject.

7. Salmonella in egg products.

Upon discussing this subject, it was the opinion of the Group that this problem is receiving very broad attention by research workers and is being quite well controlled by practical operating techniques, which industry have or are adopting. In this connection, it was mentioned that nearly all the dried eggs produced, and some of the frozen eggs produced are pasteurized.
### Members and Alternates Attending the Meeting

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<tr>
<td>Dr. Carl H. Koonz</td>
<td>Institute of American Poultry Industries</td>
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<td>Mr. J. A. Heslin</td>
<td>Pacific Dairy &amp; Poultry Association</td>
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<td>Mr. Howard Whelan</td>
<td>Northeastern Poultry Producers Council</td>
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<td>Mr. A. E. Bailey</td>
<td>Poultry and Egg National Board</td>
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<td>Dr. Allen M. Greenlee</td>
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<td>Dr. J. L. Cherry</td>
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<td>Dr. James Lieberman</td>
<td>Conference of Public Health Veterinarians</td>
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<td>Mr. A. H. Fletcher</td>
<td>Conference of State Sanitary Engineers</td>
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<td>Mr. Marlin Simonson</td>
<td>National Poultry Producers Federation</td>
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<td>Mr. Carl Potter</td>
<td>American Public Health Association</td>
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REPORT OF THE COMMITTEE ON RESOLUTIONS


Resolved by the United States Livestock Sanitary Association in the 57th Annual Meeting Assembled in Atlantic City, New Jersey, September 25, 1953:

1. That we extend our thanks to the management and employees of the Chalfonte-Haddon Hall for the good service rendered our Association throughout the 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 member, Dr. R. A. Hendershott, for the excellent local arrangements made for this meeting, the entertainment of the ladies, and the many kindnesses and demonstrations of hospitality.

3. That the members of the United States Livestock Sanitary Association express their appreciation to Mr. Lou Cunningham of the Atlantic City Racing Association for his generosity and also for his thoughtfulness in remembering the membership in the 7th race on September 22nd.

4. That the United States 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.

5. 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 the year in the prevention, control, and eradication of destructive livestock diseases.

6. That we extend our thanks and appreciation to the Seabrook Farms for the fine trip and entertainment arranged by them for the ladies.

7. That we particularly extend our thanks and appreciation to Mrs. Charlotte Smith Emmons for her cheerful and untiring efforts in the accurate and competent recording of the minutes of this and many past meetings of the Association.

RESOLUTION PERTAINING TO FINANCES FOR UNITED STATES BUREAU OF ANIMAL INDUSTRY

WHEREAS, the services of the United States Bureau of Animal Industry are essential for the health and well being of the livestock of this nation and preventing the introduction of foreign diseases, and
WHEREAS, this country cannot continue to exist and maintain its high standard of living without a healthy livestock population, and

WHEREAS, disease control and prevention cannot be maintained at a high level without a sufficient number of well trained scientists in the field of Veterinary Medicine and Regulatory Officials to carry out recognized and approved means of disease control; therefore,

*Be it resolved* that the Appropriations Committee of the Congress of the United States seriously consider these important facts and make available to the Bureau of Animal Industry an appropriation sufficient to carry out those obligations and responsibilities relative to preventing the introduction of destructive animal and poultry plagues, to enlarge their work in the research field and to improve their position in the control of all destructive animal and poultry diseases.

RESOLUTION PERTAINING TO ILLEGAL IMPORTATION OF ANIMALS

WHEREAS, the uncontrolled importation of livestock from foreign countries into the United States constitutes a threat to the livestock industry of this country, and

WHEREAS, appropriate and necessary laws and regulations have been promulgated to protect the livestock industry of this country against the threat of the uncontrolled importation of foreign livestock, and

WHEREAS, a number of Charolaise cattle have been imported into the United States illegally and in direct conflict and violation with established Quarantine and United States Customs laws, therefore

*Be it resolved*, that the United States Livestock Sanitary Association prevail upon the United States Justice Department to take all necessary measures to immediately bring to trial and to successfully prosecute the Charolaise smuggling case involving over sixty head of cattle that were illegally brought into this country from Mexico through Texas and into Louisiana; and that, the Court be urgently petitioned to impose the maximum penalty on those found to be guilty; and that the cattle that were illegally entered into this country be destroyed, as the imposition of the maximum penalties essential to discourage the illegal movement of livestock into this country.

RESOLUTION REFERRING TO ANAPLASMOSIS

WHEREAS, Anaplasmosis is becoming a more prevalent disease of cattle in this country, and

WHEREAS, it does cause great losses to the individual cattle owner as well as to the livestock industry, and

WHEREAS, the practice of infecting susceptible animals by injecting whole blood from known infected animals is believed to be a frequent practice of many herdsmen and veterinarians, and
WHEREAS, this practice tends to further disseminate the disease, and
WHEREAS, no known drug or vaccine is effective to cure or prevent the spread of anaplasmosis, and
WHEREAS, *anaplasma marginale* is the organism producing this disease in this country, and
WHEREAS, Dr. R. A. Alexander, Veterinary Director of the Union of South Africa, has brought to the attention of the Livestock Sanitary Officials of the Eleven Western States Conference the practice of infecting susceptible animals with a benign *anaplasma centrale* which does appear to protect the animals against subsequent exposure and infection to the virulent *anaplasma marginale* in South Africa; therefore,

*Be it resolved,* that the United States Bureau of Animal Industry be urged and requested by this Association to fully investigate by controlled experimentation the possibilities of the use of the *anaplasma centrale* in the United States as a control measure for anaplasmosis and to continue and to expand research on this disease.

RESOLUTION PERTAINING TO SCABIES OF SHEEP

WHEREAS, sheep scabies continues to be a serious menace to the sheep industry of this country, and
WHEREAS, it is recognized that it can be readily eradicated with proper cooperation, and
WHEREAS, those states which do not have sheep scab are desirous of knowing definitely which states and location within the states in which the disease is known to exist, and
WHEREAS, such information will be of great value to all states to assist in the prevention and dissemination of the disease; therefore,

*Be it resolved,* by the membership of the Livestock Sanitary Association and the regulatory officials that the United States Bureau of Animal Industry be requested to report every three months to the states the incidence and location of sheep scabies.

RESOLUTION REFERRING TO PRODUCTS FOR THE DIAGNOSIS OF BRUCELLOSIS

WHEREAS, *Brucella Abortus* Stained Antigen provides an accurate agent in the test for the detection of brucella infection in cattle and swine, and
WHEREAS, it does not require a skilled technician to conduct an agglutination test for brucellosis via the rapid method, and
WHEREAS, such tests are employed unofficially by veterinarians and herdsmen, and
WHEREAS, such practices provide a means by which herd owners may maintain a false unexposed negative herd, or a false certified Brucellosis-free herd, and
WHEREAS, such practices furthermore provide a means by which herd owners may dispose of their unidentified reactor and suspect cattle to be purchased by another herd owner thereby introducing infection into his herd or herds, and

WHEREAS, such practices destroy the confidence and value of official records indicating Brucellosis clean and certified brucellosis-free herds and furthermore retard the progress of brucellosis control —

THEREFORE, Be It Resolved that this Association go on record condemning the sale and distribution of Brucella Abortus Stained Antigen or any similar biological products which may be employed as agents for the purpose of conducting serological or milk ring tests for the detection of brucellosis in cattle or swine, except to official Bureau and State agencies; therefore,

Be it further resolved that this Association through its Secretary call this matter to the attention of Honorable Ezra Taft Benson, Secretary of the United States Department of Agriculture, Washington, D. C., requesting him to exercise his authority by issuing an order restricting the sale, distribution and employment of Brucella Abortus Stained Antigen or similar biological products employed as testing agents for the detection of brucella infected cattle and swine, to official Bureau and State agencies;

Be it further resolved that a copy of these resolutions be sent to Honorable B. T. Simms, Chief, United States Bureau of Animal Industry, Washington, D. C., urging him to use his influence and exercise his authority in bringing about an end to the promiscuous sale, distribution, and employment of Brucella Abortus Stained Antigen and similar biological products employed for the detection of brucella infection in cattle and swine, except by official Bureau and State agencies, and thereby restore the confidence in official records they deserve and promote the brucellosis eradication program.

RESOLUTION REFERRING TO VETERINARY EDUCATION

WHEREAS, the health of the livestock of the United States is of paramount importance to the economy and well being of the nation, and

WHEREAS, it is equally essential that veterinary students be trained in a practical manner with regulatory personnel actually engaged in the field in the eradication of Brucellosis and other infectious, contagious, or communicable diseases, and

WHEREAS, they should know to whom to report and in what manner they are expected to cooperate with State and Federal Veterinarians when unusual diseases or disease conditions are encountered in private practice, and

WHEREAS, nearly every practicing veterinarian is frequently called upon to perform such regulatory acts as issuing interstate health certificates, and

WHEREAS, it has been brought to the attention of regulatory officials that the veterinary students are lacking in a proper and accurate conception of regulatory work, and
WHEREAS, the Veterinary Colleges are today maintained for the most part at the expense of the taxpayers, and

WHEREAS, it should be the prime purpose of all Veterinary Colleges to graduate veterinarians capable of fulfilling their rightful place in their respective communities, and capable and willing to cooperate and work with the regulatory officials in the control and eradication of disease as a safeguard to the health, prosperity and perpetuation of our nation, and

WHEREAS, it is in the colleges and universities that good constructive cooperative training should be instilled into the minds of all veterinary students, and

WHEREAS, more veterinarians should engage in the protection of public health by preventing diseases transmissible from animals to man; therefore,

Be it resolved, that the Council of Eradication of the American Veterinary Medical Association, the Presidents of the Land Grant Colleges and the Deans of the Veterinary Colleges be requested by this Association to establish and maintain courses in disease control and eradication, sanitation, and cooperative practice with State and Federal disease control officials, to the end that the Veterinarians of America may be looked to with confidence by those in high authority, our livestock and pet owners, and all others, as capable and willing to work together in a cooperative manner toward the control or eradication of destructive livestock and poultry diseases and those known to be transmissible from animal to man.

RESOLUTION REFERRING TO REGIONAL CHECKING OF BIOLOGICS FOR PURITY

WHEREAS, it has been shown that the United States Bureau of Animal Industry does not under the present appropriation have sufficient funds, personnel or laboratory facilities to conduct adequate tests to assure the Livestock and Poultry industry that the biologics offered for use and for sale through commercial channels do not contain contaminating organisms which may threaten the Livestock and Poultry industry, and

WHEREAS, it has been shown that anthrax bacterin has been proved to contain the highly virulent anthrax bacillus, and

WHEREAS, it has been shown that some biologics manufactured commercially for the prevention of specific poultry diseases have been contaminated with highly pathogenic organisms or viruses dangerous to the poultry industry, and

WHEREAS, there are adequate laboratory facilities maintained by the various states that could conduct purity tests on these products; therefore,

Be it resolved that the United States Livestock Sanitary Association urge those states having facilities available to conduct purity tests to conduct those tests consigned to them on a regional basis, and that the results of tests be simultaneously reported to the United States Livestock Sanitary Association and to the Chief of the United States Bureau of Animal Industry.
Such action as proposed by this resolution to be in effect until such time as the United States Bureau of Animal Industry receives funds to provide personnel and facilities to carry on the principle of this resolution on a national basis.
REPORT OF THE COMMITTEE ON STOCKYARDS, MARKETS
AND TRANSPORTATION

A. Z. BAKER, Cleveland, Ohio, Chairman; HARRY B. COFFEE, Omaha, Nebraska; H. E. CURRY, Jefferson City, Missouri; R. A. HENDERSHOTT, Trenton, New Jersey; R. H. LAY, Winnipeg, Canada; ELDON MILLER, Iowa City, Iowa; EARLE REEDE, Omaha, Nebraska; J. G. SHAEFER, St. Louis, Illinois; GEORGE SILKNITTER, Sioux City, Iowa; S. C. SPRUNGER, Wooster, Ohio.

This report of the Stockyards, Markets and Transportation Committee inadequately covers an important phase of livestock sanitation. It is based largely upon the experience and observation of the chairman, correspondence and conversations with members of the Committee, and activities in the field of livestock sanitation and disease control during the past year or two. It is limited by information regarding the purposes, objectives, programs and activities of the Association or this newly created committee.

The Stockyards, Markets and Transportation Committee was created last spring when the widespread occurrence of the hog disease, vesicular exanthema, pointedly called attention to the need for cooperation of all agencies concerned in the handling and movement of livestock and in the study, treatment and administration of regulations designed to control and prevent the spread of infectious and communicable diseases of livestock.

No specific terms of reference were prescribed and there are no precedents to guide the committee in the matters it should consider or the manner in which it should proceed.

The President of the Association, through the Secretary-Treasurer, invited leaders in the fields of livestock transportation and market operation to serve on the Committee. None of them are familiar with the Association’s procedure or its convention programs.

The Committee has had no particular assignment and has not functioned actively or, perhaps, beneficially. It does believe, however, that with more acquaintance with Association activities it can perform a very useful function.

By the very nature of the operations it represents, the Stockyards, Markets and Transportation Committee must be a “passive” rather than an “active” committee. It represents the inspected, regulated, involuntary agencies subjected to inspection, regulation, and direction of Federal, state and local sanitary officials and practitioners charged with the administration of the various laws, regulations and directions for the control and prevention of spread of livestock diseases.

The Committee however can perform a useful service in acquainting the operators of transportation and marketing facilities with the requirements, and necessities of inspection and disease control measures; and, conversely,
in acquainting the administrators, and others engaged in livestock disease work, with the problems of stockyard operation and transportation of livestock.

The livestock carriers, stockyards and markets are constantly exposed to contamination of livestock diseases and always dangerous agencies in the spread of such diseases.

The common carriers and public stockyard owners are particularly vulnerable since they are required by law to receive and handle any and all livestock offered to them for transportation, handling, sale or delivery, except, of course, livestock known or reasonably suspected to be infected with or exposed to a communicable disease which might contaminate their vehicles or facilities and be transmitted to other livestock.

The transportation of livestock, which only 25 years ago was effected almost entirely by railroad, is now largely accomplished by motor truck; and most of the livestock transported by railroad is moved from farm or ranch to railroad loading points by motor truck. But the railroads remain the basic transportation system, especially for long haul traffic.

It was relatively simple to enforce sanitary regulations when all or most of the livestock of the country was transported by a comparatively few common carrier railroads over fixed roads and by regular schedules; and especially since these carriers were engaged in interstate commerce and subject to interstate as well as state regulations. It is not simple today—nor even possible—to effectively control and prevent the spread of livestock diseases in the course of transportation when most of the livestock is carried in trucks from and to some 5 million farms over any of the 3 million miles of rural roads, without any established schedules, and for the most part not subject to federal regulation.

There are about 223,500 miles of railroads in the United States and about 3,312,975 miles of roads and streets, some 2,990,000 of which are rural roads.

There is a total of 43,762 railroad stock cars in operation, and the 127 Class I railroads handled last year nearly 500,000 cars of livestock.

There were 9,469,000 public and private trucks, including 34,831 farm trucks registered in 1952. Figures are not available as to the number of trucks, semi-trailers and tractors used occasionally or exclusively for carrying livestock, but the number is large.

It was relatively simple to inspect, prescribe treatment, and control the movement of livestock to prevent the spread of diseases when substantially all of the livestock moved by railroad to and from a comparatively few public stockyards. The development of surfaced rural roads and the motor trucks not only diverted the livestock movement from railroads; but it also encouraged the establishment of several thousand local stockyards, markets, and concentration yards where livestock is assembled, received, held or kept for sale, delivery or further shipment.

At the 65 principal public stockyards in 1952, 75.7 per cent of the cattle,
80.4 per cent of the calves, 81.3 per cent of the hogs and 48.8 per cent of the sheep and lambs were received by truck. By carload equivalents more than 75 per cent of all livestock received at public stockyards came by truck. The total would greatly exceed this percentage since most of the livestock received at non-public stockyards throughout the country arrives by motor vehicles or attached trailers. There is also a growing proportion of the livestock from public stockyards moving in motor trucks.

The 65 public stockyards, included in the reports of the USDA, handled in 1952, 18,941,736 cattle, 4,786,260 calves, 38,017,093 hogs, and 15,771,683 sheep and lambs.

The federal government, directly or indirectly through cooperative arrangements with the several state governments, maintain inspection services at most of these stockyards. These stockyards being operated in interstate commerce as public markets are posted under the Packers and Stockyards Act and the facilities and services furnished are subject to Federal regulation. But this regulation relates only to the furnishing of facilities and services and not directly or specifically to the sanitary inspection and regulation.

Some 260 auction markets have been posted under the Packers and Stockyards Act, but none of them are directly under Federal sanitary inspection. There are some 2,000 other auction markets subject only to limited state regulation of practices and, like the other non-federally inspected markets, to state or local control of sanitation.

Substantial as is the volume of livestock handled at the 65 public stockyards, 20 per cent of the total marketings of cattle, 60 per cent of the calves, 53 per cent of the hogs, and 23 per cent of the sheep and lambs were marketed through other channels.

It is to the eternal credit of sanitary officers and practitioners, federal, state and private, that there has been no greater epidemics of livestock disease in this country. Some credit can perhaps be given to carriers and stockyard operators for their cooperation in preventing the spread of diseases.

During the past year those engaged in stockyard and market operation and in transportation of livestock have been forcibly impressed with the importance of disease control and with the necessity to use every reasonable means to control and prevent the spread of such diseases. The swine disease, vesicular exanthema, has received a major amount of attention. But outbreaks of foot and mouth disease in Canada and Mexico have caused great concern in the Cattle industry. Because of the similarity of the two diseases the apprehension has been multiplied.

The control programs instituted by the Federal government and the several state governments disclosed a need for

a) uniformity of regulations and administration within the Bureau of Animal Industry and among the several state and municipal sanitary agencies; and
b) consideration of production and marketing problems as well as the problems of identification and control of diseases.

Happily much has been accomplished by the "active" and "passive" agencies in both fields.

Regulations have been proposed, studied, prescribed, and, as conditions justified, amended to accomplish the purpose of disease control with a minimum of disruption of production, transportation and marketing. Those charged with administration and enforcement of sanitary laws and regulation have followed more uniform practices and the criteria governing practices have become more widely known by those affected.

The problems of operation in production, transportation and marketing have been considered, and regulations and administration of disease control programs have been tempered wherever possible to minimize the damage to and the cost of the transportation and marketing processes.

This is a development which should be encouraged by this Association.

Carriers of livestock have greatly expanded the cleaning and disinfection of facilities and vehicles as a specific part of the vesicular exanthema eradication program, and this has inevitably benefitted the entire disease prevention and control program.

Rail carriers in particular, because they are subject to federal regulation and because their facilities are fixed and their vehicles readily identifiable, have practiced widespread and substantially complete compliance with recognized sanitary regulations. Clearly there has been much delay and expense involved in unnecessary cleaning and disinfecting of loading, unloading, feeding and watering facilities, and stock cars; but the "shotgun" method has undoubtedly brought the disease under control.

Large commercial handlers of livestock by motor truck have voluntarily adopted sanitary practices, cleaning and disinfecting their trucks at regular intervals and whenever suspected of having been used for the transporting of infected or exposed livestock. There is a major problem in controlling the multitude of smaller trucks and other motor vehicles, many of which move relatively short distances within states, have no fixed origins, routes or destinations and observe no established schedules. They present a tremendous disease hazard.

**CLEANING AND DISINFECTING OF LIVESTOCK TRUCKS**

It is essential for the protection of the livestock industry and for the success of the livestock trucking business that all trucks, trailers and equipment used in transporting livestock be kept clean and sanitary.

Livestock shippers object to the transportation of their livestock in inadequately cleaned trucks.

Many trucks are not properly cleaned and disinfected due to

1. Lack of convenient facilities for the proper and prompt cleaning, washing and disinfecting of trucks;
2. Lack of adequate regulations requiring proper and prompt cleaning and disinfecting of trucks and truck equipment;
3. Lack of uniform enforcement of regulations; and
4. Lack of definite policy of truck operators respecting cleaning and disinfecting of trucks and equipment.

It is especially difficult without special and expensive equipment to clean trucks during winter time in those areas when the temperature is below the freezing point for long periods. Some trucks are in service between cold and warm sections of the country affording an opportunity for frequent thawing, but for the most part cleaning can be accomplished only by artificial thawing at much expense and delay.

Truckers generally do not provide adequate and suitable facilities for cleaning, washing and disinfecting trucks and truck equipment; but depend upon the facilities provided at the stockyards and services furnished by the operator of the facilities or performed there by the trucker-driver.

The facilities and services for cleaning, washing and disinfecting trucks furnished at different stockyards vary widely. The following appraisal by a reputable trucker of the operations of cleaning, washing and disinfecting facilities at a considerable number of points indicates the range of services and satisfaction:

**Excellent**

a) Complete facilities available.
b) Complete service available with adequate wash racks although not hot water.

**Good**

c) Complete service available.

**Fair**

d) Trucker must do his own cleaning, the operator of the cleaning facilities doing the washing; but the facilities inadequate for the cleaning and operation.
e) Trucker does own cleaning; operator does the washing.
f) Service available for cleaning, washing and disinfecting.
g) Complete service available.

**Poor**

h) Trucker must do his own cleaning and washing; facilities inadequate.
i) Trucker must do his own cleaning but the operator does the washing and disinfecting.
j) Trucker does own cleaning and washing; facilities very inconvenient.
k) Trucker must do his own cleaning and washing with a garden hose.
Very Poor

1) Facilities and services very poor.

m) No facilities although trucker is given statement that truck must be disinfected before being used for livestock hauling again.

n) No facilities or services furnished.

The principal public stockyards generally provide some facilities and services for cleaning, washing and disinfecting trucks and other equipment and publish schedules of charges for the use of facilities and for services or materials furnished.

Except when sanitary regulations require cleaning and disinfecting of trucks and equipment, the truck driver determines when to clean and disinfect trucks based upon the demands of the shipper and the availability of facilities for cleaning and disinfecting.

Time is of the essence to the hauler as well as the shipper of livestock. Any delay due to inadequate cleaning facilities or inability to properly clean frozen material from trucks results in losses to both the trucker and the owner of livestock transported.

The solution of the problem of inadequately cleaned trucks probably lies in

1. The provision of suitable facilities for cleaning and disinfecting trucks at each livestock market, and the furnishing of incidental services by the market operator or some other licensed agency.

2. The establishing, publication and collection from the trucker of reasonable charges to cover the use of facilities and the materials and incidental services furnished.

3. The general compliance by the truckers with regulations or policies requiring the systematic cleaning and disinfecting of trucks to protect the health of livestock handled and prevent the spread of livestock diseases.

Some reasonable and generally acceptable policy should be developed and followed in respect to ordinary and extraordinary cleaning and disinfecting of motor vehicles used in carrying livestock. Such a policy should emanate from voluntary practices of carriers, insistence of users, prescription and enforcement of regulations by government agencies, principally state agencies, and encouragement from technical groups such as this Association.

Stockyard owners and market operators, especially those subject to federal inspection, or similar inspection of some state agencies, have thoroughly and repeatedly cleaned and disinfected facilities liable to contamination and spread of disease. A number of public stockyards have been quarantined one or more times, while others have imposed embargoes on the receipt of certain kinds of livestock in order to avoid the effects of quarantines and extraordinary cleaning and disinfecting. The posted stockyard owners publish regulations in their schedules of regulations and charges reserving the right to refuse to accept any livestock infected or suspected of being infected with a communicable livestock disease. They publish and, when possible, col-
lect from the owner a nominal charge for cleaning and disinfecting facilities made necessary by the use of infected animals; but in cases of general cleaning or disinfecting the expense must be borne by the stockyard owner as a part of operating expense.

Stockyard owners have paved and repaired docks, chutes, alleys, pens and yards and installed or enlarged water lines and sewers to facilitate the regular and emergency cleaning of facilities.

Many auction markets have facilities which may be as easily cleaned as terminal stockyards, but there are unfortunately some which are not designed, constructed or maintained in acceptable sanitary condition and are not accessible to adequate water and sewer systems.

As with transportation vehicles and equipment, this maintenance of sanitary stockyard and market facilities must be achieved by cooperation of the owners and operators, persuasion of users, requirement of authorities, and encouragement of sanitary practitioners, individually and through their associations.

In spite of this inconspicuous beginning, it is believed and recommended that the committee should be continued with such changes in its personnel as may be desirable or necessary; that more complete terms of reference be provided; and that further opportunities be afforded for the development of mutual acquaintance and understanding among the members and those cooperating with the Association, and with the objects sought and the opportunities for their achievement.
OBSERVATIONS ON THE ABSORPTION AND EXCRETION OF SULFISOXAZOLE, SULFADIMETINE AND SULFAMETHAZINE IN CATTLE

By L. A. KANEKIS, D.V.M., Ph.D., ROBERT G. KELLY, B.S., and R. W. CUNNINGHAM, Ph.D., Pearl River, N. Y.

The widespread and continually increasing use of sulfonamides in Veterinary medicine has established the value of this class of chemotherapeutic agents in the treatment of a variety of infectious diseases of domestic animals. That interest in this class of compounds has not subsided is attested to by the fact that new sulfonamides continue to be made available for clinical use. When such compounds appear, it is of interest and importance to compare their characteristics with those that have become established and accepted in clinical practice.

Two or more sulfonamides may be equally active under certain in-vitro conditions. However, the “pharmacologic behavior” or the fate of the drug in the body of the host is of prime importance in determining the overall properties of the particular sulfonamide with respect to clinical effectiveness. Some of the factors concerned with the host-drug relationship include absorption, excretion, distribution, plasma protein binding and degradation of the compound. Optimum systemic therapeutic effects with sulfonamides as a class are related to the early establishment and the maintenance of adequate concentration in the tissues. Since sulfonamides in general are widely and rather uniformly distributed throughout the body, the concentration of sulfonamide in the circulating blood or plasma can be used as a measure, with some qualifications, of the concentration in the various tissues. This estimate can be refined if the volume of distribution in the body and the various partition values between plasma and specific tissues are determined.

It is generally agreed that concentrations of sulfonamides in the blood of from 5. mg. per 100 cc. (mg. per cent) to 15. mg. per cent represent the general range of concentrations required for optimum therapeusis in infections of average severity. (7,10)

Knowledge of blood concentration-time curves is a necessary requisite for the determination of the magnitude and frequency of dosage required to produce such therapeutic levels and therefore has a direct bearing on the clinical application of sulfonamides. In the treatment of domestic animals, the size of the dose and the interval between doses are of practical and economic importance.

1From the Chemical and Biological Research Section, Lederle Laboratories Division, American Cyanamid Company, Pearl River, New York.
The foregoing considerations prompted the investigation of blood concentration-time relationships following various doses in cattle of sulfisoxazole* (3,4-dimethyl-5 sulfanilamido-isoxazole) and sulfadimetine** (6 sulfanilamido-2,4 dimethylpyrimidine). Although extensive data on sulfamethazine*** (2, sulfanilamido-4,6 dimethylpyrimidine) are in the literature, this established sulfonamide was included in the study for purpose of comparison.

Several reports on sulfisoxazole in animals have appeared in the literature. (1,2,3,4,5,8,11) To our knowledge no such specific reports have as yet been published on sulfadimetine. However, other reports relevant to this paper have been published. (11)

EXPERIMENTAL

Normal adult grade dairy cattle having free access to feed and water were used throughout the study. Various dosages, dosage forms and routes of administration were used. Blood concentrations of sulfisoxazole, sulfadimetine and sulfamethazine at various hours were determined following single oral doses of 0.5, 0.8 and 1.5 grains per pound, body weight (71.5, 114 and 214 mg./kg. B.W.) and following single intravenous doses of 0.5 and 1.0 grains/pound B.W. (71.5 and 143 mg./kg. B.W.). All dosages were based on actual sulfonamide free acid content.

Observations on urinary excretion were made following single intravenous doses of 0.5 gr. per lb. B.W. Total urinary output was collected by catheterization at 30 minute intervals for 8 hours. Aliquots of known volume output were assayed at the various sampling periods for free and total drug, and the actual amounts of drug excreted were calculated.

Sulfonamide assay was performed according to the method of Bratton and Marshall with the aid of a Fisher electro-photometer. Each of the sulfonamides was recrystallized and standard curves for each were prepared from the crystalline compounds. Sulfonamide recoveries from pooled blood to which known amounts of each drug were added were determined and correction coefficients applied where necessary. Only in the case of sulfisoxazole were significantly incomplete recoveries observed. For example, at a whole blood dilution of 1-90 only 81 per cent of the added sulfisoxazole could be recovered.

RESULTS

Oral Dosage

Mean concentrations of free sulfonamides in the blood following single oral doses are given in Table I and are shown graphically in Figures 1, 2, and 3.

* Gantrisin (R), Hoffman-La Roche; Soxizol (R), Fort Dodge Laboratories
Sulfisoxazole was supplied through the courtesy of Hoffman-La Roche, Inc. and sulfadimetine through the courtesy of Ciba, Inc.
** Elkosin (R), Ciba
*** Sulmet (R), Lederle Laboratories Division, American Cyanamid Company
### TABLE 1
Mean Concentrations of Free Sulfonamides in the Blood of Dairy Cows Following Single Oral Doses

<table>
<thead>
<tr>
<th>Sulfonamide</th>
<th>Oral Dosage Form</th>
<th>Dosage gr/lb BW</th>
<th>Free sulfonamide concentrations in the blood (in mg./100 cc.)</th>
<th>Hours following dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfamethazine</td>
<td>Oblets</td>
<td>0.5*</td>
<td>1.8 4.0 5.8 5.9 3.5</td>
<td>2 4 8 12 24</td>
</tr>
<tr>
<td>(10 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>Tablets</td>
<td>0.5</td>
<td>0.5 1.6 1.9 0.9 0.3</td>
<td></td>
</tr>
<tr>
<td>(10 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>Solution</td>
<td>0.8**</td>
<td>9.4 9.7 9.4 8.7 5.5</td>
<td></td>
</tr>
<tr>
<td>(5 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>Solution</td>
<td>0.8</td>
<td>2.1 2.8 2.6 1.1 0.4</td>
<td></td>
</tr>
<tr>
<td>(5 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>Oblets</td>
<td>1.5***</td>
<td>3.3 8.2 14.1 15.6 12.7</td>
<td></td>
</tr>
<tr>
<td>(11 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>Tablets</td>
<td>1.5</td>
<td>3.0 5.5 6.2 5.4 1.4</td>
<td></td>
</tr>
<tr>
<td>(4 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfadimetine</td>
<td>Powder in gelatin capsule</td>
<td>1.5</td>
<td>0.6 2.0 4.8 5.2 2.0</td>
<td></td>
</tr>
<tr>
<td>(6 cows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 71.5 mg./kg.
** 114. mg./kg.
*** 214. mg./kg.

At all dosages sulfisoxazole and sulfadimetine produced considerably lower concentrations in the blood than did sulfamethazine over the entire experimental period.

Neither at a dose of 0.5 gr./lb. B.W. nor 0.8 gr./lb. B.W. did sulfisoxazole show concentrations in the blood that are generally considered to be within the therapeutic range.

Only at a dose of 1.5 gr./lb. B.W. did sulfisoxazole show "minimal therapeutic concentrations" which appeared between the 2nd to 4th hour and persisted to the 12th hour. Sulfadimetine concentrations rose more slowly and showed such values only from the 8th to the 12th hour. Sulfamethazine, on the other hand, showed high mean values that appeared rapidly and persisted beyond 24 hours. The peak concentrations observed at this dosage were as follows: sulfamethazine, 15.6 mg. per cent; sulfisoxazole, 6.2 mg.
Concentrations of Free Sulfonamides in the Blood of Cows

Dosage: Single Oral Dose; 1/2 grain per lb.

Sulfamethazine (10 cows): 0.7 mg per cent; sulfadimetine, 5.2 mg per cent. At 24 hours following dosing only sulfamethazine showed therapeutic levels. The following mean values were observed at 24 hours: sulfamethazine, 12.7 mg per cent; sulfisoxazole, 1.4 mg per cent; sulfadimetine, 2.0 mg per cent.

It is interesting to note the effect of dosage form on the rate of absorption. For example, when sulfamethazine was given as the sodium salt in solution,
CONCENTRATIONS OF FREE SULFONAMIDES
IN THE BLOOD OF COWS

- Sulfamethazine solution (5 cows)
- Sulfisoxazole solution (5 cows)

Dosage: Single Oral Dose; 4/5 grain per lb.
orally, in drench form, at a dose of 0.8 gr./lb., the concentrations in the blood for the first few hours were higher than when 1.5 gr./lb. was given in oblet form. This emphasizes the well-known importance of using the same dosage form as well as the same dose when comparing the absorption of drugs.
INTRAVENOUS DOSAGE

Mean concentrations in the blood following a single intravenous dose are given in Table 2 and depicted graphically in Figure 4.

**TABLE 2**

**Mean Concentrations of Free Sulfonamides in the Blood of Dairy Cows Following Single Intravenous Injections**

<table>
<thead>
<tr>
<th>Sulfonamide</th>
<th>Dose gr/lb</th>
<th>Free sulfonamide concentrations in the blood (in mg./100 cc.)</th>
<th>Hours following dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>0.5*</td>
<td>15.0</td>
<td>11.5</td>
</tr>
<tr>
<td>(5 cows)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>0.5</td>
<td>14.1</td>
<td>8.5</td>
</tr>
<tr>
<td>(5 cows)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>1.0**</td>
<td>27.8</td>
<td>24.8</td>
</tr>
<tr>
<td>(6 cows)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>1.0</td>
<td>22.7</td>
<td>12.9</td>
</tr>
<tr>
<td>(6 cows)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfadimetine</td>
<td>1.0</td>
<td>24.6</td>
<td>17.3</td>
</tr>
<tr>
<td>(6 cows)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 71.5 mg./kg.
** 143. mg./kg.

Sulfisoxazole and sulfadimetine disappeared rapidly from the blood, the latter somewhat more slowly. At a dose of 0.5 gr./lb., the mean concentrations of sulfisoxazole fell below 5. mg. per cent between the 2nd to 4th hour.

At a dosage of 1.0 gr./lb., sulfisoxazole maintained concentrations of 5. mg. per cent or higher for only 4 hours. Sulfadimetine maintained such levels for approximately 7 hours. Both drugs showed values of less than 0.5 mg. per cent at 24 hours. Sulfamethazine concentrations were high throughout the sampling period and declined at a slow rate. At 24 hours a mean of 5.4 mg. per cent was observed.

**URINARY EXCRETION**

The amount of total sulfonamides excreted in the urine is given in Table 3 and is shown graphically in Figure 3.

Sulfisoxazole was the most rapidly excreted: 60 per cent of the dose was recovered from the urine by the 4th hour. By 8 hours approximately 67 per cent of the dose had been excreted by this route.

Sulfadimetine was also rapidly excreted, but at a slower rate than sulfi-
soxazole. In 4 hours approximately 48 per cent of the dose was recovered from the urine. By 8 hours 64 per cent of the dose had been excreted.

Sulfamethazine was excreted at a slow rate: only 16 per cent being recovered in the urine in the first 4 hours. By the 8th hour only 27 per cent had been eliminated through the urine.

Concentrations of free and total sulfonamides in the urine following a single intravenous dose of 0.5 gr./lb. B.W. are given in Table 4. Table 5 shows the extent of acetylation found in the urine. Both sulfisoxazole and
sulfadimetine produced extremely high concentrations in the urine during
the first few hours when the major portion of the drug was being excreted.
The peak free and (total) concentrations in mg. per cent were as follows:

<table>
<thead>
<tr>
<th>Sulfonamide</th>
<th>Cumulative excretion in percent of dose administered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours following dose</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>4.3</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
</tr>
<tr>
<td>Sulfadimetine</td>
<td>15.3</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>28.7</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
</tr>
</tbody>
</table>

* ½ grain per pound B.W. (71.5 mg./kg.)

sulfisoxazole, 1150 (1835); sulfadimetine, 1059 (1213); and sulfamethazine 214 (263).

Sulfisoxazole concentrations declined rapidly; those of sulfadimetine more slowly. The sulfamethazine concentrations varied only slightly at the consecutive sampling periods.

Sulfisoxazole was acetylated to the greatest extent in the urine. The mean value over the 8 hour period was approximately 39 per cent. Sulfadimetine and sulfamethazine were acetylated to a much lesser degree, with means for the 8 hour period of approximately 16 per cent and 20 per cent respectively.

DISCUSSION

The rapid excretion of sulfisoxazole and sulfadimetine in cows as observed in this study no doubt accounts to a major extent for the low concentrations observed in the blood following oral dosage.

Preliminary calculations on the volume of distribution of sulfisoxazole in cows indicate that this sulfonamide is distributed primarily in the extracellular water. This is similar to findings reported by Marshall (6) for this drug in man and in the dog.

Our observations are not in agreement with those of Edds (2) who reported that cattle can be divided into two classes. One group showed high and persistent levels with a single daily oral dose of 0.5 gr./lb. B.W. The other group, it was reported, may show more rapid elimination of the drug, but adequate concentrations could be maintained by giving 0.3 gr./lb. B.W. at 8 hour intervals. The peak mean concentration reported at a single oral dose of 0.5 gr./lb. B.W. was over 12 mg. per cent. Our peak mean value at three times this dosage was only 6.2 mg. per cent.
Our findings in cattle corroborate those of Stowe (8) and Florestano et al. (3) Stowe showed that sulfisoxazole produced relatively low concentrations in the blood following oral administration of 1.5 gr./lb. B.W. The mean peak concentration reported was 4.6 mg. per cent.

Both workers observed a rapid decline in blood concentrations following single intravenous doses of 1.4 to 1.5 gr./lb. B.W. From a level of approximately 27 mg. per cent at 1 hour, the concentrations fell to less than 5 mg. per cent between the 4th to the 6th hour. Likewise Stowe found sulfisoxazole was excreted rapidly. Similar findings on the high excretion rate of sulfisoxazole have been reported in other species including man. (3, 5, 9)

The high degree of acetylation of sulfisoxazole in the urine is similar to that reported by Svec, et al. (9) for humans. The clinical significance of this observation resides in the fact that the acetyl derivative is less soluble than the free form. This is particularly apparent at lower pH values. This assumes even greater importance when one considers the extremely high concentrations of sulfisoxazole found in the urine during the first few hours following dosing.

It is of interest that although sulfadimetine can be considered a member
### TABLE 4

*Mean Concentrations of Sulfonamides in the Urine of Cows*

<table>
<thead>
<tr>
<th>Sulfonamide</th>
<th>Concentrations of sulfonamides in urine (in mg./100 cc.)</th>
<th>Hours following dose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free</td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td></td>
<td>214</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfadimetine</td>
<td></td>
<td>845</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td></td>
<td>1150</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Dose: Single intravenous dose 1/2 gr./lb. B.W. (71.5 mg./kg.)
**TABLE 5**

*Degree of Acetylation of Sulfonamides in Urine of Cows*

<table>
<thead>
<tr>
<th>Sulfonamide</th>
<th>Acetylation in percent of total sulfonamide content of urine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours following dose</td>
</tr>
<tr>
<td></td>
<td>1   2   3   4   5   6   7   8</td>
</tr>
<tr>
<td>Sulfamethazine</td>
<td>18.6</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
</tr>
<tr>
<td>Sulfadimetine</td>
<td>6.0</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
</tr>
<tr>
<td>Sulfisoxazole</td>
<td>37.4</td>
</tr>
<tr>
<td>(3 cows)</td>
<td></td>
</tr>
</tbody>
</table>

* Dose: Single intravenous dose ½ gr./lb. B.W. (71.5 mg/kg.)
of the "pyrimidine sulfonamides," its excretion characteristics in cattle differ markedly from sulfamethazine.

It is evident from the data presented that sulfisoxazole and sulfadimetine would require higher and more frequent dosage administration than sulfamethazine in order to produce and maintain blood concentrations in the generally accepted therapeutic range. This is borne out in data reported in the study of comparative dose-activity relationships in carefully standardized infection studies. (4,11)

**SUMMARY AND CONCLUSIONS**

1. Sulfisoxazole and sulfadimetine produced low concentrations in the blood of cows following oral dosage, and rapidly declining levels following intravenous administration.

2. The rapid disappearance of sulfisoxazole and sulfadimetine from the blood is due primarily to a high rate of urinary excretion.

3. For the treatment of systemic infections, high dosage, repeated at relatively frequent intervals—every 4 to 6 hours intravenously or every 8 to 12 hours orally—would appear to be required to produce what are considered to be therapeutic concentrations in the blood.

4. Of the sulfonamides studied only sulfamethazine produced and maintained high concentrations in the blood that persisted for at least 24 hours following a single dose given intravenously or orally.

**REFERENCES**


5. LEHR, D.: Comparative Merits of 3,4-dimethyl-5-sulfanilamido-isoxazole (Gantrisin) and a Sulfapyrimidin Triple Mixture. Antib. and Chemotherap. 3: 71, 1953


Footnote: 1 Published with the approval of the Director of Research, Dr. James H. Williams.
REPORT OF THE COMMITTEE ON BIOLOGICALS AND PHARMACEUTICALS

N. H. CASSELBERRY, Berkeley, California, Chairman; L. L. BREECK, Frankfort, Kentucky; S. F. SCHEIDY, Drexel Hill, Pennsylvania; C. P. VICKERS, Tallahassee, Florida; MARK WELSH, Pearl River, New York; A. H. QUIN, Kansas City, Missouri

Your committee has reviewed the progress this past year in development of new or improved biologicals and pharmaceuticals. We wish to emphasize the great need for development of satisfactory immunizing agents or at least therapeutic agents for handling several very troublesome diseases which are not yet amenable to satisfactory prevention, control or treatment. We would also like to review some new disease problems to the United States which require considerable more study in the direction of developing immunizing agents or therapeutic agents for prevention and control if we wish to cope satisfactorily with them.

HOG CHOLERA VACCINES

There are now three general types of modified live hog cholera virus vaccines available. This past year a tissue culture modified live hog cholera virus vaccine was licensed by the Bureau of Animal Industry in addition to the rabbit modified and rabbit propagated vaccines and the rabbit modified swine propagated virus vaccines which have been in use now for the past two years. The Bureau of Animal Industry reports that the combined total sales of all hog cholera vaccines were 11,664,211 doses for the first seven months of this year. (This total includes both modified live virus vaccines and the inactivated vaccines, B.T.V. and Crystal Violet Vaccines, which have been available for the past thirteen years.) The majority of this total sold during this period was modified live hog cholera virus vaccines and field performance has been very satisfactory.

In a communication from Dr. B. T. Simms, Chief of the Bureau of Animal Industry, he has informed us that the reports of results received by the Bureau following use of modified live virus vaccines show a slight decrease in losses due to all causes over last year’s figures. The percentage figure on June 30, 1952 was 1.1 per cent loss due to all causes, and on June 30, 1953 the reports show the percentage to be less than 1 per cent.

In the prevention of hog cholera this year, we were faced with a relative national shortage of anti-hog cholera serum on hand at the beginning of the vaccination season. (This shortage was the result of a vesicular exanthema spread which caused a serious setback in serum production.) Doctor Simms informed us that inventories of serum on hand indicated that 26.3 per cent of last year’s sales of anti-hog cholera serum was on hand May 1, 1953. The
percentage figure for May 1, 1952 was 42.6 per cent and in 1951 this inventory percentage was 47 per cent. The relatively low inventory of hog cholera serum on hand this year was cause for grave concern on the part of all those interested in swine production. However, reports received by the Bureau to date show an increased use of hog cholera vaccines over last year which has tended to provide immunity to a larger number of swine since smaller serum doses per pig are used. Therefore, the availability of modified live vaccines this year appears to have been very fortunate as their increased use permitted immunization of a larger portion of the swine population with the available serum supply than could have been accomplished had virulent virus been depended upon to the same extent as in past years.

In this connection, this committee feels it is time to repeat a recommendation made as a minority report of this committee nine years ago. The sense of this recommendation was that virulent hog cholera virus should be striken from the list of products that can be sold interstate for hog cholera vaccination in this country. This recommendation may have been premature at that time but, in the last year or two, recommendations for discontinuance of the use of virulent hog cholera virus have been made by many groups interested in eradication or at least more careful control of hog cholera. It appears to us that vaccination of swine with modified live hog cholera virus vaccines, inactivated hog cholera vaccines and anti-hog cholera serum have demonstrated their value in prevention of hog cholera sufficient to warrant their exclusive use in prevention of this disease, and their use does not present the same difficulties in proper control of this disease that is attended with widespread use of virulent hog cholera virus.

We would also like to recommend that research be carried on in attempting to produce anti-hog cholera serum by hyperimmunization of serum animals with modified live virus rather than virulent hog cholera virus. It seems reasonable that this could be accomplished satisfactorily and economically and would be one more large step away from possible spreading of virulent hog cholera virus through industrial use.

**NEWCASTLE DISEASE VACCINES**

Within the past year, two new forms of Newcastle vaccine have been introduced. These products are both recommended for the immunization of chicks against Newcastle disease by injection of the live virus vaccine intramuscularly. One vaccine is less virulent than the other and is recommended for use on chicks two weeks of age or older. The other vaccine is recommended for use on chickens one month of age or older.

Newcastle disease virus vaccines have also been applied in the field by spray vaccination. This work has been done experimentally in some cases but in some areas is done more or less as routine without experimental supervision. To date no products have been licensed for this specific use but licensed products are applied in this manner. Application of vaccine by the spray method is accomplished in many ways by many different types of
applicators. It seems to this committee that the multiplicity of Newcastle vaccine forms on the market and the many methods of administration, as well as the methods of administration resorted to in addition to those recommended, has become very confusing to the poultry industry, many times resulting in improper results following vaccination. The variety of licensed vaccines is confusing enough but the intrastate production of unlicensed vaccines and the variety of ways in which these vaccines are handled complicates the situation to a point where proper evaluation of Newcastle vaccination, as a whole, is difficult or impossible.

This committee would like to recommend that a committee from this association be appointed to investigate the possibilities of regulating intrastate production of Newcastle vaccines by those not holding federal licenses, so that the same requirements for product performance are in force as those required by the Bureau of all producers in interstate commerce. It is our feeling that this will do much to clarify Newcastle disease vaccination methods and more nearly assure satisfactory performance of Newcastle disease vaccination to our poultry industry. It is a large order, however, and probably in the last analysis will have to be stimulated by the individual state livestock sanitary officials concerned with the problem and with possibly group support from this association.

**SWINE ERYSIPELAS BACTERIN**

It was recently announced that the Bureau of Animal Industry has issued a license for the production of swine erysipelas bacterin. This represents a new approach to immunization against swine erysipelas in this country since only live culture vaccine has previously been available commercially for active immunization against this disease, although bacterins have been used in Europe for several years. This product is so new that your committee has no information on its efficacy as yet.

**INFECTIOUS BRONCHITIS**

It has recently been announced by the Bureau of Animal Industry that a special license has been issued for infectious bronchitis vaccine. This disease has been the cause of considerable economic loss to both the meat producing poultrymen and the egg producer, but is probably of greatest economic importance through its very marked adverse effect on egg production in infected laying flocks. The Bureau of Animal Industry, in cooperation with the state veterinarians and sanitary officials, is attempting to limit the use of bronchitis virus and/or bronchitis vaccine to areas where the disease is known to be already prevalent and under conditions where thorough evaluation of immunization procedures can be assessed. Your committee applauds this careful control of the distribution of bronchitis live viruses until products and methods for safe immunization against this disease are known to be available.
MULTIPLE-DOSE BRUCELLA ABORTUS VACCINE

The distribution of Brucella abortus vaccine in multiple-dose containers was made possible a few months ago. We wish to applaud the Bureau of Animal Industry in this action since we feel the product can be satisfactorily handled as we are sure that all users will cooperate by using the entire contents of the container when it is first opened. This is very necessary since contaminants may be introduced during withdrawal of one dose of vaccine and any contamination introduced may kill off the Brucella organisms in the remaining portion of the vaccine.

NEW TREATMENTS FOR ACETONEMIA

Within the past year, new drug applications have become effective for the use of cortisone and (A.C.T.H.) in the treatment of acetonemia. A new drug application has also been made effective for use of sodium propionate in the treatment of this disease.

ANTIBIOTICS

During the past year additional information regarding the use of antibiotic substances in the control of infections in animals and poultry has become available. A more widespread use of these agents is evident as a result of a gradual reduction in the cost of them and a better understanding regarding their application in the treatment of diseases. Mixtures of some of these agents apparently produce results that are better than those obtained with single agents. This may be due to an increase in the spectrum of antibacterial activity or synergism resulting from such mixtures. Not all mixtures, however, are conducive to so-called synergistic effect, as the opposite action or antagonism has also been noted when certain antibiotics were administered concomitantly. These phenomena, synergism and antagonism, have been observed when certain strains of microorganisms were involved and unfortunately no easy way to determine such action is available to the clinician. The problem of synergism and antagonism has been studied extensively by Jawetz and associates\(^1\). They have suggested that the following substances be included in Group I: penicillin, streptomycin or dihydrostreptomycin, bacitracin, and neomycin, and in Group II: aureomycin, terramycin, and chloramphenicol. They have indicated that, “members of group I are frequently synergistic with each other, occasionally indifferent, but have never in our hands been antagonistic to each other . . . Members of group II are neither synergistic with, nor antagonistic to, each other, but simple additive effects are observed, presumably also obtainable by an increase in the dose of a single drug.” They further state that, “combined effects between drugs of group I and group II are the most complex and depend on the relative susceptibility of the microbial strain. If the microorganism is susceptible to the group I drug, then group II agents will frequently be

antagonistic and reduce the effect of the group I drug. This effect seems
to be unilateral: Group I drugs do not interfere with group II action against
organisms tested thus far. If, on the other hand, the bacterium is group I
resistant (but can be inhibited by a large dose) then I plus II sometimes
result in synergism, never in antagonism.”

ERYTHROMYCIN

Erythromycin, a new antibiotic of clinical interest, is produced by cultures
*Streptomyces erytheus*. It is poorly soluble in water, however, readily soluble
in alcohol.

Erythromycin usually is administered orally. According to available
information based on experimental and clinical studies it would appear that
its mode of action, antibacterial spectrum of activity, and clinical efficacy
in acute infections is similar to penicillin. Extensive and thorough study
of this new antibiotic in animals and poultry has not been reported, thus
no specific recommendation for its use in the veterinary field can be made
at this time.

ANTIBIOTICS AS GROWTH STIMULANTS

In recent years the addition of antibiotic substances or antibiotic
fermentation residues to feed rations for animals and poultry has become
a regular practice in the United States. Such additions to rations usually
have had favorable effect by increasing the growth rate, decreasing the
incidence of certain disease conditions and may have increased feed efficiency
in domestic animals and poultry. Penicillin, streptomycin, dihydrostrepto-
mycin, bacitracin, aureomycin and terramycin or fermentation residues of
cultures producing these substances are used. Considerable attention has
been given to the mechanism of action through which these antibiotic
substances produce these effects. Currently the opinion prevails that the
effect is on the intestinal bacteria and not directly on the animal. The
following theoretical explanations have been presented:

1. Elimination of microorganisms that produce harmful or toxic sub-
stances in the animal.

2. Elimination of microorganisms that absorb or inactivate dietary
factors which otherwise would be utilized by the animal.

3. Stimulate the bacterial synthesis of essential growth or vitamin factors.
It would appear that the first explanation mentioned above is favored by
most individuals at the present time. Needless to say, this problem continues
to receive much attention and undoubtedly more information will become
available in the future.

In addition to this information on antibiotics, we would like to mention
that an intramuscular dosage form of terramycin for veterinary use has been
made available. This is the first so-called wide spectrum antibiotic preparation
recommended for intramuscular injection.

This committee would like to call your attention to and warn against the
haphazard use of antibiotics in the treatment of animal diseases, particularly
mastitis, because of the possible development of strains of bacteria which become resistant to these very valuable therapeutic agents.

We are all aware of the long list of diseases of more or less chronic nature for which we have no satisfactory means of prevention. While some of them respond to therapeutic measures, that approach is usually costly and in most instances unsatisfactory. We would like to mention just a few so we don't lose sight of them: anaplasmosis, infectious rhinitis, vibriosis, trichomoniasis, several of the internal parasite infestations, baby pig enteritis, swine dysentery, necrotic enteritis of swine, pink eye and foot rot.

While clinical leptospirosis might not be properly included as a chronic infection, the carrier problem involved in this disease could very well be under consideration in this group. Swine erysipelas is also one that we think is still not satisfactorily handled. Perhaps immunizing agents on the horizon will improve the picture considerably in the handling of these two diseases.

We are all a little guilty of confining most of our research effort in attempting to solve the spectacular, acute diseases of livestock since the solution of these more acute diseases is more dramatic. Also it's a case of greasing the squeaky wheel as these more acute diseases can seriously threaten the existence of the species of animals involved. However, these more insidious chronic diseases continue to rob our livestock industry and it seems to us that more and more effort should be directed towards solving the problems connected with more effectively controlling them.

NEW DISEASE PROBLEMS

In the past year our livestock economy has been threatened by diseases considered to be new to this country such as scrapie and blue tongue of sheep. Presently a program for the development of a vaccine for prevention of blue tongue is underway and it is believed that this disease can be satisfactorily handled through vaccination.

Vesicular exanthema is not a new disease to this country but within the last year it has come to be a very serious threat to our swine industry. This disease has existed in California for the past twenty years but its importance was not realized until it was so rapidly spread throughout the country. It is pretty generally agreed that the problems inherent in the handling of this disease through vaccination make this approach less desirable than to attempt eradication. If the seriousness of this disease will serve to emphasize the necessity of cooking garbage, strict quarantine measures to prevent its spread from infected animals through livestock movements and proper measures to clean up infected premises can be regulated and enforced, eradication of the disease may eventually be accomplished. If these control measures succeed in eradicating vesicular exanthema, there is also reason to hope that even a larger dividend from these efforts may be realized since many other serious disease problems such as hog cholera, trichinosis, swine erysipelas and possibly many other swine diseases will have more and more difficulty propagating themselves in our swine population.
Anaplasmosis has been one of the major problems facing the livestock industry in many parts of the country. The relentless spread of this disease has made the development of an effective means of therapy imperative. This need is illustrated by how eagerly research reports are received and some times interpreted out of their original content. At Louisiana State University, research work has been in progress for a number of years to find or develop some mode of therapy which would reduce the losses associated with anaplasmosis. The research has utilized splenectomized calves in order to detect agents which have a specific action against the *Anaplasma marginale*.

Aureomycin and terramycin were shown to have a very marked action on the *Anaplasma marginale* in splenectomized calves. A single intravenous dose at the normally recommended dosage rates, inhibited the *Anaplasma marginale* from multiplying and infesting the red blood cells. The results were spectacularly illustrated by the 100 per cent survival of the 32 splenectomized calves treated with aureomycin and terramycin, compared to 80 per cent fatalities in 26 untreated control calves. It is important to point out that the same carrier animal was the source of inoculum in all cases. These results only indicated to us that these antibiotics should be tested in adult clinical cases of this disease and were not in themselves an indication for the therapy of anaplasmosis with aureomycin or terramycin, as some of the first press releases implied. A grave deficiency in the use of these antibiotics was recognized from the original work in splenectomized calves, that is, they failed to prevent the development of anemia during the post treatment period.

An efficient treatment for anaplasmosis should have a specific action against the causative agent, and it should effectively combat the anemia. It is evident that the antibiotics are deficient in the anti-anemia properties. The use of aureomycin and terramycin in the treatment of anaplasmosis pre-supposes that the *Anaplasma marginale* are actively multiplying and infesting red blood cells at the time of treatment and that their suppression will materially improve the clinical picture. A survey conducted in Louisiana in 1952 partially answers this assumption.
Sixteen practicing veterinarians in various parts of the State co-operated in this study. One hundred thirty-two clinical cases were treated with aureomycin and terramycin in approximately equal numbers. Seventy-two per cent of all cases treated had less than 30 per cent of their normal hemoglobin at the time of treatment. Most of these animals had been ill for two or more days and were in the terminal stages of the disease and the multiplication of the *Anaplasma marginale* was not a factor at this stage. These animals were suffering from an acute anemia, the result of the anaplasmosis attack, and treatment to be successful would have to combat this anemia immediately, and also be supported by adequate nursing care. On the strength of our basic knowledge as to how the antibiotics act on the anaplasma (that is, to inhibit the active multiplication) three out of four of the animals should not have been treated with the antibiotics. In the cases presented early for treatment, approximately one in four, results were for the most part satisfactory, but the need for an adjuvant to combat the anemia was very evident.

From the foregoing, it will appear that the role of aureomycin and terramycin in the therapy of anaplasmosis is a very limited one; however, we feel that properly used they are of value to the stock owner, until more effective means of therapy are developed.

We believe that their use is indicated under the following conditions:

In herd outbreaks of anaplasmosis, where the owner, being prewarned, will be alerted to asking for veterinary assistance and diagnosis at the very first sign of abnormality, and before the classical symptoms of anaplasmosis develop. This early antibiotic treatment will of necessity have to be supported by large blood transfusions where indicated and an absolute restriction of movement. Thus the significance of early diagnosis and good nursing are again stressed. The importance and value of these two facts must be recognized and realized in applying the best treatment we have for anaplasmosis at this time.

Although the action of the antibiotics is prophylactic (if administered during the time the anaplasma are multiplying), there is a very decided limitation to this type of treatment—it cannot be administered on a herd wide indiscriminate basis as a true prophylactic. Treatment with aureomycin and terramycin in the early incubation periods (before at least 1 per cent of the R.B.C.'s are infected) will result only in a delay of the clinical symptoms, with no beneficial action on their severity.

It is quite unlikely that sporadic cases of anaplasmosis will be presented for treatment and be diagnosed in time for the use of these antibiotics. The early diagnosis depends upon the expectation of a herd outbreak. Even then, some will be missed, because it is not uncommon for very sick animals to show no evidence of illness until required to exert themselves.
THE PRACTICAL APPLICATION OF THE COMPLEMENT-FIXATION TEST FOR ANAPLASMOSIS

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J. Walter Hastings, Sr., V.M.D., J. I. Mitchell, B.S.

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Serological diagnosis of anaplasmosis became a necessity when it was found that animals which recovered from the disease generally became life long carriers. In active cases, diagnosis is readily made on the basis of a rather specific clinical picture and the presence of anaplasma in the erythrocytes of the infected animal. However, such evidence is absent following recovery from the disease and serological diagnosis is the only alternative.

In 1934 Rees and Mohler prepared a complement-fixation antigen from ticks which had engorged themselves on the blood of infected animals. Although this proved to be an impractical method of preparing antigen, results obtained indicated that serological diagnosis by complement-fixation techniques was feasible. In 1949 Mohler et al developed a complement-fixation test employing an antigen prepared at the Bureau of Animal Industry, U.S.D.A. The antigen was produced by the method of Mott and Gates (1949). Gates et al (1950) found this antigen to be over 90% accurate. Although some excellent antigens were prepared by this method, numerous cases arose where they were unsatisfactory because of their lack of antigenicity or their excessive anticomplementary activity. In 1951 Price, Poelma, and Faber of the University of Maryland described an improved antigen preparation procedure. The improvements in antigen quality were brought about by removing a great deal of extraneous material which resulted in a purer, more concentrated antigen. This procedure has given satisfactory antigens in all cases up to this time.

The experiment described in this paper was carried out with the following objective in mind: To determine if the complement-fixation test employing the Maryland antigen was sufficiently accurate to identify all the carrier animals in the three herds under study. The identification would be used as a basis for separating the infectious animals from the non-infectious. This would, of course, prevent further spread of the disease in the herds.

MATERIALS AND METHODS

The three herds employed in this investigation were located on the eastern shore of Maryland. The 73 cattle in these herds were all over 18
months of age. They were distributed as follows: Herd No. 1 was composed of 18 Herefords and 1 Guernsey. This herd had no history of anaplasmosis. Herd No. 2 had 13 Herefords and 4 Guernseys and likewise had no history of anaplasmosis. The last (Herd No. 3) contained 39 animals, all Herefords with the exception of 1 Guernsey. Anaplasmosis first appeared in this herd on August 16, 1952. Of the thirteen animals developing the disease, five died. At the beginning of this project, the 8 animals which recovered were still present in this herd.

Three different blood samples were obtained from these animals at approximately 2 month intervals. Samples were allowed to coagulate so that sera could be obtained. The sera were then subjected to the complement-fixation test.

All sera were diluted 1/10, and 0.3 cc of this dilution added to 0.3 cc of a 1/12 dilution of antigen. A similar quantity of complement having a potency of 4-50% units was then added and the mixture shaken and incubated for 1 hour at 37°C. Following this incubation period, 0.6 cc of an equal mixture of hemolysin and 2% sheep cells was added and the test samples reincubated for 30 minutes in the 37°C water bath.

Test results were recorded by estimating the degree of fixation (1+ being allowed for each 25 per cent fixation). All 2+, 3+, and 4+ readings were given a positive interpretation and 1+ reactions were considered suspicious.

Six 3 month old calves (3 Holstein, 2 Shorthorn, and 1 Guernsey) with an average weight of 250 lbs. were splenectomized approximately 1 month prior to inoculation, thus insuring their susceptibility to anaplasmosis.

The blood for inoculation was obtained at the same time the blood samples were drawn for the third complement-fixation test. Coagulation was prevented by use of a suitable quantity of sodium citrate. Following completion of the third complement-fixation test, the appropriate blood samples were pooled and inoculated subcutaneously into the calves.

Temperatures were recorded daily for 1 week prior to inoculation and then twice daily until the experiment reached its conclusion. Blood samples were obtained at frequent intervals and examined for the presence of anaplasma. Smears were prepared in the usual manner and stained by a technique developed by Wallenstein. This procedure is rapid and anaplasma are readily detected in the erythrocytes. It is carried out as follows: After a fixation period of 1 minute in methyl alcohol, the slides are dipped in a .01% aqueous solution of crystal violet (10 times if the slides are wet, 5 times if dry). After staining, wash by dipping slides 5 times into distilled water. Air dry and examine.

Following the appearance of parasites, parasite counts and blood counts were made daily to determine the degree of parasitization and reduction in erythrocyte number.

Serum samples were obtained from the calves at intervals during the
course of the experiment and subjected to the complement-fixation test. All gave a negative reaction to the complement-fixation test prior to inoculation.

RESULTS

The 19 animals in Herd No. 1 had no history of anaplasmosis. No reaction was obtained from the sera of these animals on any of the 3 complement-fixation tests (table I). Whole citrated blood samples from the 19 animals were pooled and 50 cc injected subcutaneously into Calf 196. This animal failed to show any clinical evidence of anaplasmosis; all blood smear examinations and complement-fixation tests remained negative for 60 days (table II).

In Herd No. 2 the sera from 14 of the 17 animals were negative to all 3 complement-fixation tests. This herd likewise had no history of anaplasmosis. A pool of 40 cc of citrated blood from these 14 animals was injected subcutaneously into Calf 220. No evidence of anaplasmosis was found during the 60 day observation period.

Serum from animal 66 gave a positive reaction to all 3 tests. Three cc of citrated blood from this cow was injected into Calf 763. Anaplasma were found in blood smears 31 days after inoculation. Serum obtained on the same day gave a positive complement-fixation reaction. This animal developed an acute case of anaplasmosis.

Cow 73 gave a suspicious reaction to tests 1 and 3, and was found negative on the second test. Cow 62 gave a suspicious reaction to the third test and was negative on the two previous tests. Inoculation results of blood from these animals is included under Herd No. 3.

Twenty-one of the 39 animals comprising Herd No. 3 were negative on all 3 complement-fixation tests. Fifty cc of pooled blood from this group was inoculated into Calf 929. This test animal remained free of anaplasmosis throughout the 60 day observation period.

Eight of the remaining 18 animals gave a positive reaction to all 3 complement-fixation tests. Seven of these had a history of anaplasmosis. Two and one half cc of blood was drawn from one of the seven animals and injected into Calf BHB. Blood serum from this calf was positive to the complement-fixation test 24 days after inoculation. Anaplasma were not found until the 30th day following inoculation. This animal developed an acute case of anaplasmosis.

Cows 24, 57, 36, and 54 all gave a positive reaction to at least one test. Cow 36 was a known carrier and the rest were considered carrier animals for the purposes of this experiment.

Blood from 6 animals in Herd No. 3 (22, 34, 21, 42, 43, and 30) and cows 62 and 73 in Herd No. 2 were pooled. These animals all gave suspicious reactions to 1 or more complement-fixation tests. Thirty cc of this pool was injected into Calf 147. A positive complement-fixation reading was ob-
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<tr>
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### TABLE II — Animal Inoculation Results

<table>
<thead>
<tr>
<th>Calf No.</th>
<th>First appearance of anaplasma (day)</th>
<th>Number of anaplasma (millions/cu mm)</th>
<th>Erythrocyte count (millions/cu mm)</th>
<th>Pre-inoculation</th>
<th>Post-inoculation</th>
<th>Complement-fixation test (day)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>196</td>
<td>None in 60</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>220</td>
<td>None in 60</td>
<td>—</td>
<td>965</td>
<td>36</td>
<td>36</td>
<td>—</td>
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</tr>
<tr>
<td>763</td>
<td>31 in 60</td>
<td>929</td>
<td>8.86</td>
<td>36</td>
<td>36</td>
<td>—</td>
<td>Positive in 24h</td>
</tr>
<tr>
<td>929</td>
<td>None in 60</td>
<td>—</td>
<td>30</td>
<td>30</td>
<td>34</td>
<td>—</td>
<td>Positive in 32</td>
</tr>
<tr>
<td>BHB</td>
<td>30 in 60</td>
<td>—</td>
<td>33</td>
<td>33</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>147</td>
<td>30 in 60</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</table>
tained 32 days after inoculation. Anaplasma were first observed on the 33rd day. The marginal bodies reached a maximum of 2% on the 34th day after inoculation. Although this case of anaplasmosis ran an atypical course, a very severe anemia developed. The erythrocyte count fell to less than 2 million/cu. mm.

DISCUSSION

Animal inoculation tests indicated that all carrier animals in the 3 herds were detected by complement-fixation procedures. The 54 animals which gave a negative reaction to all 3 complement-fixation tests were proven non-infectious by animal inoculation. These animals have been separated from the carrier animals and have maintained an anaplasmosis-free status up to the present.

One animal (66) in Herd No. 2, which gave a positive complement-fixation reaction to the 3 tests was found to be a carrier when subinoculation was made into Calf 763. This animal had never shown any symptoms of anaplasmosis. Several animals in Herd No. 3 (54, 24, and 57) which gave strong reactions to the complement-fixation test probably fall into the same category since they likewise had never displayed any symptoms of anaplasmosis. This is the situation where the complement-fixation test becomes a valuable tool. It is absolutely essential to use it if an attempt is made to remove all infectious animals from a herd.

Since the pooled blood from the 8 animals giving suspicious reactions was infective for Calf 147, it is evident that 1 or more of these animals were harboring anaplasma. The experimental calf showed an atypically small number of anaplasma; if the same low degree of parasitization had occurred in the carrier animal(s), it may in part, explain why only a low complement-fixation titer was produced.

The probability that some non-infectious animals were included in the suspicious group, creates a problem. Placing these susceptible animals with an infectious group is likely to result in new cases of anaplasmosis. At the present time insufficient data is available to provide a solution for this problem; however, work is now being carried out which may show more clearly the status of animals whose sera give only minor reactions with anaplasmosis antigen. We feel that the benefits that can be derived from complete removal of all carriers overshadows the possible loss of the few animals whose sera give false positive reactions. When the separation of the infectious animals from the non-infectious was made, the 8 animals whose sera gave suspicious reactions were placed in the infectious group. There have been no new cases of anaplasmosis in this group up to the present.

Although the results of this experiment indicate that the practical application of the complement-fixation test gives highly satisfactory results, certain precautions are necessary.

The test must be performed by a competent person who is well aware of the pitfalls found in all complement-fixation procedures.
Satisfactory results can only be obtained when the antigen employed has a large "antigenic range," that is, a large range between the highest dilution of a positive serum giving complete fixation and the highest dilution in which a reaction is obtained with a negative serum. Antigens with a small range are likely to produce many false positive reactions.

It is absolutely essential that at least two different samples from each animal be subjected to the complement-fixation test. If discrepancies occur when the results from these two tests are compared, a third test should be made. The value of running more than 1 test is shown in the case of animal 36 from Herd No. 3. Although this animal had a known history of anaplasmosis, a negative test was obtained on the first sample. Subsequent samples all gave strong positive reactions. An error in the labeling of samples or in the actual testing of the sample may have occurred here. However, this animal would have been placed in the non-infectious group on the basis of the first test.

The actual testing and separation of animals should be carried out in the wintertime when the incidence of anaplasmosis is at a minimum. This reduces the possibility of any animals contracting the disease during the interval between testing and removal of reactors from the herd. When obtaining blood samples for testing, care should be taken to avoid transmitting the disease within the herd.

**SUMMARY**

Seventy-five head of cattle distributed in 3 herds were subjected to 3 complement-fixation tests for anaplasmosis, at intervals of approximately 2 months. Fifty-four of these animals gave a negative reaction to all 3 tests. This negative status was verified by the subcutaneous inoculation of pooled blood into susceptible calves.

Eight animals gave a suspicious reaction to 1 or more of the three tests. The pooled blood from this group was found to produce anaplasmosis following injection into a susceptible calf.

One animal having a negative history of anaplasmosis, whose serum was positive to all three complement-fixation tests was proven infectious by subinoculation into a susceptible calf.

One of the seven animals having a history of anaplasmosis and giving a positive reaction to 3 complement-fixation tests was selected at random as a control. Subinoculation of blood from this animal produced a case of anaplasmosis.

From the results obtained, it would appear that the complement-fixation test for anaplasmosis when properly conducted would be highly efficient as a means of controlling the spread of this disease in a herd.

**REFERENCES**

DISCUSSION OF PAPERS ON ANAPLASMOSIS

PRESIDENT CHILDS: Is there any discussion of these two papers and the report of the Committee on Anaplasmosis?

DR. WILKINS: I would like to ask Dr. Price what the source of antigens is. Is it a virile antigen?

DR. PRICE: The antigen is prepared by a technique that we developed at the University of Maryland.

DR. WILKINS: Are you having any difficulty in the preparation of that uniform antigen?

DR. PRICE: No, we are not having any difficulty. We have prepared about eight antigens there, all of which have been very satisfactory. Dr. Brown at Oklahoma has prepared several following our method, and they all have been satisfactory. Dr. Miller of Louisiana also is doing very satisfactory preparations in all cases.

DR. WILKINS: Are you convinced in your own mind that you can consistently produce a satisfactory antigen?

DR. PRICE: I believe so. I have no evidence to show it is not the case so far, at any rate.

DR. WILKINS: Have you published a formula with variations?

DR. PRICE: Yes, we have.

DR. WILKINS: Is it from blood?

DR. PRICE: Yes.

VOICE: Where is it published?

DR. PRICE: In the American Journal of Veterinary Research, April 1952, I believe.

DR. WILKINS: And you get a consistently good antigen?

DR. PRICE: We have, in the twelve or thirteen cases we have prepared so far.
REPORT OF THE ADVISORY COMMITTEE ON ANAPLASMOSIS

W. T. Oglesby, Baton Rouge, Louisiana, Chairman; Vernon D. Chadwick, Jackson, Mississippi; Ronald Gwatkin, Hull, Quebec, Canada; Wm. Mohler, Washington, D. C.; D. H. Ricks, Oklahoma City, Oklahoma; Hubert Schmidt, College Station, Texas.

In most areas where anaplasmosis is present, it ranks at the top of the list as a killer and one for which the practicing veterinarian has no satisfactory treatment. The qualifying word “most” appears here because in the southern states it is at the top of the list. While it has more recently become a severe problem in the range areas of Oregon, it is probably not at the top of the list in that particular state. The insidious nature of the disease plays against the practicing veterinarian using the best treatments which he has, because too often the animal has passed the crisis before the owner calls the practitioner. This is one disease where it does not pay to wait just another day. Estimates of the cost of this disease range from six to ten millions annually.

This year your Committee is offering two papers to the formal program. One is a report of the application of the complement fixation test. The test is not yet 100 per cent perfect in the eyes of those who are studying it, but much more is known of its intricacies than at the time of your last meeting. The second paper has to do with the use of the antibiotics aureomycin and terramycin with particular reference to their application and limitations.

Most men in attendance at this meeting and those who read the Proceedings, are interested in applicable results and not details of research. However, we believe the following three sentences from the 1951 report to be of major significance and should be repeated per se and kept in mind by all at all times. “The key to the problem of the control and eventual complete elimination of anaplasmosis from our herds still is the carrier animal. The detection of all carrier animals still is awaiting a simple, reliable test, easily applicable. It must, either alone or in conjunction with some other test or tests, also easily applicable, detect every carrier in the herd, for to leave only a single carrier invites disaster in the future.”

On February 18-19, 1953, there was an anaplasmosis conference in Stillwater, Oklahoma. There were men in attendance from 14 states and the Federal Government. After one and one-half days of discussion and review, it was determined that the basic problems have not been altered, even though some very helpful additional knowledge has been uncovered in the five years since the last conference. It appears that the brief report sent out from that conference, sums up the present status of anaplasmosis very adequately and is submitted as part of this committee report.
"To: B.A.I. Inspectors in Charge
State Veterinarians
Experiment Station Directors
Deans of Veterinary Medicine

The Second National Research Conference on Anaplasmosis, met at Stillwater, Oklahoma, on February 18-19, 1953, for the purpose of noting progress in research on anaplasmosis since the last meeting of the group in 1948.

No new arthropod vectors have been incriminated. It was emphasized that any tick, biting fly or mosquito might readily transmit the disease in nature, provided, sufficient numbers are present and opportunities are available for quick transfer from infected to susceptible animals. Some differences in vector problem were noted. Thus, anaplasmosis transmission in some areas as Louisiana and Texas was thought to be primarily due to large horseflies, while ticks were pointed out as likely chief vectors in California and Oregon. The difficulties of mechanical transmission was stressed.

Attempts to immunize cattle against anaplasmosis using various chemically treated tissue extracts have failed, and the question was discussed as to whether immunity can be produced against this disease without actual infection. To date, this has not been demonstrated. The need for additional research into the basic nature of the causative organism was stressed, to serve as a basis for the approach to the problem of immunization.

Some hopeful results on the use of antibiotics, particularly aureomycin and terramycin were reported. When administered early in the disease (after 1 -2 per cent of the R.B.C.'s are carrying marginal bodies) they will stop the course of the infection; however, the usual anemia often develops. Animals treated in this manner are immune as though they had suffered an attack. These antibiotics can not be used as prophylactic agents, because it given before the infection is established, the effect is to prolong the incubation period, but the animal will finally break just as though the antibiotic had not been administered. This poses the important question of proper timing, if these materials are to be used. It is not claimed at present that the drugs are capable of killing *Anaplasma marginale* in the carrier bovine.

The problem of diagnosing carrier animals was discussed, and it was pointed out that the main objective of eliminating the disease from the United States must be kept in mind. Intensified efforts to produce an effective, standardized antigen for the complement fixation test are being made. For the present, the complement fixation test for detection of carriers is still in the experimental stage.

Attempts at chemotherapy of anaplasmosis was summarized and it was concluded that only the two antibiotics mentioned have shown an inhibiting effect upon the causative organism. Since many cases of anaplasmosis are not seen until the red blood cell count is reduced to about one-third of normal, the use of antimalarial drugs and hematinics are of questionable value. None so far have been demonstrated to have an effect upon the causative organism. Whole
blood transfusions, using at least 1 or 2 gallons of blood was cited as the best single supportive treatment.

It was the consensus of opinion of those in attendance, that the essential problems in anaplasmosis research remain unchanged and that work should continue in each line, with special emphasis on studies into the nature of the causative agent, the diagnosis of carrier animals, methods of biological control, and therapy.

ADVISORY COMMITTEE: J. F. Christensen, D.V.M., California, Chairman
Wm. Mohler, D.V.M., U.S.B.A.I., Vice-Chairman
W. T. Oglesby, D.V.M., Louisiana, Secretary'

The problem of funds and personnel is still THE major one. As reported by previous committees there is a plan for coordinated research on a large scale, if and when funds are available. None have been forthcoming from the Research and Marketing Act as hoped. Actually, at the time this report is being prepared, there are only five states and the B.A.I. which have active projects on this disease and the majority of these do not have sufficient funds or sufficient personnel to prosecute the projects in the proper fashion. Anaplasmosis research is extremely costly, principally because there is no laboratory animal which can be used. Even the use of the splenectomized calf makes the work very costly. The solution to the control of this disease lies with the research worker, because the very nature of its behavior in the field precludes any dependable results on the basis of studying field cases. At the Stillwater conference the problem of research on this disease, as outlined by the research workers in the southern states some years ago, was reaffirmed as a basic workable plan for studying this disease.
Before discussing the outbreaks that occurred in 1952 and the first 8 months of 1953, I should like to review briefly the anthrax situation in livestock from 1945 to 1951 as determined by Bureau surveys(1).

During this seven-year period there was a total of 1,141 outbreaks reported from 35 States with losses of 11,257 head of livestock with an estimated value of $1,046,900. Outbreaks in new areas were reported from 133 countries in 27 States indicating the disease is spreading.

Most of the outbreaks that were reported from 1945 through 1951 were sporadic, occurred principally in cattle and resulted in minor losses.

However, during this period major outbreaks with heavy losses occurred in Louisiana in 1946 and 1948. Sharp outbreaks involving considerable losses also occurred in Arkansas, California, Colorado, Florida, Illinois, Iowa, Kentucky, Missouri, Nevada, Oklahoma, Tennessee, and Texas.

Missouri, which prior to 1945 had reported only isolated cases, showed a marked increase in the prevalence of the disease.

In 1951 a marked increase in the incidence of anthrax occurred when 483 outbreaks were reported from 25 States.

The greatest losses were reported from an area in southeastern Missouri, and adjoining areas along the Mississippi River in Kentucky and Tennessee. A total of 302 outbreaks with losses of 1,152 head of livestock occurred in these three States. Anthrax also appeared in Florida for the first time in more than 20 years. Twenty-one outbreaks were reported from three counties with a loss of 206 cattle.

The outbreaks of undetermined origin that occurred principally in swine in Illinois, Iowa, Indiana, and Ohio in areas in which the disease is not enzootic were of special significance and interest, since they appeared to form a pattern of what was to occur in early part of 1952 in swine herds in the midwest.

An unusual feature of the disease in 1951 was the heavy losses in swine, the greatest losses being reported from Illinois, Iowa, Kentucky, and Missouri.

OUTBREAKS DURING 1952

During 1952 there were 1,644 anthrax outbreaks in animals reported

*Pathological Division, Bureau of Animal Industry, Washington, D. C.
from 32 States involving 432 counties with a total loss of 1,578 cattle, 1,614 swine, 20 horses, six mules, and 233 sheep with an estimated value of $340,600. (Tables 1, 2, and map).

Outbreaks in new areas were reported from 289 counties as follows: One county each in Colorado, Georgia, Kentucky, Louisiana, Montana, Nebraska, New Mexico, North Dakota, and Tennessee; two counties each in Florida, Minnesota, and New York; four counties each in Arkansas and New Jersey; five counties in Missouri; nine counties in Oklahoma; 16 counties in Wisconsin; 17 counties in Kansas and Michigan; 19 counties in Iowa; 37 counties in Illinois; 38 counties in Texas; 54 counties in Indiana and Ohio.

The 1,644 outbreaks reported in 1952 represent the greatest number ever to be recorded for any single year and exceeded the total number of outbreaks reported for the seven previous years. (Graph 1).

The tremendous increase in 1952 was due principally to the great number of outbreaks that occurred during the first two quarters of the year in swine herds in the Midwest and to the large number postvaccination outbreaks in cattle following prophylactic vaccination with certain lots of anthrax bacterin. These outbreaks were discussed in detail in a paper presented at the Association’s meeting in 1952(2).

The low incidence in recognized anthrax districts and the occurrence of numerous outbreaks with a low mortality rate in areas that heretofore have reported little or no anthrax, were outstanding features of the anthrax situation in 1952.

During 1952, seven outbreaks were reported in minkeries. Wisconsin reported four outbreaks with total loss of 455 animals, New Jersey one with a loss of 11, and New York two with a loss of 206.

Suspected sources of infection reported in connection with 1952 outbreaks were as follows: Post vaccination 25 per cent of outbreaks; Contaminated feed 41 per cent of outbreaks, soil infection 20 per cent of outbreaks, unknown 14 per cent of outbreaks.

In this connection it is interesting to note that Brennan(3) reported that there were 1,215 outbreaks of anthrax officially confirmed in Great Britain in 1952, which was the greatest number recorded since 1910. The possible origin in more than 1,000 of the outbreaks was believed to be contaminated artificial feeding stuffs containing protein supplements largely imported. While different classes of livestock as well as dogs and deer were involved, about 40 per cent of the cases occurred in swine and were of the intestinal type with little or no involvement of the cervical region. The majority of the outbreaks occurred on premises where anthrax was never previously reported.

The marked similarity of the outbreaks occurring in Great Britain and in the United States in 1952 appears to be more than a coincidence.
## TABLE 1

**States Reporting Anthrax Outbreaks in Livestock in 1952 and Data on Incidence.**

<table>
<thead>
<tr>
<th>State</th>
<th>No. counties</th>
<th>No. outbreaks</th>
<th>Cattle</th>
<th>Swine</th>
<th>ANTHRAX Horses and mules</th>
<th>Misc.</th>
<th>Total livestock losses*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2 horses</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Arkansas</td>
<td>7</td>
<td>13</td>
<td>39</td>
<td></td>
<td>3 mules</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>California</td>
<td>10</td>
<td>44</td>
<td>57</td>
<td>27</td>
<td>5 horses</td>
<td>81 sheep</td>
<td>170</td>
</tr>
<tr>
<td>Colorado</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td>3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Florida</td>
<td>4</td>
<td>12</td>
<td>97</td>
<td></td>
<td>2 horses</td>
<td></td>
<td>99</td>
</tr>
<tr>
<td>Georgia</td>
<td>2</td>
<td>4</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>Illinois</td>
<td>50</td>
<td>128</td>
<td>16</td>
<td>381</td>
<td></td>
<td>2 sheep</td>
<td>399*</td>
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<tr>
<td>Indiana</td>
<td>55</td>
<td>217</td>
<td>4</td>
<td>305</td>
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<td></td>
<td>309</td>
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<tr>
<td>Iowa</td>
<td>29</td>
<td>94</td>
<td>31</td>
<td>155</td>
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<td></td>
<td>186</td>
</tr>
<tr>
<td>Kansas</td>
<td>17</td>
<td>361</td>
<td>509</td>
<td>12</td>
<td>1 horse</td>
<td>127 sheep</td>
<td>649</td>
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<tr>
<td>Kentucky</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>13</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Louisiana</td>
<td>8</td>
<td>19</td>
<td>27</td>
<td>2</td>
<td>1 horse</td>
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<td>30</td>
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<tr>
<td>Michigan</td>
<td>17</td>
<td>45</td>
<td>33</td>
<td>112</td>
<td></td>
<td>17 sheep</td>
<td>162</td>
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<td>Minnesota</td>
<td>4</td>
<td>5</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Mississippi</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td></td>
<td></td>
<td>1 dog</td>
<td>5*</td>
</tr>
<tr>
<td>Missouri</td>
<td>10</td>
<td>14</td>
<td>23</td>
<td>18</td>
<td></td>
<td>1 mule</td>
<td>43</td>
</tr>
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<td>Montana</td>
<td>1</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Nebraska</td>
<td>5</td>
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<td>13</td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Nevada</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>New Jersey</td>
<td>8</td>
<td>104</td>
<td>58</td>
<td>6</td>
<td>4 horses</td>
<td>11 mink</td>
<td>68*</td>
</tr>
<tr>
<td>New Mexico</td>
<td>3</td>
<td>3</td>
<td>23</td>
<td></td>
<td></td>
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<td>23</td>
</tr>
<tr>
<td>New York</td>
<td>11</td>
<td>18</td>
<td>17</td>
<td></td>
<td></td>
<td>206 mink</td>
<td>17*</td>
</tr>
<tr>
<td>North Dakota</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Ohio</td>
<td>57</td>
<td>316</td>
<td>18</td>
<td>453</td>
<td></td>
<td></td>
<td>471</td>
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<td>Oklahoma</td>
<td>10</td>
<td>10</td>
<td>64</td>
<td>5</td>
<td>3 horses</td>
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<td>72</td>
</tr>
<tr>
<td>Oregon</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>South Dakota</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Tennessee</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2 mules</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Texas</td>
<td>77</td>
<td>165</td>
<td>419</td>
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<td></td>
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<td></td>
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<tr>
<td>Wisconsin</td>
<td>18</td>
<td>29</td>
<td>37</td>
<td>40</td>
<td>1 horse</td>
<td>455 mink</td>
<td>84*</td>
</tr>
<tr>
<td>Wyoming</td>
<td>1</td>
<td>1</td>
<td>61</td>
<td></td>
<td></td>
<td>6 sheep</td>
<td>84*</td>
</tr>
<tr>
<td>32 States</td>
<td>432</td>
<td>1644</td>
<td>1578</td>
<td>1614</td>
<td>6 mules</td>
<td>233 sheep</td>
<td>3451*</td>
</tr>
</tbody>
</table>

*Mink and dogs not included in total livestock losses.
### TABLE 2

**Incidence of Anthrax for Each Quarter of 1952.**

<table>
<thead>
<tr>
<th>Period</th>
<th>No. states reporting outbreaks</th>
<th>No. Cattle</th>
<th>No. Swine</th>
<th>Livestock losses</th>
<th>Total livestock losses*</th>
</tr>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Horses and mules</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sheep</td>
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</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Misc.</td>
<td></td>
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<tr>
<td>First Quarter</td>
<td>15</td>
<td>606</td>
<td>513</td>
<td>892</td>
<td>1 mule</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 horses</td>
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<td></td>
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<td></td>
<td>336 mink</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>1408*</td>
</tr>
<tr>
<td>Second Quarter</td>
<td>24</td>
<td>676</td>
<td>618</td>
<td>491</td>
<td>5 mules</td>
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<td></td>
<td>5 horses</td>
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<td></td>
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<td>1 dog</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1271*</td>
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<tr>
<td>Third Quarter</td>
<td>26</td>
<td>303</td>
<td>378</td>
<td>168</td>
<td>12 horses</td>
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<tr>
<td>Total, 1952</td>
<td>**</td>
<td>1644</td>
<td>1578</td>
<td>1614</td>
<td>6 mules</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3451*</td>
</tr>
</tbody>
</table>

* Mink and dogs not included in total livestock losses.

** Total number of states reporting for 1952: 32; number of counties reporting 432.
OUTBREAKS IN 1953

Data compiled from the monthly anthrax reports for the first 8 months of 1953 reveal that during this period (184) outbreaks were reported from (25) States with a loss of (310) cattle, (111) swine, (8) horses, (51) sheep, and (86) mink. (Table 3).

Aside from the widespread outbreaks that occurred in Illinois, the first two-thirds of 1953 can be considered a normal anthrax year. Most of the outbreaks were sporadic, occurred in recognized anthrax areas, involved chiefly cattle, and losses were comparatively small.

During the latter part of July and the early part of August 1953 a series of widespread outbreaks occurred in Clay, Wayne, and Richland counties in the southeastern part of Illinois, an area where anthrax had never previously been diagnosed. Approximately 40 farms were involved with loss of more than 100 head of livestock.
TABLE 3

Incidence of Anthrax in Animals for the First Eight Months of 1953

<table>
<thead>
<tr>
<th>Month</th>
<th>No. States Reported</th>
<th>No. Outbreaks Reported</th>
<th>Cattle</th>
<th>Swine</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>12</td>
<td>20</td>
<td>21</td>
<td>30</td>
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</tr>
<tr>
<td>February</td>
<td>14</td>
<td>21</td>
<td>29</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>March</td>
<td>9</td>
<td>12</td>
<td>16</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>April</td>
<td>12</td>
<td>23</td>
<td>32</td>
<td>9</td>
<td>27 sheep</td>
</tr>
<tr>
<td>May</td>
<td>10</td>
<td>13</td>
<td>17</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>June</td>
<td>9</td>
<td>11</td>
<td>21</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>July</td>
<td>9</td>
<td>55</td>
<td>124</td>
<td>43</td>
<td>5 horses 24 sheep</td>
</tr>
<tr>
<td>August</td>
<td>9</td>
<td>29</td>
<td>50</td>
<td>8</td>
<td>3 horses 86 mink</td>
</tr>
<tr>
<td>TOTALS</td>
<td>—</td>
<td>184</td>
<td>310</td>
<td>111</td>
<td>51 sheep 8 horses 86 mink</td>
</tr>
</tbody>
</table>

*A total of 25 different States reported outbreaks

TABLE 4

Comparative Incidence of Anthrax in the Midwest, Kansas and New Jersey During the First Eight Months of 1952 and 1953

<table>
<thead>
<tr>
<th>State</th>
<th>1952 LIVESTOCK Outbreaks</th>
<th>Losses</th>
<th>1953 LIVESTOCK Outbreaks</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa</td>
<td>58 *</td>
<td>150</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Illinois</td>
<td>125 *</td>
<td>393</td>
<td>45</td>
<td>122</td>
</tr>
<tr>
<td>Indiana</td>
<td>216 *</td>
<td>305</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ohio</td>
<td>315 *</td>
<td>469</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Michigan</td>
<td>45 *</td>
<td>145</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kansas</td>
<td>340 **</td>
<td>476</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>New Jersey</td>
<td>42 **</td>
<td>47</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

*Most outbreaks occurred in swine herds and were of food origin.
**Most outbreaks occurred in cattle and were of post-vaccination origin.

The sources of the outbreaks were not definitely determined but since little or no feed supplement is used in this area, and since most cases occurred in animals on pasture, soil infection was suspected.

A long period of extremely dry hot weather and the prevalence of an unusually large number of horse flies were some of the factors that appeared to influence the rapid spread of the infection in this area.

Recognized sanitary police measures were employed to combat the spread of the infection and wide scale vaccination was carried out in the area. Recent reports indicate that no additional outbreaks have occurred during the first two weeks of September.
Minnesota also reported an outbreak in a minkery during August 1953 involving 883 animals and resulting in the death of 86 mink. The source of the outbreak was attributed to feeding contaminated meat.

The small number of swine involved, the small number of outbreaks reported due to contaminated feed and the absence of postvaccination outbreaks during the first 8 months of 1953 present an entirely different anthrax picture from the situation that existed in 1952. For example, Indiana, Michigan, and Ohio that reported numerous outbreaks in swine in 1952 reported little or no anthrax during the first 8 months of 1953, while a marked decrease in incidence of swine anthrax was reported from Iowa and Illinois, Kansas, and New Jersey where numerous postvaccination outbreaks in cattle occurred in 1952, likewise reported very few outbreaks during the first two-thirds of 1953 (Table 4 and Graph 2).

The splendid results obtained in the control of anthrax in the above-mentioned areas, reveals the value of forceful cooperative effort on the
part of the practicing veterinarians, livestock sanitary officials, and public health officials in combating the spread of the disease. The veterinarians and officials who participated in this work are to be highly commended for the successful control of anthrax in these areas.

**ACTION TO PREVENT FUTURE OUTBREAKS**

Following the widespread outbreaks of anthrax in swine herds during the first quarter of 1952, special action was taken by livestock sanitary and public health officials to combat the disease and prevent its spread.

At a meeting held on March 27, 1952, attended by members of the United States Livestock Sanitary Association representing 16 States and officials of the United States Department of Agriculture, the United States Public Health Service, the Food and Drug Administration, and the Civil Defense Administration, ways and means of combating the spread of the disease were discussed.

Several resolutions concerning the problem were passed at this meeting, resulting in the following measures designed to assist in control:

1. The BAI regulations covering importation of bone meal have been amended to prohibit admission of so-called raw bone meal for use in either fertilizer or feed; however, special steamed bone meal (degelatinized, heat treated at sufficiently high temperatures to assure destruction of anthrax spores) is still permitted entry. All imported animal bones must be consigned to an approved establishment for further processing, the adequacy of sterilizing equipment being determined by the Bureau.

2. The Virus-Serum Control Division of the Bureau has required producers of anthrax bacterin to increase the number of animals used in safety tests and to increase the holding time of safety tests to a minimum of 60 days. If any test animal dies during this period, it must be established that death was not caused by the product.

3. Many states have passed laws regulating operation of rendering plants and feed-mixing plants, and requiring that all bone meal and other animal products used in fertilizer or feeds be heat-treated at sufficiently high temperatures to destroy anthrax spores.

4. The United States Public Health Service, with the assistance of the United States Bureau of Animal Industry, the Federal and Drug Administration, and the Federal Civil Defense Administration has prepared specific regulations endorsed by cooperating agencies in relation to anthrax in dairy herds. These have been recommended for inclusion in the Milk Ordinance and Code of the United States Public Health Service as applied to anthrax. They have also been approved by the United States Livestock Sanitary Association. Copies of these recommendations were sent to all State and territorial milk control authorities and others concerned on February 4, 1953.

5. In order to have up-to-date information on prevalence and distribu-
tion of the disease in livestock, arrangements have been made to have each State report monthly to the Bureau all outbreaks of anthrax occurring within its boundaries so that the Bureau can, in turn issue a monthly report on national incidence.

6. Special committees on anthrax appointed by the United States Livestock Sanitary Association and the American Veterinary Medical Association to study the anthrax problem have made specific recommendations for its future control, which if followed should materially reduce the incidence of the disease in livestock and reduce the occurrence of cases of agricultural anthrax in man.

REFERENCES


Another year has elapsed since our last report to this Association on the brucellosis eradication project and, as much as we should like to announce otherwise, this disease continues to occupy the No. 1 position among all infectious and contagious diseases of livestock occurring in the United States today. Unfortunately, because the year to year advances have not been highly spectacular, some feeling of discouragement has been evident from time to time throughout the country. Thanks to more effective promotional and educational practices, this attitude now has disappeared largely and all interested groups are taking a more realistic view of the brucellosis problem than ever before. For the most part, there is general agreement that steady progress can and is being made in eradicating brucellosis. Along with a clearer understanding of the complexities of the disease, has come the realization that from a nationwide point of view we are faced with a disease problem unlike any ever encountered before, and one that will require a long steady pull to solve. This report covers the general trend of brucellosis operations conducted throughout the nation during the past year, and contains specific observations pertaining to factors that appear to be influencing the current program.

**ADVANTAGES OF UNIFORM PROCEDURES**

After struggling through many years of divided effort, the brucellosis eradication project was finally given a fresh start in 1947, when this Association adopted an outline of recommended procedures for the eradication of brucellosis in livestock. With minor changes made during the ensuing years, these recommendations have provided the basic elements upon which our present cooperative program has developed. While it may not be perfect in every respect, there is abundant evidence to show that this instrument was a logical approach to a solution of the chaotic condition existing prior to its adoption. It has served as a rallying point for resolving the divergent views of many groups sincerely interested in unifying their efforts to eradicate brucellosis.

These recommendations continue to provide the fundamental outline for Federal-State cooperation on the brucellosis project. The fact that 47 States now subscribe to these principles, underlines the advance made in standardizing procedures. There is every reason to believe that the flexibility provided

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*Assistant in Charge, Brucellosis and Tuberculosis Eradication Division, United States Bureau of Animal Industry, Washington, D. C.*
in current recommendations has been largely responsible for the renewed
interest on the part of the livestock industry in supporting the brucellosis
eradication program. In their present form, there seems to be little need
for any major revision of the brucellosis recommendations. The natural
confusion usually attending extensive alterations should be avoided, so long
as existing procedures are found to be practical and sound. As the work
progresses, occasions will arise, of course, when the need for certain
modifications becomes apparent. Under such conditions, the Association will
no doubt make whatever changes are needed to promote more effective
practices. This policy was followed by the brucellosis committee last year in
recommending only minor additions and changes in the report adopted at
the 56th Annual Meeting in Louisville, Kentucky. Among other things, this
report included a provision for recognizing official calf vaccination in
certifying range and semi-range areas, along lines adapted to practices
followed by the industry in these regions. As a result of this approach to the
problems peculiar to beef cattle growers, new interest and more active par-
ticipation is being developed in the range and semi-range areas of the country.

As requested in the report of the Committee on Brucellosis, adopted by
this Association in 1952, the Bureau of Animal Industry has compiled and
rewritten, in simplified form, the 1947 Uniform Methods and Rules for the
Establishment and Maintenance of Certified Brucellosis-Free Herds of Cattle
and Modified Certified Areas, and subsequent modifications. In those in-
stances where re-wording could not be avoided, great care was taken to
preserve the intended meaning of the original draft. We believe the clari-
fications written into the revised Uniform Methods and Rules will be helpful
to everyone interested in the brucellosis problem.

INTERSTATE REGULATIONS ON BRUCELLOSIS

Because of the confusing array of widely differing brucellosis regulations
governing the importation of livestock by the various States, increasingly
strong pressure has developed during the past year for some immediate
effort to establish more uniformity along these lines. As a result of this
widespread interest, the Bureau of Animal Industry has arranged a meeting
of representatives from all member organizations of the National Brucellosis
Committee, to be held in Washington on September 28 and 29, 1953, for the
purpose of considering an interstate regulation on brucellosis. The entire
brucellosis eradication project can benefit materially from a practical and
effective regulation that will relieve the bewildering situation now existing
with respect to the movement of livestock across State lines.

STATUS OF BRUCELLOSIS ERADICATION EFFORT

A. Blood Agglutination Tests

It is encouraging to report that more cattle were officially tested for bru-
cellosis during the fiscal year ending June 30, 1953, than in any similar
period over the past 15 years, and 5 per cent more than were recorded in
FEDERAL-STATE BRUCELLOSIS ERADICATION

1952. In fact, the 7.75 million tests conducted last year are only about 200,000 under the peak figure reported in 1935. Based upon results of official tests reported last year, the indicated infection rate was 3.4 per cent. This compares with 4.2 per cent for the preceding year, and includes results from those States in which blood testing is restricted largely to herds where presumptive evidence of infection has been detected by the milk test. Consequently, the percentage of infection reported by such States was, no doubt, considerably higher than it would have been had the milk-test negative herds been included.

Along with the indicated reduction in percentage of infected animals, there was a corresponding drop of 0.8 per cent in the infected herd rate. We feel that evidence of a reduction in the number of infected herds is a valuable index for judging progress made in the eradication program. In this connection, it is significant to note that over the past 5 years the percentage of infected herds has dropped from 18.2 to 16.4.

B. Vaccination

As has been true each year since 1940, when vaccination was given official recognition, the number of official vaccinations again increased during the past year, reaching an all time high of 3,688,149, an increase of 16 per cent over the previous year. Although the enthusiasm for calf vaccination is being maintained and extended generally, there is a growing tendency to avoid the vaccination of adults insofar as possible. As a result of education and experience, most livestock owners are realizing that the disadvantages associated with over-age vaccination far outweigh any benefits this practice may provide. It is encouraging to see a gradually changing attitude on the part of the livestock industry with respect to the role calf vaccination should play in the over-all eradication plan. In the beginning, vaccination was too often used, solely, as an easy way out of difficult brucellosis situations that otherwise might entail a certain amount of hard work and inconvenience. In spite of competent advice to the contrary, vaccination was widely accepted as a substitute for efficient sanitation and good livestock husbandry. We are now seeing a change in the direction of more intelligent use of vaccine as a means toward an end; but not necessarily the end in itself. In several areas where vaccination has been practiced extensively for many years, increasing interest is developing for follow-up blood testing programs, looking forward to the attainment of brucellosis-free designations. Under these conditions, the advantages of vaccination can be realized to the fullest extent, thereby insuring greater progress in our eradication efforts.

One of the most debatable problems associated with vaccination, over the past several years, has been the interpretation of blood agglutination reactions in vaccinates. Because no dependable means for distinguishing between titers of vaccinal and infectious origin is available at this time, a growing need has arisen for the collection of more data on titer patterns in animals vaccinated and maintained under field conditions. In order to provide some information along these lines, a survey was undertaken during the past year.
in a county where the majority of the calves have been vaccinated over the past 10 years. Blood and milk samples were collected on a county-wide basis for serological and bacteriological studies and eventual correlation with vaccination and herd histories. After this material has been assembled and evaluated, there is reason to believe that our knowledge of titer trends, under average field conditions, will be advanced to a point where it can be used to advantage for interpreting reactions observed in vaccinates under routine program operations. In connection with this survey, it is also interesting to note that during the course of the 10-year vaccination project, the incidence of animal infection, as determined by blood agglutination test results, decreased from slightly over 5 per cent in 1942 to 0.6 per cent in 1953. Moreover, this was accomplished without any effort being made to encourage the elimination of reactors from known infected herds.

C. Milk Tests

Two years have elapsed since the milk test first became available for use in the cooperative brucellosis eradication project, and results to date confirm its anticipated advantages. From the standpoint of economy of operation and utilization of available manpower, this procedure has fulfilled the most optimistic expectations, so far as detection of brucellosis herd infection is concerned. With the continuing shortage of veterinary personnel available for routine field operations, the milk test offers a means of employing qualified lay technicians, under supervision, for the collection of milk samples, thereby permitting concentration of veterinary services on herds presumed to be infected.

A review of the year's work shows a total of 670,532 herds, representing approximately 12 million cattle, that have been milk-tested. Of the screened herds represented in this summary, 26.2 per cent were classed as suspicious. The herds tested this year represent approximately 33 per cent more than were tested during the entire preceding 16 months, during which this screening procedure was inaugurated. For the latter period, 27 per cent of the milk-tested herds showed suspicious evidence of infection.

In analyzing the 1953 milk test figures on a regional basis, we find that 93.6 per cent of these tests were conducted in 9 States, located in the Central, or Midwest, area. The balance was distributed among 14 other States and Puerto Rico, with fairly equal representation from the Eastern, Southern, and Western areas. As might be expected, the 26.7 per cent milk-test suspicious herds, detected in the Midwest States, were significantly higher than in any of the other reporting areas. It is probably true, also, from a regional standpoint, that more intensive efforts are being made to eradicate brucellosis in the Central-area States than anywhere else.

In the interest of providing efficiency and uniformity in all cooperative milk-testing operations, the Bureau has made the services of a qualified technical advisor available wherever program assistance may be required. Through this action, and the use of a standardized antigen, it is confidently expected that minor operational discrepancies may in time be reduced to a minimum.
GOAT AND SWINE TESTS

The recognition of relatively wide scale inter-species transmission of various Brucella types, has made it increasingly important that all susceptible livestock groups be considered in the brucellosis eradication program. With this in mind, the Bureau has undertaken to collect and tabulate all available data covering blood agglutination tests made each year throughout the country on swine and goat samples. In view of the fact no organized program for the eradication of brucellosis from these species is in operation at this time, it was encouraging to find a surprisingly large number of such tests being conducted at owners' requests.

To date these records have been assembled for a period of 18 months, beginning in February, 1952, and represent a total of 26,895 goats in 4,025 goat herds, and 72,190 swine in 7,251 swine herds. Of the goats tested during this period, only 0.78 per cent were classed as either reactors or suspects. In the case of swine, 4.7 per cent were similarly identified.

Here again, the data have been studied on a regional basis in order to learn more about the sectional aspect of infection in these animal groups. Approximately 80 per cent of the goat tests reported from 2 areas, namely, the Eastern and Western, with each contributing practically the same number. It is likewise interesting to note that in each of these areas the combined suspect and reactor percentages were higher than the over-all average. For the Eastern and Western areas, these figures were 0.36 per cent and 1.42 per cent, respectively.

In contrast to the concentration of goat testing in the extreme Eastern and Western areas, 96 per cent of the swine tested during the same time were located in the Central and Southern areas. Moreover, in the percentage of reactions disclosed, there was a rather wide variation between the two areas reporting most of the tests. The Southern area showed 11.2 per cent reactors and suspects, as compared with 3.9 per cent reactors and suspects reported from the Central, or Midwest area. If the Southern figures, indicating a relatively high infection rate in swine, prove to be representative for that area, they should be seriously considered in the over-all eradication program in the South. It is entirely possible that a relationship exists between the moderately high bovine brucellosis incidence in some of the Southern States and this heavy swine infection.

BRUCELLOSIS INDEMNITIES

During the past year, two more States discontinued indemnities on reactors to the test for brucellosis, leaving a total of 24 now making such payments. This equal division of States emphasizes further the continuing difference of opinion that exists on the importance of indemnity at this stage of the brucellosis eradication project. There is support, of course, for both sides of the question; however, it remains to be seen whether the use of indemnity funds for expanded service can result in more progress toward eventual eradication of brucellosis. It is generally agreed that indemnities
are an essential part of any program, such as bovine tuberculosis eradication, where no procedure other than immediate slaughter of reacting animals is recommended. In the case of brucellosis, the owners of reacting herds are provided some protection from serious economic shock by the option permitted in selecting a plan of action best suited to their particular needs and conditions.

Both appraisal and salvage values decreased appreciably last year, along with a corresponding reduction in State and Federal indemnity payments. Although the present developing surplus of beef and dairy cattle is regrettable, it may be helpful in stimulating renewed interest in eliminating reactors from infected herds. In any event, the time seems appropriate for encouraging owners to seriously consider the advantages of brucellosis-free herds in any retrenchment plans that may be necessary.

SUMMARY

Generally speaking, the campaign to eradicate brucellosis continued to show progress during the past year. In fact, the program now is receiving such strong support from the livestock industry that the immediate problem is mainly one of meeting service requirements. Two primary factors are involved in the present widespread demand for brucellosis eradication. One is the educational effort that has gone into the program over the past several years, and the other is the steady economic pressure being exerted on producers as a result of public health requirements. It goes without saying, that when the economic and public health advantages of brucellosis eradication are thoroughly understood, the livestock owners usually assume the role of leaders in promoting the work.

It is especially encouraging to see the gradually changing attitude of livestock sanitary officials and producers with respect to the eventual objective in mind. While in the past many people were thinking primarily in terms of control, we are now hearing more about the need for working along lines that will insure final eradication of brucellosis.

The 369,000 additional official blood tests and 508,000 additional vaccinations conducted in 1953, as compared with the previous year, can very well be accepted as a sign of the times. The growing demand for brucellosis eradication is making this project a priority undertaking that can assure rapid progress if the efforts of all interested groups are cooperatively applied. Under these circumstances, we cannot delay resolving minor differences that still exist on matters pertaining to program policy.

Everyone interested in seeing brucellosis eradication achieved as quickly as possible, has reason to be encouraged about the important help the milk test is affording in this regard. Over the past 12 months, this procedure has been employed as part of the official program in 22 States and Puerto Rico. This is two more States than reported use of the test last year. When the limited number of personnel required to carry out the milk test program is
considered, the coverage possible with this test is more amazing than ever. The 670,532 herds screened during the past fiscal year represent approximately 12 million head of cattle. If these figures are compared with the 660,344 herds, containing something less than 8 million animals blood-tested over the same period, at far greater cost and effort, we begin to realize the vast potentialities of an expanded milk testing program.

When it becomes possible to exploit to their fullest extent the useful qualities of the milk and blood tests and vaccination, progress will be infinitely faster than many would have believed possible.
NONSPECIFIC AGGLUTINATION REACTIONS FOR BRUCELLA*, **

MARTIN H. ROEPKE

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In evaluating the results of the serum agglutination test for brucellosis in cattle, animals with low titers ranging from incomplete agglutination at the 1:50 dilution to incomplete agglutination at 1:100 are designated as suspects. Herds containing one or more such animals with all others negative to the test are designated as suspect herds if the particular animals concerned have not been vaccinated previously within a specific time limit. The low titer agglutination reactions may be classified according to the types of herds in which they are encountered as follows:

1. Infected or reactor herds.
   A high percentage of animals with suspect titers in these herds are specific reactions for Brucella.

2. Herds following a program of vaccination with Brucella abortus strain 19.

   a. Animals in early stages of infection as indicated by high titers on subsequent tests.
   b. Cross reactions due to infections with certain species or strains of Vibrio, Pasteurella or possibly other microorganisms.
   c. Nonspecific agglutination.

A summary of a large number of reactor and suspect herds in Minnesota made by Dr. Fred C. Driver(1), Veterinarian in Charge, U. S. Bureau of Animal Industry, showed that approximately two thirds of the suspect animals in reactor herds were classified as negative on the basis of subsequent tests if the reactors disclosed on the original test were removed from the herd. This finding indicates that a high percentage of such suspect titers are probably due to a sensitization reaction as a result of exposure to the infected animals. The disease apparently does not become established in many of these animals and they become negative to the agglutination test if the exposure to the Brucella organisms is eliminated by removing the reactor animals from the herd.

A high percentage of suspect titers due to vaccination gradually subside with time. This problem is the topic for discussion by Dr. C. A. Manthei on this program, and will not be discussed here.

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* Paper No. 3051, Scientific Journal Series, Minnesota Agricultural Experiment Station, University of Minnesota.
** The studies reported herein were made possible by a grant from the Bureau of Animal Industry, U. S. Department of Agriculture.
Dr. F. C. Driver found that approximately 85 per cent of the suspect animals in nonvaccinated suspect herds are classified as negative on the basis of subsequent tests. The majority so classified were negative on the first or second retest. A small percentage were classified as negative even though the titer remained at the suspect level for the period covering several retests at 30 to 90 day intervals. The fact that a high percentage of these suspect titers subside in a short time, with the herds concerned remaining negative to all indications of brucellosis, suggests that a majority of these titers do not arise as a result of exposure to Brucella organisms.

During the past 25 years, a number of workers have reported studies which indicate that some of the transient suspect titers in typical suspect herds may be due to cross reactions with other microorganisms. Evans\(^2\) reported studies on the cross agglutination reactions between Brucella and Bacterium bronchisepticus. Mallman \(^3\) reported interagglutinability between Brucella and several species of Pasteurella organisms. Eisele and associates\(^4\), and McCullough and co-workers\(^5\) also reported an antigenic relationship between Brucella and Vibrio comma. More recently Morse and associates\(^6\) reported their studies on cross agglutination reactions between Brucella and Vibrio comma, Vibrio fetus, Pasteurella tularensis, and Salmonella pullorum. These studies indicate that some of the suspect titers may be due to temporary infections with microorganisms which have in some instances antigens in common with Brucella, particularly some species or strains of Vibrio and Pasteurella.

That the majority of suspect titers in nonvaccinated suspect herds are not due to contact of the animals with Brucella or other microorganisms which may have an antigenic component in common, is indicated by the studies on a nonspecific Brucella agglutinating substance in bovine serum reported by Hess and Roepke\(^7\). In the course of trying to demonstrate nonspecific agglutinins for Brucella, a filter paper chromatographic test was devised that made possible the detection of an agglutinating substance capable of reacting with Brucella antigen, but differed markedly from specific agglutinins in its affinity for absorption on cellulose.

The test was performed in the following manner: 1. A filter paper strip (3½ by 3/4 inches) was placed on a smooth nonabsorbent surface. With a 0.2 ml serological pipette held in a vertical position, with its tip pressed firmly against the paper, 0.02 ml of serum was allowed to soak slowly into the paper. This resulted in the formation of a spot about 18 mm. in diameter. The strip was hung with the tip just below the serum spot immersed in a special buffer-salt solution. The buffer solution was allowed to move up the paper by capillary ascent. 2. After 10-15 minutes, the filter paper strip was removed from the solution and, with the aid of a camel's hair brush, painted with hematoxylin-stained ring test antigen. 3. The strip was placed immediately on a towel, and the excess antigen washed into the towel with 1 per cent salt solution and with the aid of a second camel's hair brush, in a dabbing or blotting motion. Areas of the filter paper strip
where agglutinins and the antigen combined could withstand vigorous and prolonged washing without removing all of the stained antigen.

Figure 1 illustrates the type of reactions that were encountered. Strip 1 shows the reaction obtained with negative serums. On strips 2 and 3 the agglutinins advanced up the paper with the buffer solution, as was evidenced by the fixing of the stained antigen near the top of the strips. This type of reaction was designated as specific, for it was the type given by high-titered bovine serums and by a high percentage of the suspect or low-titered serums from infected herds, as well as by serums from animals vaccinated with strain 19 Brucella abortus. Serums from humans suffering from brucellosis as diagnosed clinically, and confirmed by agglutination tests and blood culture, also gave this type of reaction. On strips 4 and 5 the agglutinating material remained at the spot where the serum was applied. This reaction was designated as non-specific because the agglutinating substance was found to absorb on a variety of cellulose materials and in this respect differed from the specific or gamma globulin antibody. Quite a number of serums were found to display both types of agglutinins. Strips 5 and 6 serve as examples. Similar reactions were obtained by mixing serums of the specific and nonspecific types. Reactions of this nature were designated as specific.

It was found that the nonspecific substance absorbed on cellulose or Brucella cells could rather easily be removed or eluted by distilled water. This property was used to concentrate and purify the nonspecific substance in order to characterize the material. By adsorbing several liters of nonspecific reacting serum with a small amount of Brucella antigen, and washing the cells with a 1 per cent salt solution, then suspending the Brucella cells
in a small amount of distilled water to dilute the material, a water clear solution with a high titer could easily be obtained.

Table 1 is a summary of the studies by Hess(8) on the differences between the specific and nonspecific Brucella-agglutinating substances in bovine serum. The differences in properties of the two types of agglutinating substances illustrate rather clearly that the nonspecific substance is an entirely different compound than the specific agglutinins which arise as a result of an antigenic stimulus of the classical type.

Table 2 is a summary of the results obtained with the filter paper test(7) applied to suspect serums kindly supplied by Dr. F. C. Driver and his staff from samples submitted for routine field testing.

TABLE 1.

<table>
<thead>
<tr>
<th>BASES FOR THE DIFFERENTIATION OF AGGLUTINATING SUBSTANCES</th>
<th>NONSPECIFIC SUBSTANCE</th>
<th>SPECIFIC AGGLUTININ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removal from serum by adsorption with bacteria</td>
<td>Accomplished</td>
<td>Accomplished</td>
</tr>
<tr>
<td></td>
<td>with a variety of organisms</td>
<td>with Brucella only</td>
</tr>
<tr>
<td>Heat treatment required for inactivation</td>
<td>70 C. for 10 minutes</td>
<td>90 C. for 10 minutes</td>
</tr>
<tr>
<td>Adsorption on cellulose</td>
<td>Adsorbed</td>
<td>No adsorption</td>
</tr>
<tr>
<td>Yield obtained by elution from Brucella abortus with distilled water</td>
<td>Up to 38%</td>
<td>Less than 2%</td>
</tr>
<tr>
<td>Concentration of ammonium sulfate required for precipitation</td>
<td>30% saturation</td>
<td>50% saturation</td>
</tr>
<tr>
<td>Relationship to the gamma globulins</td>
<td>No association</td>
<td>Contained in the gamma globulin fraction</td>
</tr>
</tbody>
</table>

Nonspecific filter paper reactions were obtained on some of the human and swine serums tested. It is believed that the nonspecific agglutinating substance or substances are present in varying concentrations in a large portion of a variety of animals, but that in a low percentage is the concentration sufficiently high to cause agglutination in the 1:50 or 1:100 dilutions. In cattle this probably does not occur in more than 0.5 per cent of the animals in otherwise negative herds. Nonspecific reactions are most
NONSPECIFIC REACTIONS FOR BRUCELLA

TABLE 2
Summary of Differential Tests on Bovine Serums

<table>
<thead>
<tr>
<th>FILTER PAPER REACTION</th>
<th>SOURCE OF SERUM</th>
<th>NO. OF ANIMALS TESTED</th>
<th>NO. NONSPEC. ONLY</th>
<th>% NONSPEC. ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suspects from reactor herds</td>
<td>197</td>
<td>188</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Suspects from suspect herds</td>
<td>220</td>
<td>79</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Negatives from negative herds</td>
<td>100</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

commonly obtained in suspect herds in which only one animal shows a suspect titer. Rarely do all suspect titered serums from a suspect herd show a nonspecific reaction if three or more suspect animals are involved.

In co-operation with Dr. Fred C. Driver and his staff of the U. S. Bureau of Animal Industry, and Dr. R. L. West and his staff of the State Livestock Sanitary Board. Dr. Hess(9) has made a preliminary field study on the reliability of the filter paper test. Table 3 is a summary of the results of retests on animals classified as non-specific or as specific on the basis of the differential test.

TABLE 3
Field Results with the Filter Paper Chromatographic Test.

<table>
<thead>
<tr>
<th>FILTER PAPER REACTION</th>
<th>NO. ANIMALS</th>
<th>AGGLUTINATION RETEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Remained Suspicious</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>Non-Specific</td>
<td>172</td>
<td>10</td>
</tr>
<tr>
<td>Specific</td>
<td>115</td>
<td>40</td>
</tr>
</tbody>
</table>

The preliminary field studies indicate that the filter paper differential test is quite reliable. In the case of the one animal designated as showing a nonspecific reaction and which on the retest was diagnosed as a reactor, the agglutination titer increased from partial agglutination at the 1:100 dilution to complete agglutination at 1:100 at the time of the retest. On the basis of more recent studies in which a few animals have been found with titers as high as partial agglutination at the 1:200 that gave definite nonspecific reactions to the differential test, it is believed that the one apparent error of the differential test shown in Table 3 is not an error of the test.

The filter paper differential test requires rather exacting conditions for satisfactory performance and, therefore, is not readily adaptable for use under field conditions.
This past year in our laboratory, Dr. A. Amarasinghe directed his efforts to finding a suitable field test. Preliminary results indicate that certain rough strains of *Brucella abortus* which have lost the antigenic components of Brucella still retain an appreciable portion of their ability to absorb the nonspecific agglutinins from serum, without absorbing the specific agglutinins. This property of certain rough or dissociated strains of Brucella is the basis of several types of tests which are under study. Included in the various tests being studied is the differential test reported by Hoerlein for swine serums which utilizes inactivation of the nonspecific agglutinins by heat. Agglutination results of the tube test following incubation at 56°C for 18 hours are compared with the control titer obtained after incubation for 48 hours at 37°C.

Two different absorption tests involving a retest of serums after absorption with a rough strain of *Brucella abortus*, and incubation of the tube tests at 56°C. for 18 hours were compared with the filter paper test on 500 suspect serums collected from the blood samples submitted to the State Animal Diagnostic Laboratory for routine tests. The correlations of the results of these tests with those obtained with the filter paper test are very encouraging. Field type studies are now under way to determine their reliability and feasibility in an attempt to find a practical differential test for field use.

The problem of nonspecific reactions for brucellosis becomes more apparent as the infection in an area reaches a low level. In areas where three per cent or more of the cattle are infected and a significant per cent of the animals show titers in the suspect range due to exposure to Brucella, the nonspecific reactions represent a small fraction of the total number of animals manifesting some degree of reaction to the regular agglutination test. However, in areas where the infection rate is low, the opposite is true.

An example of the problem may be illustrated by the results of a recent county wide blood test in a county which has been certified for a number of years. A total of 1440 herds and 16,877 cattle were tested. Ten reactor herds (0.7 per cent), containing 20 reactor animals (0.12 per cent) and 11 suspects (0.07 per cent) were disclosed. In addition, 46 suspect herds containing a total of 60 suspect animals were found. This is a ratio of 4.6 suspect herds for each reactor herd disclosed and an average of 1.3 suspects per suspect herd. On the basis of past experience it is anticipated that a high percentage of these suspect herds will be diagnosed as negative following the first or second retest.

The reports to farmers of one or two suspect titers in their otherwise negative herd presents a rather serious problem to them. Many become quite concerned regarding a possible outbreak of brucellosis in their herds, and they immediately dispose of the suspect animals for slaughter. Also the time and expense of conducting retests in suspect herds is of considerable importance in a brucellosis control program. The development of a satisfactory differential test to distinguish between specific and nonspecific reactions...
would be of material value to the brucellosis control program, particularly in areas with low infection rates.

A similar problem seems to exist with regard to the milk and cream ring test. In the southern part of Minnesota where the infection rate is of the order of 3 to 4 per cent of the cattle, and 20 to 25 per cent of the herds, approximately 10 per cent of the ring test positive herds prove to be negative to the individual animal blood test. A recent summary of the last 4 county wide ring tests in 7 counties which have been certified for a number of years showed 170 new ring test positive herds (0.43%) out of a total of 39,135 herd tests. Sixty-eight per cent of the ring test positive herds were negative to the follow-up blood test. Twenty per cent of the ring test positive herds contained reactors, and 12 per cent suspects only. Preliminary studies indicate that nonspecific agglutinins in the milk of some animals negative to the blood test are in many instances responsible for the discrepancy between the two tests. A satisfactory differential test is also needed to meet this problem, and studies are under way in this direction.

REFERENCES


STUDIES ON BOVINE BRUCELLOSIS IMMUNIZATION: CONTROLLED EXPERIMENTS WITH B.A.I. STRAIN 19 AND HUDDLESON'S MUCOID VACCINES

H. S. BRYAN, D.V.M., Ph. D., M. E. MANSFIELD, B.S., D.V.M.

AND ROBERT GRAHAM, B.S., D.V.M.*

Following the discovery of Brucella abortus as the cause of widespread abortion in cattle by Bang1 in Denmark (1897) and the first confirmation of his findings in the United States by MacNeal and Kerr5 of Illinois (1910), efforts have been made by numerous investigators to artificially immunize cattle against brucellosis. Prior to this discovery, the natural course of the disease in infected herds clearly substantiated the fact that a majority of aborting cows and heifers calved normally in subsequent pregnancies. This natural phenomenon gave impetus to studies on the preparation of vaccines for the control of this malady. Even though Brucella immunization studies have been carried on for over 50 years, the ideal immunizing agent still has not been found.

A number of factors prompted the investigations. Between 1946, when Huddleson4 first suggested the use of mucoid growth phases of Brucella as vaccines, and 1948, when the present work was initiated, the cattle owners of the United States were subjected to reports from the lay farm press extolling the virtues of Huddleson's mucoid vaccine. Yet, results of controlled experiments on its protective value or its value compared with the B.A.I. strain 19 vaccine were not made available. The fact that strain 19 produces a significant resistance but not an absolute immunity to Br. abortus infection in cattle was recognized in 1948. It was generally accepted as the best available Brucella vaccine for cattle. This vaccine also had recognized limitations and the hope was freely expressed that a better vaccine would eventually be developed. The investigations to be described herein were undertaken to determine, if possible, the protective value of B.A.I. strain 19 and of Huddleson's mucoid Brucella vaccines in immunizing cattle against brucellosis.

MATERIALS AND METHODS

Animals. Native grade Hereford heifers between the ages of four and eight months were used in the experiments. The herd, supplying the heifers,
STRAIN 19 VERSUS MUCOID VACCINE

was free from brucellosis. The heifers were raised and bred at the University of Illinois' Dixon Springs Experiment Station, Robbs, Illinois.

In Experiment 4 grade Holstein heifers, between the ages of four and eight months were purchased from farmers in Illinois. The brucellosis status of the herds from which these dairy heifers originated was not established. However, in no case had the heifers previously been injected with a Brucella vaccine. This group of heifers was assembled and maintained as a single herd at the University of Illinois' Veterinary Research Farm, Urbana. Both the Hereford and Holstein heifers were pasture-bred for the first pregnancy by natural service at 15 to 19 months of age. All heifers were exposed to the virulent Br. abortus strain 2308 during the mid-gestation period of the first pregnancy, approximately 13 months after vaccination.

Vaccines. The B.A.I. strain 19 vaccine was purchased immediately prior to use from biological manufacturers. The dose of vaccine was 5 ml. injected subcutaneously into the heifers on the side of the neck.

Huddleson's mucoid vaccine was supplied through the courtesy of Dr. I. Forest Huddleson from current production lots of the Brucella Laboratory, Michigan State College, East Lansing, Michigan. The dose of vaccine was 1 ml. injected subcutaneously on the side of the neck in heifers in Experiments 1, 2 and 3 and subcutaneously posterior to the scapular region in heifers in Experiments 4 and 5.

Exposure Culture. All animals were exposed to the non-CO$_2$ requiring virulent Br. abortus strain 2308. The lyophilized culture was supplied by Dr. B. T. Simms, Chief of the U.S.B.A.I., prior to each exposure. Cultures of the strain were obtained on four separate occasions during the course of this study.

The concentration of organisms for the exposure dose was obtained by suitable dilution in sterile physiological saline of a basic suspension of the culture standardized by means of the Lumetron, photoelectric colorimeter, to contain 300 million cells per milliliter. The final cell concentration was adjusted so that 0.1 ml. contained the individual infective dose. The final preparation was checked for viable cells by standard plate counts. In each case the exposure culture was used the same day as prepared in the laboratory, except in Experiment 4, in which it was used on the second day after storage in a refrigerator. The following numbers of viable organisms were administered conjunctivally to each heifer in the various experiments; Experiment 1, approximately 2 million organisms on initial exposure, followed by an additional 12 million organisms after a 6 week interval; Experiment 2, approximately 10 million organisms; Experiment 3, approximately 4 million organisms; Experiment 4, approximately 4 million organisms; and Experiment 5, approximately 4 million organisms.

Artificial Exposure Technique. The 0.1 ml. infecting dose of Br. abortus strain 2308 was equally divided so that 0.05 ml. was introduced into each conjunctival sac. The inoculation was made with a tuberculin syringe. The
operator pulled the lower eyelid away from the eyeball with one hand and introduced the culture from the syringe with the other hand. After each inoculation the eyelid was closed and the eye massaged lightly. Precautions were taken so that the operator and the animal handlers would not become infected with the organism.

**Blood specimens.** Blood samples from each of the heifers were collected periodically during the prevaccination, postvaccination, and postexposure periods for the brucellosis serum agglutination test. The standard plate agglutination test, using B.A.I. Brucella plate antigen was employed. End titers were determined on all serum samples showing a complete reaction in the 1:100 dilution or above. For this purpose the standard tube agglutination test was used in which two-fold dilutions of serum starting with the 1:25 dilution and ending with the 1:51,200 dilution were made in B.A.I. Brucella tube antigen.

**Bacteriological specimens.** Bacteriological examinations were made of each aborted fetus or weak calf that died. For this purpose liver, spleen and stomach contents were collected aseptically into sterile pint jars. The jars were properly identified and placed in a deep freezer until delivered to the laboratory. Uterine discharge or placental cotyledons were collected from each heifer that calved normally in Experiments 3 and 5. This material was placed in sterile jars and handled as described above. In Experiment 4, fetal liver, spleen and stomach contents together with milk, uterine discharge and placental cotyledons from the dam were not frozen but were taken to the laboratory immediately for culture.

Attempted recovery of *Br. abortus* strain 2308 after exposure was made by inoculation of tryptose and crystal-violet tryptose agar plates with the fetal and maternal specimens. Colonies on the plates showing Brucella characteristics were selected for identification. Specimens from each heifer not yielding *Br. abortus* on direct culture were pooled, suspended in sterile physiological saline and injected into guinea pigs. Six weeks later the guinea pigs were killed. Guinea pig liver and spleen tissues were cultured on tryptose agar in further Brucella isolation attempts.

**Experimental Results**

*Experiment 1.* There were 60 Hereford heifers, 20 of which were vaccinated with strain 19 vaccine, (Lot 1), 20 were vaccinated with Huddleson's mucoid vaccine, (Lot 2), and the remaining 20 were retained as unvaccinated controls (Lot 3). These animals were maintained as a single herd on summer pasture and in winter quarters under conditions intended to avoid extraneous Brucella exposure.

In summarizing Experiment 1, the following results were noted (see Table 1):
Table 1. Results of Conjunctival Exposure to Brucella abortus* of Pregnant Vaccinated and Unvaccinated Heifers, Experiment 1

<table>
<thead>
<tr>
<th>Lot</th>
<th>Vaccine</th>
<th>No. of Heifers</th>
<th>Live Calves</th>
<th>Abortions</th>
<th>Brucella isolation from fetuses</th>
<th>Pos. Blood test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>1</td>
<td>B.A.L. strain 19</td>
<td>14</td>
<td>50</td>
<td>7</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Huddleson's mucoid</td>
<td>16</td>
<td>56</td>
<td>7</td>
<td>44</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Unvaccinated controls</td>
<td>15</td>
<td>60</td>
<td>6</td>
<td>40</td>
<td>2</td>
</tr>
</tbody>
</table>

*Heifers exposed while pregnant with 2 million Br. abortus strain 2308, 56 weeks after vaccination, and with 12 million organisms, 62 weeks after vaccination.

1. **Lot 1, strain 19 vaccinated heifers.** Of 14 pregnant, 7 (50 per cent) either aborted or produced premature weak calves that later died and 7 (50 per cent) calved normally. *Br. abortus* was recovered from only 1 (14 per cent) of the 7 fetuses. Six (43 per cent) developed agglutinin titers of 1:100 or higher after exposure.

2. **Lot 2, Huddleson's mucoid vaccinated heifers.** Of the 16 pregnant, 7 (44 per cent) either aborted or produced premature weak calves that later died and 9 (56 per cent) calved normally. *Br. abortus* was recovered from 2 (29 per cent) of the 7 fetuses. Four (25 per cent) had agglutinin titers of 1:100 or higher after exposure.

3. **Lot 3, unvaccinated control heifers.** Of 15 pregnant, 6 (40 per cent) either aborted or produced premature weak calves that later died and 9 (60 per cent) calved normally. *Br. abortus* was recovered from 2 (33 per cent) of the 6 fetuses. Five (33 per cent) had agglutinin titers of 1:100 or higher after exposure.

Experiments 2, 3, 4 and 5. The results of these four experiments were combined as they were found to be homogeneous statistically and served as the basis for the conclusions. The results obtained in each individual experiment are presented in Table 2. The postvaccination agglutinin responses of the heifers in the various groups are illustrated in Figure 1. The mean post-exposure agglutinin titers of the heifers according to gestation outcome are presented in Table 6.

In summarizing Experiments 2, 3, 4, and 5, the following results were noted:

1. **Lot 1, strain 19 vaccinated heifers.** Of 31 pregnant 11 (35 per cent) either aborted or produced premature weak calves that later died and 20 (65 per cent) calved normally. *Br. abortus* was recovered from 12 (46 per cent) of the 26 fetal and maternal specimens examined. Fourteen (45 per cent) developed agglutinin titers of 1:100 or higher after exposure.

2. **Lot 2, Huddleson's mucoid vaccinated heifers.** Of 34 pregnant, 27 (79 per cent) either aborted or produced premature weak calves that later died
### TABLE 2.
Results of Conjunctival Exposure to Brucella abortus* of Pregnant Vaccinated and Unvaccinated Heifers. Experiments 2, 3, 4 and 5

<table>
<thead>
<tr>
<th>Exper No.</th>
<th>No. of Heifers</th>
<th>Live Calves</th>
<th>Abortions</th>
<th>Brucella Isolation</th>
<th>Maternal and/or fetus Isolations</th>
<th>Pos. blood test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Per Cent</td>
<td>No. Per Cent</td>
<td>No. Exams.</td>
<td>No. Per Cent</td>
<td>No. Per Cent</td>
<td>No. Per Cent</td>
</tr>
<tr>
<td>B.A.I. strain 19 vaccines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>5</td>
<td>50</td>
<td>50</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>9</td>
<td>90</td>
<td>1</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>100</td>
<td>0</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>3</td>
<td>37</td>
<td>5</td>
<td>63</td>
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<tr>
<td>Totals</td>
<td>31</td>
<td>20</td>
<td>65</td>
<td>11</td>
<td>26</td>
<td>12</td>
</tr>
<tr>
<td>Huddleson's mucoid vaccines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>0</td>
<td>—</td>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>4</td>
<td>33</td>
<td>8</td>
<td>67</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>1</td>
<td>33</td>
<td>2</td>
<td>67</td>
<td>3</td>
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<tr>
<td>5</td>
<td>9</td>
<td>2</td>
<td>22</td>
<td>7</td>
<td>78</td>
<td>9</td>
</tr>
<tr>
<td>Totals</td>
<td>34</td>
<td>7</td>
<td>21</td>
<td>27</td>
<td>79</td>
<td>34</td>
</tr>
<tr>
<td>Unvaccinated Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>0</td>
<td>—</td>
<td>6</td>
<td>100</td>
<td>6</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>67</td>
<td>1</td>
<td>33</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>1</td>
<td>12</td>
<td>7</td>
<td>88</td>
<td>8</td>
</tr>
<tr>
<td>Totals</td>
<td>25</td>
<td>3</td>
<td>12</td>
<td>22</td>
<td>88</td>
<td>25</td>
</tr>
</tbody>
</table>

*Heifers exposed while pregnant with 10 million Br. abortus strain 2308 organisms in Experiment 2 and with 4 million in Experiments 3, 4 and 5.

and 7 (21 per cent) calved normally. *Br. abortus* was recovered from 26 (76 per cent) of the 34 fetal and material specimens examined. Twenty-eight (82 per cent) developed agglutinin titers of 1:100 or higher after exposure.

3. Lot 3, Unvaccinated control heifers. Of 25 pregnant, 22 (88 per cent) either aborted or produced premature weak calves that later died and 3 (12 per cent) calved normally. *Br. abortus* was recovered from 22 (88 per cent)
of the 25 fetal and maternal specimens examined. Twenty-two (88 per cent) developed agglutinin titers of 1:100 or higher after exposure.

During the investigations an experimental streptomycin-killed Br. suis bacterin and an experimental vaccine prepared from a dissociated strain of Br. suis were tested on 57 heifers. The bacterin was prepared by inactivating standardized culture suspension with 500 milligrams of streptomycin per milliliter. The dissociated strain of Br. suis employed for the preparation of the vaccine was prepared by treating a smooth culture of the organism with sublethal doses of X-irradiation. This strain displayed 100 per cent non-smooth, roughlike types, of which 99 per cent were of a type called I₃ (Intermediate 3) and 1 per cent were rougher and resembled an I₄ or R type according to Dr. Werner Braun's system of classification. It was observed that the bacterin stimulated the production of a high antibody titer in heifers vaccinated between the ages of 4 and 8 months and that the vaccine injections caused either no titer reaction or only a slight rise in antibody level. Subsequent Br. abortus challenge of vaccinated heifers revealed that neither the bacterin nor the vaccine provided protection as demonstrated by abnormal births, recovery of Br. abortus and positive serum agglutination tests.

**DISCUSSION**

Statistical analysis of the data showed Experiments 2, 3, 4 and 5 to be homogeneous. The results obtained in Experiment 1 did not qualify for consideration with the results obtained in Experiments 2, 3, 4 and 5 because of their striking lack of similarity. The reason or reasons for the dissimilarity must have been in the heifers, the vaccines, the exposure culture, the techniques employed, or perhaps the weather. It was impossible to determine the exact reason for this apparent failure. No change in over-all planning
## TABLE 3.

**Results of Conjunctival Exposure to Brucella Abortus of Pregnant Vaccinated and Unvaccinated Heifers, Experiments 2, 3, 4 and 5.**

<table>
<thead>
<tr>
<th>LOT</th>
<th>VACCINE</th>
<th>NO. OF HEIFERS</th>
<th>NO. LIVE CALVES</th>
<th>PERCENTAGE</th>
<th>NO. ABORTIONS</th>
<th>PERCENTAGE</th>
<th>NO. MATERNAL AND OR FETUS</th>
<th>NO. POS. BLOOD TEST</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B.A.I. strain 19</td>
<td>31</td>
<td>20</td>
<td>65</td>
<td>11</td>
<td>35</td>
<td>79</td>
<td>34</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>Huddleston mucoid</td>
<td>34</td>
<td>7</td>
<td>21</td>
<td>11</td>
<td>27</td>
<td>79</td>
<td>34</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>Unvaccinated controls</td>
<td>25</td>
<td>3</td>
<td>12</td>
<td>22</td>
<td>88</td>
<td>88</td>
<td>22</td>
<td>88</td>
</tr>
</tbody>
</table>

*Note: No. indicates number, % indicates percentage.*
or application of procedures occurred between Experiment 1 and the subsequent experiments. Therefore, the data obtained in Experiments 2, 3, 4 and 5 were grouped and discussed together. The results of Experiment 1 were recorded in Table 1 but not discussed because of their apparent lack of significance.

Based upon abnormal births in heifers following Brucella challenge, infection was established in 35 per cent of the strain 19 vaccinated heifers, 79 per cent of the Huddleson's mucoid vaccinates and in 88 per cent of the non-vaccinated control heifers (see Table 4). If the 12 per cent failure of infection in the control heifers may be accepted as representing the index of natural resistance for each of the groups under similar conditions of exposure, the protective values would be 53 per cent for strain 19 vaccine and 9 per cent for Huddleson's mucoid vaccine (see Table 5).

Based upon recovery of Br. abortus from the experimental heifers or their fetuses at the time of calving, infection was established in 46 per cent of the strain 19 vaccinates, 76 per cent of the Huddleson's mucoid vaccinates, and 88 per cent of the unvaccinated controls (see Table 4). If the 12 per cent failure of infection in the control heifers may again be accepted as representing the index of natural resistance for each of the groups under similar conditions of exposure, the protective values would be 42 per cent for strain 19 vaccine and 12 per cent for Huddleson's mucoid vaccine (see Table 5).

**TABLE 4.**
Protective Values of Various Brucella Vaccines Assessed on Infectivity Rate

<table>
<thead>
<tr>
<th>LOT</th>
<th>VACCINE</th>
<th>NO. OF HEIFERS</th>
<th>INFECTION, BASED UPON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Abnormal births</td>
</tr>
<tr>
<td>1</td>
<td>B.A.I. strain 19</td>
<td>31</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Huddleson's mucoid</td>
<td>34</td>
<td>79</td>
</tr>
<tr>
<td>3</td>
<td>Unvaccinated controls</td>
<td>25</td>
<td>88</td>
</tr>
</tbody>
</table>

Based upon positive serum agglutination tests (titers of 1:100 or higher) in heifers after Brucella challenge, infection was established in 45 per cent
of the strain 19 vaccinates, 82 per cent of the Huddleson’s mucoid vaccinates and in 88 per cent of the nonvaccinated controls (see Table 4). If the 12 per cent failure of infection in the group of unvaccinated control heifers may be accepted as representing the index of natural resistance for each of the groups under similar conditions of exposure, the protective value would be 43 per cent for strain 19 vaccine and 6 per cent for Huddleson’s mucoid vaccine, (see Table 5). Evaluation of the establishment of infection on the basis of agglutinin development following Brucella challenge of the heifers was possible because retained post-vaccination titers were low or nonexistent. In no case were pre-exposure titers present in the range of 1:100 or higher.

These results indicate the adequacy of the doses of Br. abortus strain 2308 employed for challenge under the conditions of Experiments 2, 3, 4 and 5. The challenge in one instance, (Experiment 2), overcame the protective value of Huddleson’s mucoid vaccine, if it possessed any value. In none of the experiments was the protective value of strain 19 vaccine overwhelmed. Neither of the vaccines gave 100 per cent protection to the challenging infection.

Statistical analysis of the data revealed that strain 19 vaccine afforded a protection against brucellosis that was significantly better than that provided in the unvaccinated controls. In protection against abortions, the difference was significant at the 0.1 per cent level. Huddleson’s mucoid vaccine was not significantly better in providing resistance than that already inherent in the unvaccinated animals. It was observed that Huddleson’s mucoid vaccine may afford some protection but chances for this occurring by chance were determined to be in the order of about one in 10 instances. This is not an acceptable level for significance. Edgington, King and Frank² reported on the exposure of 6 nonvaccinated control heifers, 6 Huddleson mucoid vaccinates, and 5 strain 19 vaccinated heifers. The protective value of the vaccines was determined by the recovery of Br. abortus. The percentage of heifers classed as resistant to exposure was 16.7 per cent of the controls, 50 per cent of “M” vaccinates and 80 per cent of strain 19 vaccinates. In a subsequent test Edgington and King³ reported the results of exposure of 11 nonvaccinated control heifers, 9 Huddleson mucoid vaccinates and 6 strain 19 vaccinated heifers. The percentage of resistant animals in this test was 9.9 per cent of the non-vaccinates, 22.2 per cent of the “M” vaccinates and 83.3 per cent of the strain 19 vaccinates. In both trials the exposure challenge consisted of a total dose per animal of 750,000 organisms of Br. abortus strain 2308. They concluded that strain 19 vaccine afforded a greater protective value than did the “M” vaccine but that “M” vaccine was not entirely devoid of protective value. Under conditions of our experiments, in which somewhat larger exposure doses of Br. abortus strain 2308 were employed, strain 19 vaccine was the only vaccine that afforded a significant degree of protection.

High and rather persistent blood agglutinin titers were observed following
vaccination with strain 19 vaccine (see Figure 1.) These titers gradually receded so that at exposure time, approximately 13 months after vaccination, only 1 (2.7 per cent) of 37 heifers carried a suspicious (1:50) titer. Huddleson’s mucoid vaccine did not produce a high or persistent blood titer. No titers exceeded 1:50.

The postexposure agglutinin titers, the duration of pregnancy and the outcome of gestation are tabulated in Table 6. Where the gestation terminated

<table>
<thead>
<tr>
<th>TABLE 6.</th>
<th>Postexposure Agglutinin Responses According to Gestation Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experiments 2, 3, 4 and 5</td>
</tr>
<tr>
<td>VACCINE</td>
<td>ABORTIONS No. Titer Days</td>
</tr>
<tr>
<td>B.A.I. strain 19</td>
<td>11 1:1700 67</td>
</tr>
<tr>
<td>Huddleson’s mucoid</td>
<td>27 1:1540 63</td>
</tr>
<tr>
<td>Unvaccinated controls</td>
<td>22 1:1450 59</td>
</tr>
</tbody>
</table>

in abnormal births, the highest agglutinin titers occurred, indicating Brucella infection. The titers in heifers producing live calves were generally low, indicating lack of infection. The difficulty of infecting sexually mature non-pregnant heifers was indicated by the low titers in such heifers. The average duration of pregnancy after Brucella challenge was 62 days in 60 pregnant heifers in which the gestation terminated in abnormal births as compared with 121 days in 30 heifers with normal births.

**SUMMARY**

Results of controlled experiments with Bureau of Animal Industry strain 19 vaccine and Huddleson’s mucoid vaccine in immunizing cattle against brucellosis are reported.

Five experiments involving 228 heifers vaccinated between the ages of 4 and 8 months were completed. All heifers were Herefords except 12, which were Holstein-Friesians.

Challenge was by conjunctival sac instillation, using virulent *Brucella abortus* strain 2308 organisms, during the midgestation period of the first pregnancy. The exposure dose varied with the experiment from 4 million to 14 million viable organisms per heifer.

The results of four experiments with a total of 90 pregnant heifers were homogeneous statistically and served as the basis for the conclusions.

The protective value of the vaccines was determined by (1) abnormal births, (2) recovery of *Br. abortus* and (3) positive serum agglutination tests after challenge of the pregnant heifers.

Abnormal births occurred in 11 (35 per cent) of 31 strain 19 vaccinates,
27 (79 per cent) of 34 Huddleson's mucoid vaccinates and 22 (88 per cent) of 25 unvaccinated controls.

Recovery of Br. abortus by cultural methods and guinea pig innoculation of specimen material from the heifer and/or her aborted fetus was obtained from 12 (46 per cent) of 26 specimens from strain 19 vaccinates, 26 (76 per cent) of 34 specimens from Huddleson's mucoid vaccinates and from 22 (88 per cent) of 25 specimens from the unvaccinated controls.

Positive Brucella serum agglutination tests (titers of 1:100 or higher) were obtained after challenge in 14 (45 per cent) of 31 strain 19 vaccinates, 28 (82 per cent) of 34 Huddleson's mucoid vaccinates and in 22 (88 per cent) of 25 unvaccinated controls.

It was concluded that, under the conditions of these experiments, Huddleson's mucoid vaccine failed to provide a significant degree of resistance against brucellosis, whereas B.A.I. strain 19 vaccine did induce a significant resistance of a relative type.

An experimental streptomycin-killed Br. suis bacterin and an experimental vaccine prepared from a roughlike dissociated strain of Br. suis were tested on 57 heifers. Neither the bacterin nor the vaccine provided protection against Br. abortus challenge.

Other observations made in connection with the Brucella vaccinal immunization study are reported and discussed.

REFERENCES
The problem of cattle (suspects and low-titer reactors) with low agglutinin titers of 1:50 and 1:100 has always caused confusion and indecision in the control and eradication of bovine brucellosis. According to reports from some states, the number of suspects has apparently increased following an accelerated calf-vaccination program. The degree of increase in the number of suspects has not been determined because of considerable variation in reports from different states. Indiscriminate vaccination of over-aged heifers and adult cattle has added to the confusion by increasing the number of animals with suspicious and low reacting vaccinal titers which can not now be differentiated from infection titers. Consequently, we are not only confronted with the problem of nonvaccinated suspects and low-titer reactors but also with vaccinated cattle in the same category.

Considerable research has been conducted to determine the significance of suspicious agglutinin reactions for brucellosis of cattle as well as differentiation between vaccinal and infection agglutinin titers. The different procedures investigated or under investigation are: Comparison of prevaccinal and postvaccinal titers of cattle following the injection of viable or dead strain 19 vaccine, whey agglutination test, milk ring test employing the dilution technique, filter paper chromatographic technique, treatment of blood sera with heat, and agglutination absorption with nonspecific antigens. Since the first three procedures mentioned are the ones that have been most extensively investigated for the purpose of differentiating between vaccinal and infection titers, they will be given the most consideration in this presentation.

In order to fully discuss all of the research conducted on the comparison of agglutinin titers in vaccinated and infected cattle before and after injection of strain 19 vaccine, it will be necessary to first present the unpublished results of studies conducted at the Animal Disease Station during the past several years.

The techniques employed were similar in all respects to those described by Dick, Venzke and York\(^1\). A total of 155 nonpregnant vaccinated and nonvaccinated cattle with agglutinin titers of 1:25 or higher were studied. These animals were selected on the basis that their titers remained unchanged or decreased on two preinjection tests conducted two weeks apart. Bacteriological and serological tests were conducted on the cattle immediately prior

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*Pathological Division, Bureau of Animal Industry, Beltsville, Maryland.
BRUCELLA YACCINAL AND INFECTION TITERS

to and in the majority of animals for at least two years before intramuscular injection of strain 19 vaccine. Viable strain 19 vaccine was injected intramuscularly in 5 ml. amounts two days following the second preinjection agglutination test. Blood samples were also collected at approximately 9 and 18 days following injection of vaccine to determine its effect on agglutinin response. End-point titers were ascertained on all sera by the tube method and the maximum titer was assigned to the dilution showing 50 per cent or more agglutination. Comparisons of prevaccinal and postvaccinal titers and interpretation of results were made in accordance with the criterion established by Dick, Venzke, and York. Their criterion for establishing the brucellosis status of cattle is that a rise in the postvaccinal agglutinin titer of one or more dilutions is evidence of freedom from brucellosis; whereas, a decrease or no change in titer is evidence of infection.

Results obtained from the intramuscular injection of viable strain 19 vaccine into vaccinated or nonvaccinated cattle showing titers of 1:25 or higher are presented in Tables I and II. It was found that postvaccinal titers increased one or more dilutions in 77.7 per cent of the infected vaccinated cattle and 56.5 per cent of infected nonvaccinated cattle or 62.5 per cent of all infected cattle. If the established interpretation of this test is correct, 62.5 per cent of the infected cattle would be classified as animals having titers due to vaccination rather than infection. It should be noted that all of the infected animals had preinjection titers of at least 1:100 which is the present accepted diagnostic level of infection and which was in complete agreement with bacteriological findings. In summarizing the results on the

### TABLE I

<table>
<thead>
<tr>
<th>Maximum Pre-injection Titers</th>
<th>Range of Maximum Dilution Changes of Post-Injection Titers</th>
<th>+7 or More</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Cattle</td>
<td>-2</td>
</tr>
<tr>
<td>Noninfected Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:25</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>1:50</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>1:100</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>1:200</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>1:400</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Totals</td>
<td>70</td>
<td>2</td>
</tr>
</tbody>
</table>

| Infected Group              |                |    |    |   |    |    |    |    |    |    |       |
| 1:100                       | 2              |    |    |   |    |    |    |    |    |    |       |
| 1:200                       | 2              |    |    |   |    |    |    |    |    |    |       |
| 1:400                       | 2              |    |    |   |    |    |    |    |    |    |       |
| 1:800                       | 1              |    |    |   |    |    |    |    |    |    |       |
| 1:1600                      | 2              |    |    |   |    |    |    |    |    |    |       |
| Totals                      | 9              |    | 1  | 1 | 7  |    |    |    |    |    |       |

increased one or more dilutions in 77.7 per cent of the infected vaccinated cattle and 56.5 per cent of infected nonvaccinated cattle or 62.5 per cent of all infected cattle. If the established interpretation of this test is correct, 62.5 per cent of the infected cattle would be classified as animals having titers due to vaccination rather than infection. It should be noted that all of the infected animals had preinjection titers of at least 1:100 which is the present accepted diagnostic level of infection and which was in complete agreement with bacteriological findings. In summarizing the results on the
BRUCELLA VACCINAL AND INFECTION TITERS

TABLE II
Agglutinin Response of Nonvaccinated Cattle to Injection of Viable Strain 19 Vaccine

<table>
<thead>
<tr>
<th>Maximum Pre-injection Titers</th>
<th>Number of Cattle</th>
<th>Range of Maximum Dilution Changes of Post-Injection Titers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-2</td>
</tr>
<tr>
<td>Noninfected Group</td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>1:25</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>1:100</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>1:200</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>53</td>
<td>1</td>
</tr>
</tbody>
</table>

Infected Group

|                 | 3                | 3  | 2  | 1  |    |    |    |    |    |    |           |
| 1:100           | 4                | 1  | 2  | 1  |    |    |    |    |    |    |           |
| 1:200           | 5                | 1  | 1  | 2  | 1  |    |    |    |    |    |           |
| 1:400           | 5                | 2  | 1  | 1  | 1  |    |    |    |    |    |           |
| 1:800           | 3                | 2  | 1  | 1  |    |    |    |    |    |    |           |
| 1:1600          | 3                | 1  | 1  | 1  |    |    |    |    |    |    |           |
| 1:3200          |                  |    |    |    |    |    |    |    |    |    |           |
| Totals          | 23               | 1  | 3  | 6  | 5  | 6  | 2  |    |    |    |           |

noninfected groups, it was found that the postvaccinal titers increased in 86 per cent of the vaccinated and 85 per cent of the nonvaccinated cattle or 85.4 per cent of the 123 animals tested. Of the 85.4 per cent (105 animals) classified as noninfected by bacteriological tests and postinjection agglutinin response, 100 were also classified as noninfected by virtue of their preinjection titers which were below the 1:100 diagnostic level of infection. Of the 18 noninfected animals (14.6 per cent) classified as infected by their postinjection agglutinin titers, 10 had a preinjection titer of 1:100 or higher. Postinjection agglutinin titers of approximately 40 per cent of the noninfected animals did not recede to their preinjection level within eight months following injection of strain 19 vaccine.

ANAMNESTIC REACTION

The most frequently discussed method of differentiating between vaccinal and infection titers for brucellosis in cattle is the one introduced and described by Dick, Venzke, and York. The theory of this procedure is that the injection of viable strain 19 into noninfected vaccinated cattle will produce an increase in their agglutinin titers of one or more dilutions; whereas, injection of the same vaccine in infected cattle will not produce an increase in their titers. A prerequisite for a successful test is that the agglutinin titers of cattle are receding or stable immediately prior to injection of strain 19 vaccine. Barner, Oberst, and Atkeson proposed that the basis for this test involves the anamnestic reaction which is a prompt and efficient production of antibodies following the secondary injection of a specific or
nonspecific antigen. It would be exceptional if everyone agreed with their explanation and nomenclature of this phenomenon, nevertheless the test will be identified as the anamnestic reaction in this paper.

In an attempt to evaluate the significance of a secondary agglutinin response in cattle to an injection of viable strain 19 vaccine as a method of differentiating between vaccinal and infection titers, the discussion will be on the results reported by Dick, et al. Venzke, Barner, et al. King, et al. and Manthei. These results are summarized in Table III.

**TABLE III**

**Review and Summary of Research on the Agglutinin Response Produced by Injecting Viable Strain 19 Vaccine in Cattle with Preinjection Titers of 1:50 or Higher**

<table>
<thead>
<tr>
<th>REFERENCES</th>
<th>Number of Cattle</th>
<th>Maximum Unchanged</th>
<th>Post-Injection Titors Decreased 1 or More Dilutions</th>
<th>Increased 1 or More Dilutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dick, et al¹ and Venzke²</td>
<td>17-V</td>
<td>0</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>Barner, et al³</td>
<td>17-V</td>
<td>2</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Manthei⁵</td>
<td>38-V</td>
<td>4</td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td><strong>&quot;</strong></td>
<td>20-NV</td>
<td>6</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>92</td>
<td>12</td>
<td>4</td>
<td>76</td>
</tr>
<tr>
<td>Dick, et al¹ and Venzke²</td>
<td>16-V</td>
<td>15</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Barner, et al³</td>
<td>4-NV</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>King, et al⁴</td>
<td>14-V</td>
<td>13</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Manthei⁵</td>
<td>45-V</td>
<td>12</td>
<td>6</td>
<td>27</td>
</tr>
<tr>
<td><strong>&quot;</strong></td>
<td>9-V</td>
<td>1</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>&quot;</strong></td>
<td>23-NV</td>
<td>6</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>111</td>
<td>50</td>
<td>11</td>
<td>50</td>
</tr>
</tbody>
</table>

V — Vaccinated with strain 19; NV — Not vaccinated; *
— Vaccination status of cattle is unknown.

Since Brucella agglutinin titers of 1:50 are the lowest ones considered significant, only cattle having titers of 1:50 or higher are considered. This test classified 76 of 92 noninfected cattle as being free of brucellosis for an average efficiency performance of 82.7 per cent. If the brucellosis status of the same group of cattle is ascertained by the standard sero-agglutination test, on the basis that a preinjection titer of 1:100 is evidence of infection, 44 of 92 or 48.9 per cent would be classified as non-infected. Of the 16 noninfected cattle classified as infected by their anamnestic reactions, 13 also had preinjection titers of 1:100 or higher.

The results of injecting infected cattle with viable strain 19 vaccine reported by the different investigators vary considerably. King, et al. reported that 60 per cent of the known infected cattle were classified as having titers
due to vaccination rather than infection. These results are similar to those presented by the writer in this paper which show that 62.5 per cent of the known infected cattle were classified as noninfected on the basis of their secondary agglutinin titers. Results reported by the other investigators were considerably different from those already discussed. They classified at least 90 per cent of their known infected animals correctly. A summary of all the data shows that 50 of 111, or 45 per cent of the known infected cows were classified as noninfected or having titers due to vaccination rather than infection. In contrast to these results, the standard sero-agglutination test showed that all of known infected cattle had Brucella agglutinin titers of 1:100 or higher prior to injection of strain 19 vaccine.

Barner, Oberst, and Atkeson recently reported on the anamnestic reactions in noninfected vaccinated and infected cattle following the intramuscular injection of 5 ml. of dead strain 19 vaccine. They injected 35 noninfected and 11 infected cattle. The preinjection agglutination test of the noninfected group showed that 16 had no titers as high as 1:50, 12 had titers of 1:50, 5 had titers of 1:100, and 2 had titers of 1:200. The same test conducted on the infected group showed that all these cattle had titers of 1:100 or higher. All of the noninfected cattle showed a rise of one or more dilutions in titer following injection of dead strain 19 vaccine; whereas, none of the infected cattle showed a rise in titer at this time.

We have recently conducted a similar experiment in which 12 noninfected and 5 infected cattle were employed. The preinjection titers of the noninfected cattle were as follows: 5 were negative at 1:25, 4 were positive at 1:25, 2 were positive at 1:50, and 1 was positive at 1:200. All of the infected cattle had preinjection titers of 1:200 or higher and had been infected for at least three years. Our results in differentiating between vaccinal and infection titers with dead strain 19 vaccine were the same as those reported by Barner, et al. However, more research must be done before a reliable evaluation of the test can be made. Furthermore, these preliminary studies indicate that dead strain 19 has some of the same disadvantages as viable strain 19. All of our noninfected cattle, 10 vaccinated and 2 nonvaccinated, have persistent postinjection titers of at least two dilutions higher than their preinjection titers four months after injection of dead strain 19 vaccine. The mean number of dilutions change in preinjection titers of the 17 cattle in this experiment was 0.71 and the standard deviation around this mean was 1.2.

A review of the compiled data on the anamnestic reactions produced by strain 19 vaccine has clearly pointed out again that most diagnostic tests have definite limitations. The principal weakness of this test is its failure to identify a significant percentage of the cattle classified as infected by both the bacteriological and standard sero-agglutination tests. Failure to identify infected animals by their anamnestic reactions is certainly more detrimental to a brucellosis control program than elimination of some noninfected vaccinated animals with agglutinin titers of 1:100 or higher by the standard
sero-agglutination test. Furthermore, the percentage of strain 19 vaccinated cattle over 30 months of age with titers of 1:100 or higher can be held to a minimum by vaccinating calves between 6 and 8 months of age and by stopping indiscriminate vaccination of over-aged heifers and adult cows. There is no concrete evidence that shows adult vaccination or revaccination of calf-vaccinated cattle will produce a more solid or prolonged immunity to brucellosis than vaccination of calves within the recommended age limits. There is, however, considerable experimental evidence to the contrary.18,14,16

Several other disadvantages of this differential diagnostic test should be mentioned before concluding the discussion. The failure of postinjection titers to recede to their preinjection level in a significant number of cattle within eight months after vaccination further adds to the interference with the standard sero-agglutination test in determining the brucellosis status of cattle. King, et al4, has presented evidence showing that the average normal fluctuation of vaccinal and infection titers is 0.73 of a dilution and the average deviation around this mean is 1.1. This observation is similar to our data on approximately 300 vaccinated and infected cattle. Similar observations have been reported by Edgington and Donham7 and Metzger and Shuarts. This evidence makes the significance of a one dilution rise in titer extremely questionable. The test is also time consuming and costly.

The principal advantage of the test is that it can be applied to cattle of all ages and during all stages of lactation as well as during the nonlactating period.

No mention was made about the pregnancy status of experimental cattle by the other investigators;1,2,3,4 consequently, we do not know what effect a secondary injection of strain 19 will have on pregnant vaccinated cows showing titers of 1:50 or higher.

**WHEY AGGLUTINATION TEST**

Traum and Maderious9 first introduced the whey agglutination test as a possible method of differentiating between infected and noninfected cattle with comparable blood serum agglutinin titers for brucellosis. They conducted bacteriological examinations and whey agglutination tests on quarter milk samples of 342 cattle. The maximum whey agglutinin titer of any single quarter was the titer used to classify each animal. Eighty-five of 107 (79.4 per cent) cattle with whey titers of 1:25 or higher had udder infection; whereas, only 4 of 235 (1.7 per cent) cattle with whey titers less than 1:25 had udder infection.

Blake and Manthei10 conducted the whey agglutination test on a total of 810 composite milk samples collected from 44 cattle over a period of 18 months. All of the cattle from which 380 composite milk samples gave whey titers of 1:25 or higher had blood titers of 1:50 or higher; 329 (86.5 per cent) were from infected cows; whereas, of 430 composite milk samples with whey titers of less than 1:25, only 19 (4 per cent) were from infected cattle. Further elaboration of this study showed that 94.6 per cent of the
milk samples from the 18 infected cows had whey titers of 1:25 or higher. All of these animals had blood titers of 1:100 or higher. In the group of 26 noninfected cattle, whey agglutinin titers were negative in the 1:25 dilution in 89 per cent of their milk samples; whereas, only 35 per cent had blood titers less than 1:100.

The results of experiments conducted by Traum and Maderious \(^9\) and Blake and Manthei \(^{10}\) were comparable regardless of testing individual quarter milk samples in one case and composite quarter milk samples in the other. In view of these findings, conducting the whey agglutination test on composite quarter milk samples appears to be the most practical because it simplifies collection of milk and decreases the number of whey samples to be tested by 75 per cent.

Venzke \(^2\) reported that in his experience the whey agglutination test was less specific than the anamnestic reaction in differentiating between vaccinal and infection titers for brucellosis in cattle. Barner, et al. \(^8\) stated that studies on the whey agglutination test were discontinued because of so many variations and lack of correlation in results.

The advantages of the whey agglutination test as a method of differentiating between cattle with vaccinal and infection titers are that equipment now being used in Brucella testing laboratories is adequate and there is no inconvenience involved in collecting composite quarter milk samples from cattle. The disadvantages are that this test cannot be applied to males, nonlactating cows and heifers and it is not reliable in cattle during the early and late stages of lactation because of numerous false positive reactions.

**Milk Ring Test**

In 1950, van Drimmelen \(^{11}\) reported that cattle with vaccinal titers could be differentiated from those with infection titers by testing their diluted milk with the milk ring test. He considered cattle whose milk was not positive above the 1:4 dilution as free from brucellosis. Holm, Eveleth, and Rheault \(^{12}\) stated that the results obtained with the milk ring dilution test indicated that a high percentage of blood reactor vaccinated cattle could be distinguished from naturally infected animals. When cattle with suspicious and positive blood reactions and identified as milking were the only ones considered in their report, 19.6 per cent of the vaccinated and 69.2 per cent of the nonvaccinated animals were classified as infected by virtue of a positive ring reaction in the 1:5 dilution of milk. By employing the same criterion of infection, Blake and Manthei \(^{10}\) classified 35.5 per cent of the noninfected vaccinated animals and 97.4 per cent of the infected animals correctly. The absence of uniformity of results makes the reliability of the milk ring dilution test questionable.

In summarizing the information that has been presented on the various tests employed for differentiation of vaccinal and infection titers for brucellosis in cattle, several definite conclusions are apparent.

The anamnestic reactions produced by the injection of viable strain 19
failed to identify a significant number of bacteriologically proved infected cattle and persistence of secondary agglutinin titers make the test incompatible with a sound brucellosis control program. Moreover, the number of trips that must be made in collecting blood sample makes the test both impractical and costly.

Although the whey agglutination test has certain limitations, it has generally given more consistent and reliable results than either the anamnestic reaction produced with strain 19 or milk ring test. Furthermore, the test can be conducted in the present Brucella diagnostic laboratories and it does not interfere with our present diagnostic procedures, principally the sero-agglutination test.

The lack of uniformity and consistency of results with the milk ring test make its use as a differential test highly questionable.

If this review has done nothing more, it has demonstrated that the three recommended differential tests have definite limitations and that no similar test should be recommended or accepted until sufficient work has been done to make a thorough evaluation possible.

This brings us to the point of discussing the standard sero-agglutination test. Although it incorrectly classified approximately 50 per cent of the non-infected, vaccinated cattle as infected, it was the only test that identified all of the bacteriologically proved infected cattle. There is, however, a frequent criticism of the test, which is that the present interpretation discriminates against calf-vaccinated cattle with low agglutinin titers.

The problem of suspects and low-titered reactors is one that is man-made by the present interpretation of the sero-agglutination test. Consequently, more fundamental information is required on the significance of various titer levels, particularly in calf-vaccinated animals. This information is necessary for establishing a sound basis for interpreting the results of present diagnostic tests as well as new tests that may be developed. Work is in progress to obtain further information as well as to review past results on this problem.

REFERENCES


5. Manthei, C. A.: Data presented in this paper.
of the Chief Livestock Sanitary Officials of the states where area control work was extensively used. It is the opinion of this Committee that after two years of trial, it has been demonstrated this amendment is not for the best interests of the eradication program, and it is hereby recommended that the Uniform Methods and Rules be amended to provide for certification of areas for three years instead of two, as indicated in the attached copy.

3. Production of Brucella antigen.

It is recommended that the Bureau of Animal Industry, United States Department of Agriculture, produce all of the Brucella antigens employed in the United States for the diagnosis of brucellosis in animals.

This recommendation is based on the wide experience of the Bureau in developing and producing standard antigens and establishing uniform techniques and interpretation of results.

These antigens shall be distributed to the state and/or federal disease control officials for redistribution to official Brucella testing laboratories and approved and accredited veterinarians. This procedure would have a two-fold beneficial effect on the livestock industry. It would insure them that all Brucella antigens employed would be of the same standard and that all tests conducted would be officially reported which would prevent the majority of traffic in non officially-tested, infected animals.

4. Reporting Shipments of biologics.

The Bureau of Animal Industry, U.S.D.A., is requested to require that licensed producers and distributors of Brucella biologics shall report, at the time of shipment or delivery, all shipments and sales of Brucella biologics for use on animals to the state livestock sanitary official of the state of destination.

5. Diagnostic levels.

The Committee requests the Sub-committee on Research of the National Brucellosis Committee to make a thorough review of published and unpublished literature bearing on the diagnostic levels for Brucellosis and to report their recommendations for changes, if any, in diagnostic determinations for consideration by the United States Livestock Sanitary Association at its next annual meeting.

6. Standard identification of cattle under the brucellosis program.

The Bureau of Animal Industry, U.S.D.A. is requested to survey the states to secure identification practices and report to the next annual meeting of the United States Livestock Sanitary Association so that possible uniform national identification practices might be considered.

7. Discontinue liquid vaccine.

The committee recommends that the state livestock sanitary officials, the livestock industry, and the veterinary profession discontinue the use of liquid Strain 19 Brucella abortus vaccine. In the use of lyophilized vaccine it is recommended that the product be held and used in strict accordance
or not, particularly after it attains breeding age, must be considered potentially a dangerous animal. Also, experience in the field comparing the results of the ring test and the blood test, indicates clearly that with our present knowledge, a final determination of the brucellosis status, either of an individual or herd, cannot be made safely on the basis of the ring test alone.

Although the ring test and vaccination have definite limitations, they are exceedingly valuable when used as supplements to the blood test. When proper use is made of all these procedures, each in its proper place, together with prompt identification and removal or segregation of diseased animals together with application of sound sanitary practice, satisfactory progress towards eradication is being continued. On the other hand, as soon as undue credit is given to a negative ring test, or when blood test reactions shown by vaccinated animals are ignored or unduly discounted, or if animals positive to the blood test or untested animals, or negative animals from herds of unknown origin are permitted to move in the channels of trade other than to immediate slaughter, progress towards eradication is impeded.

In considering brucellosis eradication, we must keep in mind we are dealing with a highly communicable but insidious disease which has become firmly established over the years in most, if not in all of our states. It would appear from laws enacted and regulations promulgated in many states, that the serious nature of this disease has been ignored. If eradication is to be successfully prosecuted, it seems imperative that we exercise caution and sound judgment in making exceptions for animals showing positive or suspicious reactions to the agglutination test. It has been fully demonstrated the disease may be and is being controlled where sound sanitary principles are followed, and contrarywise, that halfway measures will fail to eradicate brucellosis.

RECOMMENDATIONS

1. Editing of Uniform Methods and Rules.

In accordance with the request included in the report of the Committee on Brucellosis adopted by this Association in 1952, the Chief of the Bureau of Animal Industry edited the wording of the Uniform Methods and Rules for the Establishment and Maintenance of Certified Brucellosis-Free herds of cattle and Modified Certified Areas. It is believed this revision did not materially change the Uniform Methods and Rules previously adopted and amended in 1951 and 1952. It is recommended the Uniform Methods and Rules as edited by the Bureau of Animal Industry (copy attached) be hereby approved by this Association.

2. Lengthen period of certification.

In 1951 the Association recommended and the Bureau of Animal Industry adopted a radical change in the period of certification of Modified Certified Brucellosis Free Areas, shortening the period of certification from three to two years. This amendment was proposed and adopted without previous notice, and clearly was not in accordance with the considered opinion of most
REPORT OF COMMITTEE ON BRUCELLOSIS

R. L. West, St. Paul, Minnesota, Chairman; Francis Buzzell, Augusta, Maine; James Cavanaugh, Columbus, Ohio; T. C. Green, Charleston, West Virginia; H. A. Milo, Harrisburg, Pennsylvania; C. A. Manthei, Beltsville, Maryland; A. M. Orum, Chicago, Illinois; M. N. Riemenschneider, Denver, Colorado; F. L. Schneider, Albuquerque, New Mexico; E. R. Shannon, Lafayette, Indiana; R. W. Smith, Concord, New Hampshire; Kenneth F. Wells, Ottawa, Ontario, Canada; H. F. Wilkins, Helena, Montana

During the past year, the campaign to eradicate brucellosis has continued to show some progress. The statistical report from the Bureau of Animal Industry indicates blood testing increased approximately 5 per cent, vaccination increased 16%, and the use of the ABR or ring test increased 47% as compared to 1952. Also the percentage of reactors to the blood test decreased from 4.2% in 1952 to 3.47% in 1953. However, it must be realized that these percentage figures do not necessarily reflect the incidence of the disease throughout the United States. No testing is reported in some states. In other states testing is largely confined to certified herd testing and represents only a comparatively small number of herds and cattle. Testing of these herds would probably show a lower infection rate than a complete test of all cattle in the area.

On the other hand, in two states, Wisconsin and Minnesota, in which well over 25% of the total blood testing in the country has been conducted during the past year, the ring test has been used extensively. A large part of the blood testing in these two states has been conducted in herds positive to the ring test. Therefore, the figures from these states without doubt, indicate a much higher percentage of infection than actually exists since no accounting is made of the majority of herds which are negative to the ring test, and consequently not subject to the blood test. The actual incidence of infection in any area, can only be determined when all cattle, or at least a sufficient number of representative herds, properly selected, are tested and the results compiled.

The significant continued increase in the vaccination of calves and the use of the ring test indicates the value of these supplementary procedures is becoming more extensively recognized. However, it also requires repetition of the words of caution regarding their limitations often expressed by research and control authorities and the Brucellosis Committee of this Association. If the eradication of this insidious disease is to be our goal, we cannot employ these procedures excepting as adjuncts or supplements to the blood testing program. Since no satisfactory practical field test has yet been devised to differentiate between vaccinal reactions and reactions due to virulent infection, an animal showing a reaction to the blood test, whether vaccinated


with the recommendations of the manufacturer and the Bureau of Animal Industry, U.S.D.A.

After January 1, 1956, the Bureau of Animal Industry, U.S.D.A. is requested to cease licensing the manufacture and sale of liquid Strain 19 Brucella abortus vaccine.

8. Recommended interstate regulation.

The following proposed interstate regulation is recommended for approval for submission to the Brucellosis Conference scheduled to be held in Washington, D.C. September 28 and 29, 1953:

Only the following bovine animals may move in interstate commerce:

1. Animals originating directly from officially certified brucellosis-free herds.

2. Strictly feeder cattle originating directly from herds, not under quarantine for brucellosis in modified-certified Brucellosis-free areas. Strictly feeder cattle referred to in this section are animals of beef type and breed.

3. Steers, spayed heifers, and calves under 6 months of age.

4. Cattle consigned for immediate slaughter.

5. Officially calfhood vaccinated animals, without test, up to thirty months of age.

6. Officially calfhood vaccinated animals, over thirty months of age, but under 36 months of age, providing the blood test within 30 days of shipment does not disclose a reaction exceeding incomplete in 1:100 dilution.

7. All other vaccinated animals and nonvaccinated animals if blood tested within thirty days and found negative.


All members of this subcommittee have been contacted and no constructive suggestions were made; however, it is recommended that states be encouraged to initiate swine brucellosis control programs. At the present time, several states have initiated or are in the process of initiating control programs.

The Chairman of the Subcommittee on Swine Brucellosis, Dr. L. M. Hutchings, recommends that this subcommittee be incorporated into the Committee on Brucellosis and that personnel who have had experience with brucellosis of swine be appointed to this committee.
UNIFORM METHODS AND RULES FOR THE ESTABLISHMENT AND MAINTENANCE OF CERTIFIED BRUCELLOSIS-FREE HERDS OF CATTLE AND MODIFIED CERTIFIED AREAS

PART I

Individual Certified Herd Plan

A herd may be placed under supervision for certification as brucellosis-free upon complying with provisions governing the testing requirements of the respective State-Federal cooperative program.

SECTION I. Herd Certification

A. Herd tests shall be made at intervals of not more than 60 days until all evidence of infection has been eliminated. These tests shall include all animals over six months of age except steers, spayed heifers, and officially vaccinated animals not more than 24 months of age. A herd may be certified as brucellosis-free when it has passed at least three consecutive tests, with the first clean test and the certifying test not less than 12 months apart.

B. Where there is no evidence of infection on the first test a herd may be certified as brucellosis-free when it has passed one additional clean test conducted not earlier than six months from the date of the first.

C. Where the milk test is employed, herds may be certified as brucellosis-free with a minimum of three satisfactory milk tests conducted at not less than 90-day intervals and followed by a clean blood test.

SECTION II. Herd Recertification

A. Upon evidence of a negative herd blood test at the end of one year, certification of that herd may be extended for another year.

B. If the retest of a certified herd, or of animals from such a herd reveals one reactor, the remainder of the herd shall then be subject to further tests. The herd may be recertified on the results of two negative tests conducted not less than 60 days apart, with the first such test must be made at least 30 days after the date of the test on which the reactor was disclosed.

C. If the retest of a certified herd or of animals from such a herd reveals more than one reactor, the herd must requalify for certification as under Section 1.

D. Where the certified status of a herd has been cancelled only because of the presence of over-age vaccinated animals showing continuing reactions of 1:100 or higher, the status may be restored upon evidence of one clean herd retest. It must be applied not earlier than 60 days following removal of such reactors.

REPORT OF COMMITTEE ON BRUCELLOSIS

PART II

Modified Certified Area Plan

The provisions of the individual certified herd plan that relate to testing, cleaning, and disinfecting shall apply to the modified certified area plan. The extent of the area shall be determined by the cooperating State and Federal agencies. When an area has been designated and the required percentage of herds and cattle included under any of the plans, the area shall be placed under quarantine and the following rules apply:

SECTION I. Area Certification

A. If as a result of a blood test of all cattle within an area the number of reactors (exclusive of officially vaccinated animals under 30 months of age) does not exceed one per cent and the herd infection does not exceed five per cent, the area may be declared Modified Certified Brucellosis-Free for a period of three years. Infected herds, however, shall be quarantined until all reactors have been removed and the entire herd has passed two consecutive blood tests not less than sixty days apart.

B. An area may be declared Modified Certified by the application of two milk tests not less than six months apart, together with a blood test of all milk reacting herds and such other herds as are not included in the milk test. The number of reactors (exclusive of officially calf vaccinated animals under 3 months of age) must not exceed one per cent of the cattle and the herd infection must not exceed five per cent of the herds in the area. Infected herds shall be quarantined until they have passed at least two consecutive blood tests not less than 60 days apart.

C. Range and semi-range areas may qualify as Modified Certified Brucellosis-Free for a period of three years if as the result of a blood test of all dairy cattle, all purebred cattle, and not less than 20 per cent of the range and semi-range cows over 3 years of age in each herd, the number of reactors does not exceed one per cent of the area cattle population over six months of age (excluding steers and spayed heifers) and five per cent of the herds.

a. Cattle officially vaccinated as calves may carry a titer of not more than incomplete in 1:100.

b. Should evidence of infection be disclosed in any of the animals required to be tested in the range or semi-range herds, such herds shall be quarantined until the entire herd has passed at least two consecutive tests not less than 60 days apart.

D. If testing as outlined under Section 1“A”, 1“B”, or 1“C” reveals an infection rate of more than one per cent, but not over two per cent, and a retest of the infected herds applied within 120 days discloses not more than one per cent animal infection in not over five per cent of the herds, the area may then be certified.

E. If the test of an area as outlined under Section 1“A”, 1“B” or 1“C”
results in more than two per cent reactors, or if a retest of infected herds as under Section 1“D” does not qualify the area for certification, it shall be necessary to make a complete area retest.

SECTION II. Area Recertification

A. At the expiration of the three-year period (Section I“A”, Part II) areas may be recertified for another three year period. To do so, the results of a test of all herds in which infection was reported at the time of the previous certifying test or since, together with the results of a test of 20 per cent of other representative herds, must reflect a rate of infection which does not exceed one per cent of the cattle or five per cent of the herds so tested. The number of herds required for retest shall be computed from the last area test and shall not include the same 20 per cent previously tested for this same purpose.

B. Areas certified under the provisions of Section 1“B” may be continued as certified with the application of semi-annual milk test, follow-up blood tests of milk reacting herds, and blood tests at three year intervals of 20 per cent of all herds not included in the milk test, if the incidence of infection does not exceed one per cent of the cattle, and five per cent of the herds under test.

C. At the expiration of the three-year period range and semi-range areas may be recertified for another similar period when at least 20 per cent of the herds, including animals as outlined under Part II Section 1“C” have been retested and the animal infection rate does not exceed one per cent in not more than five per cent of the herds under test. The number of herds required for restest shall be computed from the last area test and shall not include the same group previously tested for the same purpose.

D. If testing as outlined under Section II “A”, II“B”, or II“C” reveals an animal infection rate of more than one per cent, but not over two per cent and a retest of the infected herds applied within 120 days discloses not more than one per cent animal infection in not over five per cent of the herds, the area may then be certified.

E. Any area not qualifying for recertification under the provisions of this section shall be required to reestablish its certified status through testing procedures as outlined under Section I.

SECTION III. Additions to Certified Areas

A. Cattle from officially certified brucellosis-free herds and cattle from negative herds in Modified Certified Areas, when officially blood tested with negative results within one year of the date of shipment, may enter other Modified Certified Areas without being retested for brucellosis. All such cattle shall be individually identified and shall be accompanied by approved certificate of health indicating herd and animal status.

B. Cattle from herds under Federal-State supervision for the control of
brucellosis may enter a Modified Certified Area or an area in the process of such certification when all animals in the herd over six months of age (except animals officially vaccinated as calves and under 30 months of age) were negative to the official blood agglutination test for brucellosis within 90 days of the date of entry. Individual animals to be moved must be negative to an official retest at least 30 days from the date of the previous herd test and within 30 days of entry.

C. **Heifers under 24 months of age officially vaccinated as calves** when six to eight months of age coming from (a) negative herds in Modified Certified Areas, (b) individually certified brucellosis-free herds, or (c) herds under Federal-State supervision which have passed a test as under paragraph “B” may enter a Modified Certified Area or an area in the process of certification without further test when individually identified by mark, brand, tattoo, or other acceptable identification, and approved by the proper sanitary official of the state of origin.

D. Breeding cattle not over 24 months of age, officially vaccinated as calves when six to eight months of age, which do not qualify under paragraph “C” may enter a Modified Certified Area providing they do not show blood agglutination reactions higher than incomplete in dilutions of 1:100 and the animals are maintained in quarantine until they have passed a negative blood test.

E. All other male or female cattle over six months of age, except steers, spayed heifers, and cattle intended for immediate slaughter, shall be required to pass a negative officially recognized blood agglutination test for brucellosis within 30 days prior to the date of entry. They shall be maintained in quarantine separate from other cattle and retested in not less than 30 nor more than 60 days after date of entry. If passed, they shall be released from quarantine.

### PART III

**Recommended Procedures**

**SECTION I. Individual Herd Plans**

*Plan A.* Testing of cattle, permanent identification, and prompt disposal of reactors, for slaughter only, with or without vaccination of calves.

*Plan B.* Testing of cattle, permanent identification and temporary retention of reactors pending their disposal, with vaccination of calves. Reactors may be retained in a quarantined herd for a period not to exceed three years from the date retention of reactors was started.

*Plan C.* Calf vaccination without test of any part of the herd. This plan is to be confined to those herds in which the movement of animals is restricted to special permits issued by State Livestock Sanitary officials.

*Plan D.* Testing of entire herds of livestock with vaccination of non-reactor cattle within 10 days after completion of test and permanent identification
of reactors. This plan to be used only in emergencies in herds where there is evidence of a rapid spread of brucellosis, and then only with the written approval of the State-Federal cooperating agencies. Whenever the plan provided under this subsection is used, written notice that vaccination may not prevent the spread of such disease shall be given by the State and Federal agencies to the owner of the livestock.

SECTION II. Participation on Area Basis:
A. Voluntary—When 65 per cent of the livestock owners holding at least 51 per cent of the cattle have placed their cattle under any one or a combination of the four plans.
B. Compulsory—When 75 per cent or more of the livestock owners holding 95 per cent or more of the cattle in a given area sign up under any one or a combination of the four plans.

SECTION III. Supervision:
The official brucellosis eradication programs shall be supervised by full-time employed State and/or Federal veterinarians.

SECTION IV. Entering Premises:
Officials engaged in the brucellosis project shall be authorized to enter premises to carry out eradication procedures.

SECTION V. Services to Owner:
Services to owner should be made available without expense to him so long as funds for such purposes are available (owner to provide for the handling of his cattle). Provision should be made if possible to pay practicing veterinarians for brucellosis eradication services on a per head or on a per head and per farm basis.

SECTION VI. Classification of Reactors:
Reactors will be classed as under existing policies of the United States Bureau of Animal Industry except calves officially vaccinated, identified, and reported shall not be classified as reactors until after reaching the age of 30 months if retained in the herd. (See Sections VIII, IX, XI).

SECTION VII. Branding Reactors:
A permanent brand with the letter "B" (at least 2x2 inches) must be placed on the left jaw of all reactors. Reactors must remain on premises where found until a State permit has been obtained for movement to slaughter where State or Federal inspection is maintained. Exception: Registered purebred cattle, or animals eligible for registry, otherwise permanently identified need not be branded until they are sent to slaughter or moved under permit to other premises where Brucella infection is known to exist.

SECTION VIII. Vaccination:
Calves should be vaccinated when not less than six months old, but not more than eight months of age. However, beef calves in range or semi-range areas may be vaccinated up to twelve months of age. Only vaccine approved and manufactured under license of United States Department of Agriculture, Bureau of Animal Industry, shall be used in any brucellosis control program.
SECTION IX. **Identification of Vaccinated Animals:**

A. Adult animals tattooed “AV” in right ear or branded “AV” on right jaw.

B. Calves tattooed “V” in right ear or branded “V” on right jaw.

If the *tattoo* is used, then the “V” shall be preceded by a numeral indicating in which quarter of the year the vaccination was done. The “V” shall be followed by the last number in the year in which the vaccination was done.

If the *brand* is used, then the “V” shall be applied in four different positions—one each year over a four-year period to indicate in which year the vaccination was done. The fifth year will repeat the first year, and so on indefinitely. In 1951 the “V” shall be placed with the open end up; in 1952 the “V” shall be placed with the open end facing right; and so on clockwise indefinitely.

Each State should use all available channels to obtain for its livestock sanitary official the sole right to use the “V” brand on the right jaw.

SECTION X. **Movement of Cattle:**

No female cattle or breeding bulls over six months of age shall be moved after an announced date.

**Exceptions:**

(a) Slaughter animals

(b) Those tested and found negative for brucellosis within 30 days prior to date of movement.

(c) Dairy and breeding cattle under 24 months of age, or feeder cattle under 30 months of age which were officially calf vaccinated identified, and reported (See Sections VIII, IX, XI).

(d) When a part of a certified brucellosis free herd or area at the time of sale.

(e) Officially vaccinated calves that are more than 30 months of age from otherwise clean herds which do not react at more than 1:50, provided the animal has three successive tests not less than 30 days apart without a rise in titer.

SECTION XI. **Reports:**

All activities, such as results of agglutination tests and vaccinations, must be reported promptly to State and Federal cooperating agencies.
REPORT OF REPRESENTATIVE TO MEETING ON PROPOSED FEDERAL INTERSTATE REGULATION ON BRUCELLOSIS

SEPTEMBER 28-29, 1953 — Washington, D. C.

RALPH L. WEST.

On September 28, a meeting of representatives of member organizations of the National Brucellosis Committee was called for the purpose of studying an interstate regulation pertaining to brucellosis. The following resolution was unanimously adopted:

1. That the group recommend to the Bureau of Animal Industry that it proceed to draft a resolution relating to the interstate movement of cattle and in such draft incorporate the ideas expressed in the recommended regulation set forth below;

2. That the Bureau of Animal Industry prepare the recommended regulation of this group and submit it in mimeographed form to the various segments of the industry; and

3. That the regulation as prepared by the Bureau of Animal Industry be published in the Federal Register on February 1 to become effective on March 1, 1954, and that any criticism or recommended changes must be made known to the BAI on or before March 1, 1954.

RECOMMENDATION FOR AN INTERSTATE REGULATION PERTAINING TO BRUCELLOSIS, as made by representatives of member organizations of the National Brucellosis Committee, Washington, D. C., September 28, 1953.

Cattle moving interstate must be accompanied by a certificate issued by an authorized State or Federal Inspector or by a veterinarian approved by the Bureau and State, showing that the cattle have been tested for brucellosis under the supervision of State or Federal livestock sanitary officials within 30 days of date of shipment and found negative, except as follows:

1. Steers and spayed heifers;

2. Strictly feeder calves under 8 months of age and all other calves under 6 months of age;

3. Cattle consigned for immediate slaughter or to public stockyards where Federal inspection is maintained.

4. Bulls and female cattle for strictly feeding purposes shipped under permit from State of destination and to be held subject to quarantine at destination.

5. Animals originating in certified brucellosis-free herds;

6. Animals originating in modified certified brucellosis-free areas:
7. Animals identified as official vaccinates and under 30 months of age on date of shipment.

8. Officially calfhood vaccinated animals, over 30 months of age but under 36 months of age, providing the blood test within 30 days of shipment does not disclose a reaction exceeding incomplete in 1:100.

DEFINITIONS

"Official vaccinates" are cattle vaccinated under the supervision of State or Federal livestock disease control officials with a vaccine approved by the United States Bureau of Animal Industry, and permanently identified and reported at the time of vaccination.

"Feeder cattle" are animals of the beef type and breeds and not used for breeding purposes.

"Certified herds and areas" are as defined by the Bureau.

"Reactor" and "negative" are defined in accordance with United States Bureau of Animal Industry instructions.
REPORT ON
FEDERAL-STATE COOPERATIVE TUBERCULOSIS ERADICATION
PROJECT

Asa Winter, D.V.M.¹

Those of us assembled here understand perhaps better than any other group the complacency that has prevailed generally since accreditation of the Nation. The accredited status was accomplished through the effects of a forceful program, well supported, but as we have since learned without full appreciation of the continuing potentials of tuberculosis under even such a reduced incidence.

The ability of the disease to re-establish itself, given favorable conditions, was well demonstrated during the recent war years. I believe each one of us should review our own thinking on tuberculosis, and if necessary resell ourselves, and then our associates, on the significance of completing the eradication job. We are glad to report some advances during 1953 in this direction, and even though the period has witnessed unusual demands in other disease control fields the reports show gradual progress toward our goal.

It is becoming increasingly difficult to show progress when judged only through the yardstick of percentage reduction in reactors, since we have reached a point where even a material decrease is not reflected in the two point percentage table. That is true this year as it has been before. While it was necessary this year to test more cattle to locate each reactor, the reported rate of infection remains at 0.11 per cent. It is of interest also to note that this favorable reactor percentage resulted from total testing which included an increase of more than one half million animals, the greatest number of animals tested in any one year since 1942. Even so, these tests represent only about 10 per cent of our increasing cattle population.

While there is little question that this limited amount of testing will serve as a guide to the true index of infection, it can be seen how this, alone, will not locate enough of the remaining centers of infection to continue reduction of the disease. This amount of testing however, when coupled with the proper follow-up of tuberculosis cases located through the official Meat Inspection Services, is gradually but surely eating away the remaining sources of exposure.

It is significant that there has been a very consistent annual decline in the number of tuberculous lesion cases reported through Federal Meat In-

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inspection. That is especially evident this year when with inspection conducted on more than 15 million non-reactor cattle, an increase of 25 per cent over the previous year, there were only 1,406 carcasses retained because of tuberculosis, as compared with 3,133 in 1952. The marked drop in retentions is graphically illustrated by the fact that in 1952 there was one retention for every 3,872 animals slaughtered under Federal inspection, while 10,814 inspections were made for each animal retained in 1953, only about 35 per cent as many retentions.

Perhaps all of us have on occasion heard it stated that our reaccreditation policies are ineffective for making an accurate disease determination, and that a complete, carefully conducted, survey of the country would show the infection rate to be much higher than the records indicate. These very favorable reports of the Federal Meat Inspection Service and others appear, however, to refute the contention that the incidence of tuberculosis is not being consistently reduced. This, then, is the time to really bear down through every known device in order to continue the progressive elimination of the disease.

The recommendation for greater use of the cervical test so that earlier and more frequent retests may be conducted on infected herds should be more generally accepted. That somewhat controversial paragraph of the 1952 regulations which referred to testing necessary for herd reaccreditation was intended by the Tuberculosis Committee to encourage the use of the cervical test frequently applied as a means of more rapid elimination of infection and reaccreditation of herds.

A possible issue which must be faced by those of us associated with this project is the continuing cost to the States and Federal Government of the program as related to the present annual loss from the disease. This is something which must be studied by all of us in an effort to devise practices which will hasten the complete eradication of bovine tuberculosis. There are many ways of tightening up, and we as livestock sanitarians are derelict in our duty to the public if we don't recognize this and do all within our power to hurry the day when the country is free from the disease, rather than rest content with a modified accredited status.

We agree that testing alone isn't the answer, and in fact if we can reduce the disease incidence sufficiently and properly control all sources of infection, it should be possible through an improved animal identification system and meat inspection reporting service eventually to eradicate the remaining sources of trouble with a very minimum of testing. This thought has been nurtured for several years, and some progress has been made in developing the mechanics necessary to follow back from meat inspection reports on all tuberculosis lesion cases. Very little has actually been accomplished, however, to aid in the identification of animals consigned for slaughter, the remaining real crux to the problem. The greater accomplishments in locating originating infected herds have been due largely to increased interest and work on the part of inspectors on the killing floor, and associated stockyards veterinarians,
in obtaining possible thread of information to send back to the field, with
in turn an understanding on the part of more of the veterinarians in charge
of disease control activities of the true value of these reports to their partic-
ular program.

The Division is giving close attention to this phase of the program and
every possible effort is being made to see that each meat inspection report
is followed through within the limits of available information. The records
show that each group dealing with the identification or follow up of these
cases is operating with difficulty under the present limitations. As an indi-
cation of the significance of this feature of the program it is interesting to
review the results of the past year. Of 364 T.E.-35 reports covering tuber-
culous lesion cases in non-reacting cattle, 251 herds or 69 per cent of the
named exposed herds and 25 other related herds were located and tested by
field veterinarians. A total of 848 additional reactors were located as a result
of the follow up testing.

This record is by far the best yet reported, but even so, there is reason
to believe that further improvement can be made. This is supported by the
fact that in one State, where animal identification is currently maintained
through an intensive tuberculosis testing program, it was possible to trace
down 46, or 92 per cent of the 50 reported cases. We urge a review by the
sanitary officials in each State of ways for getting their animals to market
with better identification, and that this Association also give more study to
the matter. The attention now being given in the field to each meat inspection
report of a tuberculous lesion case will assure increased efficiency in this
important feature of the program in direct proportion to any improvement
made in the animal identification system.

Avian-swine Tuberculosis

Bureau veterinarians assigned to the Midwestern States continue to make
observations on flocks of poultry and discuss recommended practices with
poultry owners for control of this disease. Each veterinarian is also available
to work closely with the Extension Service on the technical aspects of the
disease as these relate to the educational program for which Extension is
so well equipped. This service also carries over into the swine production
field because of the relationship of avian tuberculosis to the infection as
found in swine. A limited amount of poultry and swine testing is being con-
ducted on farms where tuberculosis of swine is reported from slaughterings
at central establishments. Swine retentions for tuberculosis remain at a level
which would denote a continuing lack of interest on the part of producers
to heed advice regarding the proper handling of poultry and swine in Mid-
western States where the farm flock and swine are all too commonly directly
associated.

In addition to heavy losses suffered by poultry producers from avian tuber-
culosis, swine condemnations from this disease have represented, over the
past ten years, an average annual loss of more than $800,000. Nearly 2½
FEDERAL-STATE TUBERCULOSIS ERADICATION

million swine carcasses (4.3 per cent) were retained this year in Federally inspected slaughtering establishments with 9,936 totally condemned as unfit for food and 7,632 more passed only for sterilization. This is a high penalty to pay when it is considered that the loss could be largely avoided by following accepted poultry management practices which include the primary recommendation of an all pullet flock separately maintained.

Completion of a fully illustrated educational film on avian tuberculosis is expected within the near future. It is hoped that this will restimulate extension and industry groups to the significance of the avian-swine problem as an economic factor of considerable magnitude.

Paratuberculosis

This year saw increased interest in testing, with 8 additional States, making a total of 20, reporting some work. Several of these have also increased their volume over previous years and since testing is limited primarily to herds showing clinical evidence of the disease, there is an indication that livestock owners are becoming more conscious of this condition. Tests on 5,077 animals revealed 7.1 per cent reactors.

Statistical tables summarizing the progress of these projects are available for distribution and may be obtained here or by writing the Bureau office in Washington.
REPORT OF THE COMMITTEE ON TUBERCULOSIS

JAMES W. CROUSE, Trenton, New Jersey, Chairman; T. O. BRANDENBURG, Bismarck, North Dakota, FRANCIS BUZZELL, Augusta, Maine, JOHN CANTY, Montpelier, Vermont, T. C. GREEN, Charleston, West Virginia, J. U. GIRARD, Ottawa, Ontario, Canada, JOHN HARRIS, Topeka, Kansas, R. S. SMILEY, Columbus, Ohio, J. M. STUART, Ottawa, Ontario, Canada.

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


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 in not less than 60 days, (unless the cervical test is applied), and the last test between five and six months following the date infection was disclosed, in order to be released from quarantine. To qualify for accreditation or reaccreditation 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 should also be informed of the possibility of cattle becoming sensitized as a result of exposure to people affected with tuberculosis.

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

4. No animal that has been designated as a reactor at any time shall be presented for retest.

5. Reactors to the tuberculin test shall be promptly removed from the farm, and after their removal the infected premises shall be thoroughly cleaned and disinfected with a disinfectant approved by the United States Bureau of Animal Industry, and in a manner satisfactory to the cooperating State and Federal authorities. Full information is desired with respect to every factor that might have a bearing on the appearance of infection in the herd, such as past history of herd; water supply; light; ventilation; sanitation; management; manner of making additions to the herd (source, isolation pending retest, and retests); disposal of waste products; human infection; avian infection; Johne's disease; etc.

6. Herd owners are required to house, feed, and care for their cattle under such sanitary conditions as will tend to promote good health, and to follow such recommendations as are made by the cooperating State or Federal authorities.

7. Calves in accredited herds shall not be fed milk or other dairy products from other herds not fully accredited, or from unknown sources, unless such materials have been properly pasteurized.

8. (a) The herd owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the grade animal to be
marked by a tag or other means satisfactory to the cooperating State and Federal authorities.

(b) Each herd owner is required to keep a record of all additions.

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

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

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

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

PART II

Modified Accredited Area Plan

13. The provisions of the individual accredited herd plan that relate to testing, removal of reactors, cleaning, disinfecting and sanitation shall apply to the modified accredited area plan. All infected herds shall be quarantined and tested as provided in paragraph 1.

14. Modified accredited areas that disclosed on the last test of all cattle (except as hereinafter provided in paragraph 19) 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 areas discloses a degree of infection not exceeding 0.2 per cent, provided that in calculating the degree of infection all post-mortem meat inspection reports of tuberculosis or otherwise disclosed cases of tuberculosis accumulated in said area since the last accreditation test are included, and provided further that adequate State laws and regulations permitting effective quarantine and testing of all infected herds as provided in paragraph 1 are enforced.

16. Modified accredited areas that disclosed on the last test of all cattle

*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.
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. (a) 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.

(b) If following a retest of all cattle in an area the degree of infection exceeds 0.5 per cent but the percentage of herds infected does not exceed 1 per cent, the area may be reaccredited for a period of three years provided a retest of the infected herds discloses that the total number of reactors as a result of this retest is less than 0.5 per cent of the entire cattle population of the area.

19. A county or area may be reaccredited in the range or semi-range region upon compliance with paragraph (a) or (b) and other provisions of 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 identified post-mortem reports are produced showing that at least 10 per cent, and not less than 25 animals, of the breeding herd have been slaughtered within a year, and that such post-mortem examination failed to disclose lesions of tuberculosis.

If under paragraph (a) or (b) of this section a reactor or any other evidence of infection is revealed in any herd by post-mortem reports, etc., including post-mortem inspection at packing plants of those branded cattle that are sold direct from the range for immediate slaughter, 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 accred-
ited area plan. The area may then be reaccredited 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 cattle tested in the area.

20. The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper livestock sanitary official of the State of destination.

21. Reactors found in herds where no visible lesions or skin lesions only are found, and where there is no history or other evidence of infection, will not be counted in determining the percentage of infection, as provided in Section 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.
OBSERVATIONS ON VIBRIOSIS OF CATTLE IN RELATION TO IMPAIRED FERTILITY

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Only recently has the widespread existence of vibriosis become known and its association with impaired fertility recognized. Infertility is generally described as being due to endocrine dysfunctions, inheritance of low breeding ability, nutritional deficiencies, or pathologic conditions of the reproductive tract. Diagnostic procedures and treatment employed indicate that endocrine dysfunctions affect only a limited number of animals while inherited conditions are generally limited to certain family characteristics or breed deficiencies. Nutritional disturbances are usually diagnosed by either the animals becoming emaciated or showing other clinical symptoms by the time reproductive functions cease. All of these conditions may be contributing causes to reproductive failure; however, pathological conditions or infections of the reproductive tract undoubtedly cause most of the trouble and are generally characterized by repeat breeding.

In a previous report, Frank4 described two types of impaired fertility in cattle known to be free of brucellosis and trichomoniasis. In one type, cows and heifers failed to come in estrus by the time they should be bred. Fifteen to twenty per cent of the females were classed as anestrus cases in many herds. Except for a very limited number of anestrus cases, the ovaries were found to be cyclically functioning. The number of anestrus cases was reduced to five per cent or less in most herds by additional efforts taken to observe estrus. In the other type of infertility, females apparently failed to conceive when bred and had repeatedly returned to service four or more times (repeat breeders). All herds contained repeat breeders and their breeding histories indicated two types of trouble. The first type affected a variable number of individuals, generally 5 per cent or less, and had no tendency to spread from one animal to another. The second type affected approximately 10 to 20 per cent of the females and had a breeding history of a venereal infection.

Both in this country and in Europe it has been shown that repeat breeding

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1 From the Pathological Division, Bureau of Animal Industry, Beltsville, Maryland. The Authors wish to extend acknowledgment to the following workers in the Bureau of Animal Industry, U. S. Department of Agriculture: Drs. C. A. Manthei and H. W. Johnson for assistance in preparation of the manuscript, Dr. E. R. Goode, Jr., for examination of aborted fetuses for Vibrio fetus, Dr. Gerard Dikmans for examinations made for Trichomonas foetus, and Dr. W. M. Dawson for cooperation on the project, Dr. Leroy E. Bowen, Jr., Lynchburg, Virginia, and Mr. Arthur Freeman for technical assistance.

The work reported herein was carried out cooperatively by the Pathological Division and various herd owners and their employees. Their contributions are greatly appreciated.
is a result of failure of the conceptus to exist beyond the first few days or weeks following service. Laing\(^7\) states that fertilization follows when sufficient spermatozoa are deposited in the uterus within 16 hours before the end of estrus, provided ovulation occurs at the normal time. Laing\(^8\) has shown further evidence that many ova die soon after fertilization and that the mortality may be of two forms. In the first, the ovum becomes fertilized, develops for some days, but dies before mid-cycle; the corpus luteum regresses as in the normal cycle where fertilization has not occurred; and the animal returns to estrus after one normal estrus cycle without evidence that fertilization has occurred. In the second, fertilization occurs and the ovum develops beyond mid-cycle before degeneration begins with resorption of the embryo, thus delaying regression of the corpus luteum until after a time greater than one estrus cycle. Early death of the conceptus was also shown by Tanabe and Casida\(^9\) and Christian, Dreher, and Casida\(^8\) working with cows that showed no detectable genital abnormalities upon clinical examination, but that had been inseminated at least four times without apparent conception. They recovered fertilized ova in 66.1 and 88.5 per cent of the cases, respectively, when slaughtered three days after insemination.

Infections in the uterus are known to cause repeat breeding. Bartlett\(^1\) has shown that herds experiencing reproductive failure should be suspected of *Trichomonas foetus* infection when females require several services before becoming recognizably pregnant. Most females are involved following introduction of infection in a herd, but the repeat breeding condition is mostly confined to the heifers and new additions when first bred to infected bulls in herds with longstanding infection. The repeat breeding in affected females persists up to 5 to 6 months with the estrus cycles being essentially regular.

Manthei, Detray and Goode\(^11\) used a bull known to be discharging *Brucella abortus* organisms in his semen to artificially inseminate cows into the mid-cervix by the cervical fixation method. Care was taken to prevent the mechanical discharge of semen into the uterus. The majority of cows became pregnant from the first insemination. Manthei, Detray and Goode\(^10\) used a similar group of cows for insemination by the cervical fixation method, but by injecting the semen directly into the uterus. Most of the cows became infected and repeatedly returned to service before conceiving. The injection of Brucella bacteria into the uterus produced a breeding history similar to that of trichomoniasis.

Plastridge, Williams and Petrie\(^12\) suggested that lowered conception rates might be found in *V. fetus* infected herds. Stegenga and Terpstra\(^16\) presented evidence that a herd condition recognized in Holland for many years as “enzootic sterility” is caused by *V. fetus* (*Vibrio fetus*) and that infection can be transmitted by the herd sire. Terpstra and Eisma\(^17\) reported the isolations of *V. fetus* from vaginal mucus of cows, semen of bulls, and swabs from the prepuce. Much evidence has fast accumulated to show that *V. fetus* infection in a herd produces a history very similar to that of trichomoniasis. An extensive review of literature is not attempted here but may be obtained
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from Plastridge, Williams, Easterbrooks, Walker, and Beccia\textsuperscript{18}, Sjollema\textsuperscript{14}, and Lawson and MacKinnon\textsuperscript{9}, and Hughes and Gilman\textsuperscript{8}.

In an attempt to isolate any infectious organism or organisms from the reproductive tract that may be causing cows and heifers to repeatedly return to service, \textit{V. fetus} was the only specific bacterium isolated regularly from herds with a breeding history of a venereal infection. The occurrence and course of vibriosis associated with infertility of cattle and experimental control and eradication procedures have been followed in commercial and institutional herds by cultural isolation of the organism from infected individuals.

\textbf{MATERIAL AND PROCEDURES}

Cattle examined for vibriosis consisted of institutional and commercial herds in the vicinity of Beltsville, Maryland. Examinations were continued on herds that had been under observation and new herds were selected because they were experiencing trouble. The majority of the herds were practicing hand breeding by natural service to herd sires, while a few herds were practicing artificial insemination or a combination of the two methods.

For diagnostic cultural procedures as described by Bryner, Frank and Manthei\textsuperscript{2}, vaginal mucus samples from females were obtained with a specially designed instrument, Frank and Bryner\textsuperscript{6}. Semen samples from males were collected in the artificial vagina, and preputial samples were obtained from males (after relaxation of the penis with an epidural of 2 per cent procaine) with cotton swabs. Preputial samples were also collected with the instrument described by Bartlett\textsuperscript{3} for \textit{T. foetus} examination, and the instrument used to collect vaginal mucus samples from cows.

A routine examination schedule was followed on a few selected farms to study the bacterial flora in herds not experiencing impaired fertility in contrast to a study of the bacterial flora in conjunction with the course of vibriosis infection in positive herds. For these routine examinations vaginal mucus was used for diagnostic cultural purposes. Two or more mucus samples were collected from virgin heifers just prior to or at the time of puberty and again just prior to breeding. Cows were sampled 30 days after calving and again prior to breeding. Cows and heifers were generally sampled about 10 to 25 days after service and again at the time of pregnancy examination at 30 to 45 days. Samples were taken approximately every 28 days from repeat breeders, animals that aborted, and known vibriosis cases. In selected herds different methods of management and treatment with antibiotics were used for experimental control and eradication of vibriosis.

\textbf{RESULTS}

In a study of the bacterial flora of the reproductive tract, \textit{V. fetus} (Vibrio bacteria indistinguishable by cultural and morphological characteristics from \textit{Vibrio fetus} has been the only bacteria commonly found in connection with cows failing to conceive both within a specific herd and in trouble herds as a whole.
Herd infection was diagnosed by the cultural insolation of \textit{V. fetus} from infected females and males. Positive cultures were obtained from vaginal mucus of cows and heifers with the following histories: 1. recently bred, 2. repeatedly bred, 3. after calving, and 4. after conception. Vibriosis was diagnosed in 25 of 45 herds examined. It was found in 19 of the 45 herds upon first examination and in 6 additional herds out of 15 upon a second examination.

In sampling females for diagnostic purposes, 420 vaginal mucus samples were collected from 21 positive herds. Of the 420 samples, 110 or 26 per cent gave positive cultures for \textit{V. fetus}. Thus a ratio of about 1 in 4 cultures were found positive.

\textit{V. fetus} has been demonstrated in recently infected herds by the culturing of vaginal mucus from females within 30 days after service. In herds with long standing infection however, the chance of a positive diagnosis was generally limited to repeat-breeder cows and heifers. \textit{V. fetus} was isolated from 19 pregnant females. Isolations were made as early as 11 days after conception in one case and as late as 224 days in another case. Positive cultures were obtained from 8 cases that were not bred following calving. The time of isolation ranged from 21 days in one to 196 days in another following parturition. A total of 114 vaginal samples were obtained from 71 known virgin heifers. These heifers were selected because they were kept in contact with known infected cases. All samples were negative for \textit{V. fetus}.

In five herds that were examined over a period of 8 months or longer, samples were obtained repeatedly from 42 positive females. \textit{V. fetus} was demonstrated in 32 or 76 per cent of these females for only 40 days, in 5 or 12 per cent for 2 to 6 months and in the remaining 5 or 12 per cent for 7 to 12 months. One of these cows that had been a repeat breeder for 18 months was still infected at the end of a five month sexual rest period. A similar condition was observed in a heifer after first service to an infected bull, in which the infectious organism was isolated 9 times or from every mucus sample obtained over a period of 6 months. In some herds conception was delayed on an average of 3 months, whereas in other herds it was delayed 12 months or longer. Delayed conception was characterized clinically by females repeatedly returning to service. A delayed estrus cycle of 25 to 60 days and sometimes over 100 days commonly followed the first service to an infected bull, however a delayed interval might follow any service. Such cows were found open when examined for pregnancy at 30 days following service, but no pathological or abnormal conditions that might be characteristic of the disease were observed. With few exceptions, all females eventually conceived. After pregnancy was diagnosed in infected cases, abortion rarely occurred although some conceiving at first as well as later services remained infected for an indefinite period while pregnant.

Three methods were used to diagnose \textit{V. fetus} in bulls: 1. breeding suspicious males to virgin heifers and later culturing the vaginal mucus; 2. culturing of semen collected in the artificial vagina; 3. microscopical
examination and cultural isolation from preputial swabs. A satisfactory method has been to breed suspicious males to virgin heifers and obtain vaginal mucus samples for culturing from the 15th to 30th day after breeding. Because of the fact that the breeding history in herds with vibriosis was indistinguishable from that of trichomoniasis an effort was made to collect the vaginal samples close to the 17th to 20th day which is the optimum time for *T. foetus* (*Trichomonas foetus*) examination. However, vaginal mucus was positive for *V. fetus* from some cases as early as 10 days and as late as 90 days post service. Suspect bulls from 17 herds were bred to 82 virgin heifers, 44 or 53 per cent of which were later positive for *V. fetus*. A positive culture was obtained from semen of one of the above bulls that was bred to one of the heifers that was negative; however, a positive culture was obtained from a second heifer bred at a later date. It was impossible to run further tests on all bulls bred to heifers that failed to show evidence of infection. Following development of our technique for isolation of *V. fetus*, this organism has also been isolated from 7 herds having *T. foetus* infection. A second satisfactory method for diagnosing vibriosis in bulls was the culturing of semen collected in the artificial vagina. From a total of 307 samples, 64 or 20 per cent were found positive; thus an average of one positive culture in every 5 samples tested. A third method, which has been unsatisfactory because of excessive contamination consisted of demonstrating *V. fetus* directly by microscopic identification and by cultural isolation from preputial samples. For all three methods the bulls were held out of service 7 days or longer previous to use or sampling. Semen cultures from infected individuals have shown that infection is present after a 6 months sexual rest period, and infected bulls continually used for natural service remained active spreaders after 18 months.

Six positive and nine negative *V. fetus* cows have been posted and cultured. *V. fetus* was isolated from three of the six positive cows. It was isolated from the cervico-vaginal juncture in one pregnant and two repeat-breeder infected cows. All other organs were found negative, such as the vagina posterior to cervix, juncture of fallopian tube and uterine horn, urinary bladder, urethra, and kidney. All reproductive and urinary organs of bulls have been negative upon culture; however, preputial samples contained organisms indistinguishable from *V. fetus* microscopically. Our inability to isolate *V. fetus* was probably due to marked extraneous contamination.

Through cooperation of the manager of an infected herd much information was obtained on the spread of vibriosis through natural service (Table 1). Five bulls were used on this herd. Bulls, Nos. 1 and 4 were virgins and Nos. 2, 3, and 5 had been used previously. All bulls except No. 5 were negative for Vibrio. One of the Vibrio-free bulls, No. 3, was kept in the same stall and exercising lot with infected bull No. 5 and there was no evidence of transmission of infection by contact.

The herd averaged about 80 breeding cows and heifers. Each female was assigned to a group for breeding to a specific bull and was not changed to another bull until after calving. Cows and heifers of all ages were assigned
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to each bull, but were divided into lots according to age, breeding status, and lactation period for assignment to pastures and housing facilities. Because of this arrangement, one or more cows and heifers found positive after service to Bull No. 5 were present with cattle bred to Vibrio-free bulls. *V. fetus* was demonstrated only in females bred to No. 5 with two exceptions. In the one exception, *V. fetus* was isolated 23 days after a single service to bull No. 4. Although many samples were obtained from cows and heifers subsequently bred to this bull, they were all negative for *V. fetus*. The other exception was a cow found positive 40 days following calving with no record of having been bred. She was later assigned to the No. 5 bull to prevent possible exposure of a clean bull.

### TABLE 1

Spread of *V. Fetus* Within a Herd Using Natural Service to Four Non-Infected Bulls and One Infected Bull

<table>
<thead>
<tr>
<th>Bull</th>
<th>Cows Bred</th>
<th>Services Cows</th>
<th>Preg. Services per Cows</th>
<th>Pregnancies</th>
<th>V. Fetus Examinations</th>
<th>Days lost to Preg.</th>
<th>1st. Serv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>1.2</td>
<td>13</td>
<td>9.6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>31</td>
<td>16</td>
<td>1.1</td>
<td>47</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>18</td>
<td>26</td>
<td>12</td>
<td>1.5</td>
<td>27</td>
<td>16.6</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>28</td>
<td>13</td>
<td>1.8</td>
<td>43</td>
<td>1</td>
<td>32.0</td>
</tr>
<tr>
<td>5¹</td>
<td>18</td>
<td>38</td>
<td>11</td>
<td>2.2</td>
<td>66</td>
<td>23</td>
<td>56.0</td>
</tr>
<tr>
<td>5²</td>
<td>6</td>
<td>53</td>
<td>4</td>
<td>1.0</td>
<td>22</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>5³</td>
<td>32</td>
<td>7</td>
<td>3.0</td>
<td>44</td>
<td>23</td>
<td>89.0</td>
<td></td>
</tr>
</tbody>
</table>

1. Infected bull. Cows bred to this bull further divided into non-infected and infected groups, see below.
2. Cows bred to infected bull, but remained negative to culture.
3. Cows bred to infected bull, and were positive to culture.

Cows bred to the No. 1 bull all became pregnant after one to two services while those not becoming pregnant to the other 4 bulls were either disposed of, bred too recently for pregnancy diagnosis, or continued to return to service. Forty-nine females bred to the 4 clean bulls conceived with an average loss of 15 days each from first service to pregnancy, while 11 cows bred to the infected bull conceived with an average loss of 56 days each. However, the average loss of time from first service to pregnancy for the 7 of the 11 cows which became infected was 89 days. By subtracting 15 days which was the average loss of time for the negative cows from 89 which was the average loss of time for the positive cows, an average of 74 days was lost per pregnancy apparently because of *V. fetus* infection.

A herd sterility problem was found in some artificially inseminated herds where 10 to 30 per cent or more of the females were repeatedly returning to service. In two of these herds using artificial insemination with non-treated
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semen from infected bulls, *V. fetus* was isolated from some repeat breeder females. However, *V. fetus* was not isolated from 99 repeat breeder cows and cows and heifers from 7 herds artificially inseminated with antibiotic treated semen from known infected bulls.

**Efficacy of Control Measures**

Various methods have been used and observed in experimental control and eradication of *V. fetus* in commercial herds. Three herds of the same breed, located in the same vicinity, frequently exchanged bulls and cows for breeding purposes. All three herds were experiencing similar breeding trouble. One herd stopped breeding operations from September to May. During this interval the herd sire died and was replaced with a virgin bull. The herd was examined in May at the time breeding was resumed. All cows and heifers that had been giving trouble and remained open during this interval were found negative for *V. fetus* and *T. foetus* upon one examination. On the same date, the other two herds were examined and both *V. fetus* and *T. foetus* were isolated. All three herds began using artificial insemination with antibiotic treated semen from bulls free from *T. foetus*. Since initiation of the above methods, breeding results in these herds are considered very good. At the same time artificial insemination was begun, the most valuable bulls infected with *T. foetus* and *V. fetus* were treated with bovoflavin (German Proprietary Compound marketed as bovoflavin-sable) to which was added either one gm. of streptomycin or aureomycin per treatment. Check tests on four treated bulls by breeding virgin heifers 6 weeks after the second treatment have been negative for *V. fetus*. However all are experimental and further tests must be made before these animals are classed as negative or cured.

In comparison to the above herd held out of service, a second herd with *V. fetus* infection stopped breeding in September and resumed operations in January. One cow remained positive over this sexual rest period. A positive bull was test bred to a virgin heifer in November, and the heifer remained negative. Semen collected from this bull in January however, was positive.

In another herd that was found to be infected, a change from natural service to artificial insemination was recommended. Semen for this herd was obtained from *V. fetus* infected bulls, but treated with antibiotics 6 to 24 hours before use. Furthermore, the cows were divided into two groups, each containing infected cases. One group was left untreated while the other group was given one gm. of streptomycin and 1,000,000 units of penicillin both intra-vaginally and intra-uterinely. Cows in both groups became pregnant simultaneously and subsequent tests at 3, 5, and 8 months were negative for *V. fetus*.

A small herd of 45 cows and heifers, and 3 bulls of breeding age was found infected with *V. fetus*. The infectious organism was isolated from cows and heifers bred to each bull. To obtain information on the efficacy of treatment, with a minimum of change in management, this herd was treated while natural service was continued. The bulls were treated by mixing one gram of
an antibiotic into about 4 ounces of a water miscible ointment for massaging onto the penis and mucus membrane of the sheath similar to the method described by Bartlett\textsuperscript{1} for trichomoniasis. The antibiotic chosen, either chloromycetin or aureomycin as stated, was used continuously on the same bull. The first bull continued to spread infection to cows and heifers bred to him after each of 3 treatments, but remained negative after the fourth treatment with aureomycin. The second bull was found spreading infection after the first treatment. He was bred to an infected cow after the second treatment which necessitated a third treatment. He continued to spread infection after the third treatment however, requiring a fourth treatment with chloromycetin before he remained negative. The third bull remained negative for 6 months after the first treatment with aureomycin, but apparently became reinfected when bred to an infected cow on the 7th month as revealed by cows and heifers becoming infected following service to him after this time. All cows and bred heifers were treated by flushing the vagina and uterus each with one gram of chloromycetin in 50 to 200 cc. of saline. \textit{V. fetus} was isolated from one cow before and again 28 days after treatment, and another was found infected after service to the 3rd bull on this 7th post treatment month. The conception rate before the bulls and cows were treated averaged 2.5 services per pregnancy as compared to 1.2 services per pregnancy after they became negative.

\textbf{DISCUSSION}

Repeat breeding is a constant clinical symptom in the most frequently encountered type of impaired fertility. A review of the literature, reveals that fertilization takes place in 70 per cent or more repeat-breeder females, but the conceptus is apparently destroyed before 30 days of gestation or by the earliest time pregnancy can be diagnosed. Infections such as trichomoniasis and brucellosis are characterized by repeat-breeding. Trichomoniasis is a venereal disease of cattle. The causative organism, \textit{Trichomonas foetus}, is located in the sheath of infected bulls. It is motile and can swim from the vagina, where it is deposited at coitus, into the uterus simultaneously with the spermatoza. Although brucellosis is not necessarily a venereal disease, it is a disease of the reproductive organs of cattle which causes abortion and sterility. Repeat-breeding is not an uncommon sequel to abortions, and it is the predominating symptom in susceptible cattle that have become infected following intrauterine insemination with semen containing \textit{Brucella abortus}. This was not the case, however, following mid-cervical or intravaginal insemination with the semen from the same infected bull. A partial explanation for this phenomenon may be that this nonmotile causative agent was unable to reach the susceptible uterine tissue following insemination except by mechanical means. Vibriosis of cattle is indistinguishable from trichomoniasis by the breeding history of infected herds. The causative agent, \textit{V. fetus}, is motile and is located in the sheath of infected bulls. When this organism is deposited in the vagina, it can swim into the uterus. All three infectious agents are capable
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of living and multiplying in the uterus for an indefinite time. Thus, *V. fetus* fits perfectly into the picture of impaired fertility as a venereal disease of cattle.

From the above it is indicated that for organisms to produce a venereal disease in cattle they would either have to be motile so they could swim from the vagina into the uterus, be placed in the uterus mechanically, or be intracellular agents so they could be carried into the uterus by the spermatozoa.

Two methods have been used to control and eradicate *V. fetus* infection. One method was the use of artificial insemination. *V. fetus* has not been isolated from repeat breeder cows and heifers artificially inseminated with antibiotic treated semen from known infected bulls. The antibiotics (1000 u. of penicillin and 1000 micrograms of streptomycin per cc. of diluter) were added to the diluter a few hours before the semen was added. The diluter was warmed to the temperature of the semen (near body temperature) for its addition after which the mixture was cooled to storage temperature. As antibiotics are most effective at higher temperatures, they would be most active against *V. fetus* during the cooling process. A limited number of cows inseminated with semen that had been diluted 5 hours or longer have been found negative for vibriosis. Further work will be necessary to determine optimum requirements for rendering *V. fetus* non-infectious in diluted semen.

The second method consisted of treating infected and exposed animals with antibiotics. Cows and heifers found infected were given 1 gm. of either chloromycetin, aureomycin, terramycin, or streptomycin in combination with 1,000,000 units of penicillin, both into the uterus and vagina. Vibrio bacteria were recovered from infected females treated with each antibiotic. Thus, a single treatment with the antibiotics used failed to eradicate the infection from all individuals. Neither has a practical test been found that is sufficiently reliable to always detect the presence of *V. fetus* in the female. Due to the lack of a reliable test for active infection and the fact that the disease is self-limiting after a short period in about 75 percent of infected females, it would seem useless to attempt to eradicate infection by treatment. Neither could natural service be used with any assurance of the bull not becoming infected from a carrier cow in which the treatment failed. In combination with artificial insemination, treatment would be indicated in repeat breeder females after the second or third insemination. Treatment with antibiotics is indicated in the bull were *V. fetus* tends to persist, and reliable tests can be made to determine their effectiveness. Despite the successful use of antibiotic treated semen from infected bulls, semen free of *V. fetus* would be added assurance against any possible spread of the disease.

A sterility condition similar to a venereal disease in naturally bred cattle, exists in artificially inseminated herds. One herd will contain 15 per cent or more repeat breeders while a neighboring herd of the same breed and serviced by the same technician contains only five percent or less. Such trouble may follow two or more years of artificial insemination. *V. fetus* or *T. foetus* have not been isolated from these herds. In limited work on the bacterial
flora of the reproductive tract of cows having trouble in these herds, an organism believed to be causing the trouble has not been found. It is possible however, that any organism that is capable of entering the uterus may gain virulence for a limited existence in the uterus or the resistance of the animals in a herd may become temporarily lowered and allow various organisms to remain in the uterus a sufficient time to cause temporary sterility. Such organisms could come from a shedder cow in which they had gained virulence sufficient to remain in the uterus indefinitely. Nothing has been determined on how these organisms may be transmitted from cow to cow in artificially inseminated herds.

The same condition may exist in naturally serviced herds which are found free of both *T. foetus* and *V. fetus* but contain repeat breeders. In these herds the infection could be transmitted by natural service. While our findings show that *V. fetus* is the cause for most of the temporary sterility encountered, it must be remembered that other causes exist and may be erroneously diagnosed as vibriosis.

*V. fetus* was isolated from four cows that have not had a history of having been bred to an infected bull. It remains for the mode of infection and species of organism to be ascertained.

**Summary**

Herd infection was diagnosed by the cultural isolation of *Vibrio fetus* (Vibrio bacteria indistinguishable by cultural and morphological characteristics from *Vibrio fetus*) from cows and heifers recently bred, from those repeatedly bred, from those examined after calving, from those which have conceived, and from the prepuce and semen of bulls. Vibriosis is a venereal disease of cattle and may be self-limiting in most females; however a variable percentage remain infected for an indefinite length of time. *Vibrio fetus* has not been isolated from females bred artificially with antibiotic treated semen from known infected bulls.

**Acknowledgements**

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The work reported herein was carried out cooperatively by the Pathological Division and various herd owners and their employees. Their contributions are greatly appreciated.

**References**


A METHOD FOR CONTROL OF BOVINE LEPTOSPIROSIS

CHARLES J. YORK, D.V.M., PH.D.
AND
A. H. BRUECKNER, PH.D.

Although leptospirosis in the bovine population has been known to exist for a long period of time, only in comparatively recent years has it received widespread interest by both the veterinary clinician and the laboratory investigator. Numerous papers (1-5) have now been published describing adequately the importance of the disease in the individual animal or individual herd. The isolation of the causative organism in 1947 (6) and its subsequent identification as *Leptospira pomona* (7) were important steps necessary for understanding both the pathogenesis and the epidemiology of the disease. *Leptospira pomona* infections in cattle have been recognized in all geographic areas of the United States as well as Canada. With modern methods of moving animal populations, it is doubtful if any would remain free of the disease for any period of time. Actual surveys that have been made in several states indicate a variation in incidences of infection from 5 to 20 per cent (8) of the cattle population. Such information indicates that leptospirosis is a disease constituting a serious problem to the livestock industry.

A brief description of the disease and its method of transmission in the bovine population is necessary as a background before going into details concerning possible control. The symptoms of leptospiral infection in cattle vary considerably from a very severe fulminating infection to one so mild as to be inapparent in nature. The severe form with hemoglobinuria, icterus, and probably death is usually in the minority, and in many areas the disease is primarily an economic problem with loss in milk production, loss of weight, general un thriftiness in younger animals, or loss of calves due to abortion. This latter symptom is considered by many as the most serious aspect of the disease, frequently occurring in pregnant cows regardless of the severity of the initial infection.

During the later stages of infection, again regardless of the severity of the symptoms, a carrier condition develops in the kidneys of the animal and organisms are eliminated in the urine to spread to other susceptible cattle. Transmission generally occurs by inhalation of infected urine droplets although contact with contaminated streams and pastures should not be overlooked. The rapidity of spread through a herd depends somewhat on the congestion of animals in the area, the number of infected cattle introduced into a herd, and other factors of herd management. Frequently, it has been observed that the disease spreads slowly through a herd over an extended period of time.
Another feature of *Leptospira pomona* infection that has recently received attention is that about 20 to 25 per cent of the swine population carry antibodies against this organism and that infected pigs readily become carriers of the infection shedding leptospira in their urine for long periods of time (9). Furthermore the disease may readily be transmitted from swine to cattle. Thus it is apparent that the introduction of a single carrier animal into a herd, whether it be of bovine or porcine origin, is sufficient to infect a herd.

It has been observed that cattle naturally recovered from the disease are immune, probable for life. Cows that have aborted readily conceive and may have calves regularly thereafter. These facts coupled with the known epidemiology of the disease as described above indicate that a vaccine would be of value for controlling outbreaks of the infection and for prophylactic use in uninfected herds.

*Experimental use of vaccine* - Details of experimental development and preparation of the vaccine have been described elsewhere (10). In tests for reliability, a total of 21 calves were given subcutaneously 5 or 10 ml. of the preparation. At intervals varying from 2 to 8 weeks following vaccination a challenge test for immunity was conducted by inoculating one or more calves subcutaneously with 2 ml. of blood from guinea pigs infected with a virulent strain of *L. pomona*. At the time of this test for immunity one or more unvaccinated calves were inoculated with guinea pig blood in the same manner. Temperatures were taken daily on all animals during the period of immunization and challenge. A serum sample from each animal was taken at the time of vaccination, at the time when the calf was tested for immunity, and again 3 weeks following this challenge and compared by the complement-fixation test. The results of these tests are presented in Table I.

As can be seen in Table I, the 21 vaccinated calves showed no signs of illness following challenge with virulent leptospira. Of the 18 control animals, 16 developed a febrile illness and of these 2 died. Two showed no signs of illness but developed a positive serological reaction. None of the sera from vaccinated animals showed a positive complement-fixation test following vaccination or after the test for immunity. Although the data is not presented in Table I, the agglutination-lysis test was also used on 18 of the vaccinated

**TABLE I**

*Results of Vaccination for Leptospirosis in Experimental Calves*

<table>
<thead>
<tr>
<th></th>
<th>Pre Vaccinal C. F.** Test</th>
<th>Post Vaccinal C. F. Test</th>
<th>Results of Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Calves</td>
<td></td>
<td>Clinical C. F. Test</td>
</tr>
<tr>
<td>Vaccinated</td>
<td>21</td>
<td>0/21*</td>
<td>0/21</td>
</tr>
<tr>
<td>Controls</td>
<td>18</td>
<td>0/18</td>
<td>0/18</td>
</tr>
</tbody>
</table>

* Numerator: number of animals showing a reaction  
 Denominator: number of animals tested  
 ** C. F.: complement-fixation test at a 1:4 dilution of serum.
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animals. In each instance a low blood titer developed, varying from 1-40 to 1-160, following the vaccination period. Again, however, there was little or no rise in agglutination titer following the period of challenge for immunity.

Clinical trials with the vaccine - To test the value of the vaccine under field conditions, herds were selected where clinical and serological evidence indicated the *L. pomona* infection was currently present. However, care was taken not to study the use of the vaccine in herds where there was a history of long continuous disease resembling leptospirosis, to prevent the possibility that the majority of the cattle had already been exposed to the infection. Within the limits of practicability, 1/4 to 1/2 of the animals selected at random in each herd were left as unvaccinated controls. Each animal in the vaccinated group was inoculated subcutaneously with 5 cc. of a vaccine* that had previously been tested for potency in the laboratory. Serum samples obtained from the vaccinated and control animals at the time of vaccination, and again 3 and 6 weeks following vaccination were tested for the presence of leptospiral antibodies by the complement-fixation test. The results of these tests, summarized in Table 11, have been completed for 5 herds up to this time involving 429 animals.

As can be seen in Table II, each herd with the exception of one had a mixture of serologically positive and negative animals in both the vaccinated and control groups at the time of vaccination. Similarly, samples taken three weeks after vaccination had a number of new positive reactors in both groups, indicating a number of cattle were infected at the time of vaccination, but had not yet developed detectable antibodies. However, at the end of the 6 week interval it is evident that fewer serologically positive animals developed in the vaccinated group as compared to the control group. Of the animals that could have become positive during the 3 to 6 week interval, the number that gave a positive reaction by the complement-fixation test varied in the different herds from 0 to 5.8 per cent in the vaccinated group as compared to 8 to 60 per cent in the control animals.

The data presented above is summarized in Table III in a manner to illustrate the spread of the disease in the vaccinated and control groups of cattle. The ratio of the number of serologically positive animals in the vaccinated and control groups in each herd is compared to the ratio of the total number of vaccinated and control animals in the same herd. As can be seen in Table III, the number of reactors in the vaccinated over control animals at the time of vaccination gave a ratio very similar to the ratio of the total number of vaccinated over control animals in that herd, indicating that the reactors had been selected at random and were equally distributed. At the end of the 3 week interval the ratio generally remained the same indicating that infection had continued at about the same rate in both vaccinated and control animals. However, at the 6 week interval there was a significant drop in the ratio of positive animals in the vaccinated group compared to control animals in each of the 5 herds presented in the table.

*Leptogen, Pitman-Moore Co., Indianapolis, Indiana
When the number of reactors developed during the 3-6 week interval in the vaccinated group is divided by the number in the control group, the ratio obtained approaches zero in each herd.

**Discussion** - The use of a vaccine where infection is currently spreading through a herd provides a severe test on the ability of a vaccine to stop or slow down the spread of an organism. Data has been presented showing that a vaccine against *Leptospira pomona* infection is of definite value in protecting susceptible animals against a current outbreak of this disease. As has been pointed out in the introductory paragraphs, leptospirosis in cattle is widespread geographically, and its manifestations and severity are exceedingly variable. Moreover, it has a multiple host range, with carrier conditions existing in some hosts for long periods of time. Hence, it is felt that the control of bovine leptospirosis must be based upon the development of an immune cattle population.

In the use of a vaccine for control measures, three major factors should be given consideration—prompt and accurate diagnosis, control of an outbreak, and prophylaxis in susceptible herds.

1. **Diagnosis**

Any control program necessitates providing an adequate serological service both as an aid in diagnosis of diseased cattle and in detecting animals which have had the disease and may be acting as spreaders of infection. Although a number of tests are available, such as the old microscopic agglutination-lysis test, the more recently introduced complement-fixation reactions (11-12), the capillary tube agglutination, (13) and the improved plate agglutination test (14), any wide spread program should include attempts to standardize procedures.

2. **Control of an outbreak**

As has been illustrated in Table II & III, following prompt and early diagnosis of leptospirosis in a herd of cattle, a vaccine is of value in slowing down or stopping the spread of the disease. As mentioned earlier, cattle do become carriers of leptospiral organisms, but at no time has the carrier condition in cattle been detected for longer than 2 to 3 months. Although the duration of immunity following the use of this inactivated type vaccine is not accurately known, because of the limited duration of the carrier condition it need not provide protection for longer than 6 months for an infected herd to free itself of leptospiral organisms, provided no new unvaccinated animals are introduced during this period of time.

3. **Prophylactic measures.**

Such a vaccine would be of value in protecting herds in all cases where there exists the possibility of introducing an infected animal either in the early stages of incubation, inapparent illness or carrier state. Briefly, some possibilities for use would be in assembled herds, commercial herds with constant replacements, feeder cattle running with swine,
TABLE II
Summary of Results of Serological Studies in L. Pomonavaccine Field Trial Herds

<table>
<thead>
<tr>
<th>HERD</th>
<th>VACCINATED CATTLE</th>
<th>CONTROL CATTLE</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Prevacc. Reactors</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>C</td>
<td>V</td>
</tr>
<tr>
<td>Alberson</td>
<td>91</td>
<td>39</td>
<td>19</td>
</tr>
<tr>
<td>Bivens</td>
<td>71</td>
<td>29</td>
<td>13</td>
</tr>
<tr>
<td>Langley</td>
<td>25</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Elmes</td>
<td>50</td>
<td>43</td>
<td>—</td>
</tr>
<tr>
<td>Elmes</td>
<td>40</td>
<td>28</td>
<td>1</td>
</tr>
</tbody>
</table>

V = Vaccinated Cattle
C = Control Cattle
### TABLE III

**Results of Field Trial Tests with L. Pomona Vaccine**

*Showing Change in Ratio of Positive Reactors in Vaccinated and Unvaccinated Animals*

<table>
<thead>
<tr>
<th>HERD</th>
<th>VACCINATED CATTLE</th>
<th>CONTROL CATTLE</th>
<th>RATIO V/C*</th>
<th>RESULTS EXPRESSED AS RATIO V+/C+**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Prevacc. 3 weeks 6 weeks New Positive 3-6 weeks</td>
</tr>
<tr>
<td>Alberson</td>
<td>91</td>
<td>39</td>
<td>2.3</td>
<td>2.7 2.9 1.5 0.6</td>
</tr>
<tr>
<td>Bivens</td>
<td>71</td>
<td>29</td>
<td>2.5</td>
<td>2.6 3.0 1.4 0.0 (0/2)</td>
</tr>
<tr>
<td>Langley</td>
<td>25</td>
<td>13</td>
<td>2.0</td>
<td>2.0 2.0 0.75 0.0 (0/6)</td>
</tr>
<tr>
<td>Elmes</td>
<td>50</td>
<td>43</td>
<td>1.2</td>
<td>— 1.0 0.3 0.2</td>
</tr>
<tr>
<td>Elmes</td>
<td>40</td>
<td>28</td>
<td>1.4</td>
<td>1.0 5.0 1.0 0.3</td>
</tr>
</tbody>
</table>

* V/C = Vaccinates/Controls  
** V+/C+ = Vaccinated Reactors/Control Reactors
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herds where animals are sent to fairs or shows and reintroduced into the herd, and for susceptible animals introduced into infected herds.

**Summary** - The use of a leptospiral vaccine in experimental animals and in infected herds has been described. Data is presented to show that the vaccine does protect cattle against infection following either deliberate inoculation with virulent leptospira or by adequate field exposure. With our present understanding of the epidemiology of the disease, the use of a vaccine against *L. pomona* infection coupled with an adequate serological service should provide reasonably adequate control of leptospirosis as it now exists in cattle.

**REFERENCES**

REPORT OF COMMITTEE ON
INFECTIONOUS DISEASES OF CATTLE

_Mastitis, Shipping Fever, Leptospirosis,
Johne's Disease, Mucosal Disease_

S. H. McNutt, Madison, Wisconsin, Chairman; T. O. Brandenburg, Bismarck, North Dakota; John Canty, Montpelier, Vermont; I. A. Merchant, Ames, Iowa; James Murphy, Ithaca, New York; H. J. Rolins, Raleigh, North Carolina; O. W. Schalm, Davis, California; and C. D. Stein, Washington, D. C.

The Committee on Infectious Diseases of Cattle is indebted to Dr. Aubrey B. Larson, Regional Animal Disease Laboratory, Auburn, Alabama, for the part of the report dealing with Johne's disease and to Dr. Karl R. Reinhard, Rocky Mountain Laboratory, Hamilton, Montana, for the part on leptospirosis.

**MASTITIS**

Mastitis continues to be a major detrimental factor in production among dairy cows. During the past few years careful production records have been maintained in one of the representative dairy counties in Wisconsin. These records have been studied and analyzed recently in so far as possible. When the loss due to mastitis in this county is used as a basis for estimation of total mastitis loss, it is found that the total annual loss due to mastitis is over $20,000,000 in Wisconsin alone. This is on a basis of something over 2 million cattle—about 2,000,000 dairy cows. It is reasonable to suspect that a like situation prevails among all dairy cows throughout the United States. Thus, total annual loss due to mastitis for the entire country is $250,000,000. Such loss adds to the cost of production—a cost that can not be very well justified. All this is more evident now when the dairy industry is pressed on every side by keen competition, fair or foul, in the form of substitutes, increased costs of distribution and so-called merchandising. If the industry is to meet this competition, its cost of production must be decreased—the industry cannot afford the luxury of disease. Nowhere can cost of production be decreased so effectively as in the elimination of loss due to mastitis and other diseases. This was belatedly recognized by the American Dairy Science Association at its last annual meeting and has been recognized by several breed associations within recent years. So uncertain is the position of the dairy industry that no one is making long time predictions on its future. About all one can predict it that it will be a long time before the last dairy cow is slaughtered, but the day of the sacred cow is definitely over.
Unfortunately knowledge of mastitis is not being used effectively in control and eradication. Treatment (defined as an admission of failure in all diseases) has been accepted as an end, not a partial means to an end. Some more or less organized control programs have become rather hopelessly involved in priorities, precedence and prerogatives until the objective of the programs has been lost. Other programs have concerned themselves with treatment of frank cases of mastitis disregarding the cause and reservoir as well as environment and management, thus failing in the primary objective.

On the bright side of the mastitis picture stands the virtual eradication of tuberculous mastitis, gains in preventing udder infection with Brucella, sufficient knowledge to eradicate *Streptococcus agalactiae* infection in individual herds and areas, and significant knowledge on other types of mastitis.

There is now sufficient preliminary evidence to cause one to theorize that the present promiscuous, wide-spread use and misuse of drug treatments for mastitis is causing a shift to other types of infectious agents that previously were rare but are more damaging than the common types of the immediate past.

It has been said that the three great needs for the control of mastitis are understanding, research, and incentive. With leadership these can be obtained. Perhaps the United States Livestock Sanitary Association can furnish that leadership—perhaps the American Dairy Science Association will do so. In any event full co-operation of all parties concerned will be necessary.


**Shipping Fever**

Shipping fever continues to be a serious hazard wherever cattle are raised in the United States, but especially so in those areas where there is extensive movement of cattle, the northern half of the country, more specially the north central region. The condition is most apt to occur in cattle that have been moved by common carrier or in individual herds shortly after the introduction of new purchases, but its incidence is increasing in closed herds where the source of infection is a total mystery.

There is no doubt but that the condition is an infectious, contagious disease but the cause or causes are still questionable. If diagnosis were based on bacteriological examination only, one would conclude shipping fever was caused by Pasteurella. There is a belief, still unproved, that it may be initiated by a virus and that the bacteria, including Pasteurella, so abundant in the inflamed lung are secondary invaders, nevertheless, able to cause death at this stage of the disease. Stress, such as the shipment of animals, is a factor in initiating an outbreak,—may be the trigger mechanism
whereby the disease is started—but once initiated, stress is not needed since contact exposure will cause animals to sicken with pneumonia. Climatic conditions also are involved. Classical shipping fever is rarely reported from the tropics, but is very common during cold weather in the temperate zones.

There is no uniform method for the treatment of animals affected with shipping fever but in general the same treatment is employed everywhere. This consists of 1) good care 2) drugs and 3) biologics. Of these, the first two are the more effective. Number one is sometimes forgotten or impossible to apply under existing local conditions. The sulfa drugs are employed more extensively than are the antibiotics. For some unknown reason antisera prepared against the bacteria commonly found in the diseased lungs of affected animals are not as effective as one would reasonably expect. Bacterins are employed by many who believe they have better success in treatment when these are used. There is essentially no direct conclusive experimental evidence either for or against the use of such bacterins. Their use rests on clinical evidence. Individual outbreaks are being encountered in increasing numbers where the disease is semi-resistant to treatment. Response is slow or delayed and apparent relapses are numerous. In these instances, treatment must be even more intense and prolonged. Even in these instances the prognosis is good considering the seriousness of the disease.

Bacterins often in multiple doses, serum and antibiotics are employed in an attempt to prevent infection in cattle previous to or at about the time of shipment. Exact evaluation of these procedures as a means of prevention are difficult because there are usually no true controls.

All states have general regulations or laws that, if applied, would prevent the movement of animals clinically affected with shipping fever but very few or none have procedures directed toward the control of shipping fever per se. More knowledge on the disease must be developed before a sound basis for truly effective control of shipping fever can be developed.

LEPTOSPIROSIS

Definition. Bovine leptospirosis is a complex of diseases of cattle caused by each of several serotypes or species of spirochaetes belonging to the genus Leptospira, and is manifested principally by hemolytic anemia, abortion, and transitory or chronic physical debility.

Distribution and Incidence. Bovine leptospirosis has been diagnosed clinically, and confirmed serologically in forty states involving every geographical region of the United States. In at least ten states, leptospirae have been recovered in pure culture from clinical cases. Random sample serological surveys conducted by the agglutination-lysis technique have demonstrated a herd infection incidence of nearly 20 per cent, and individual infection incidence of 10 per cent. (3). A similar survey by the complement-fixation technique—which has a shorter retrospect—yielded an individual infection rate of 4.1 per cent (16).
**Etiology.** *Leptospira pomona* (5) has been recovered consistently from cases of bovine leptospirosis, and serological tests indicate this type to be the most common etiological agent. *Leptospira canicola* infection of cattle has been found, and confirmed by cultural and serological tests in a localized outbreak in Georgia (12). Serological reactions obtained by various laboratories indicate the presence over a wide area of leptospira of the *L. hebdomadis* group (6,12,13). This agent has not been recovered in cultures from clinical cases.

Occasional serum titers against *L. autumnalis*, *L. icterohaemorrhagiae*, and *L. grippotyphosa* have been found (6,13).

**Clinical Signs and Diagnosis** The enclosed chart serves to summarize some of the more important manifestations of bovine leptospirosis. Rarely will individual cases show all these signs. The disease can vary in form from fulminating fatal hemolytic anemia to chronic debility, or inapparent infection. In some herds the most evident sign has been abortion, in some hemolytic anemia, in some only chronic debility, or unthriftiness. The factors causing such a wide variation in the clinical picture are not understood. Present cultural methods are of limited use in diagnosis because of the difficulty of obtaining suitable inocula from field cases. Serological procedures are the most valuable laboratory tools for confirmation of diagnoses of leptospirosis. The antibodies appear during the second week after infection. Agglutinins persist in the blood for years, while complement-fixing antibodies last a few weeks or several months. Several serological techniques are available: the microscopic-agglutination test with live or killed antigen (11), complement-fixation (14, 15), capillary-tube agglutination (10), and a plate test using cholesterol-adsorbed antigen (13).

**Pathology.** In the acute phase, focal necrosis without marked cellular reaction is found in the liver, and acute interstitial nephritis is usually present in the kidneys. Hemorrhages may occur under mucosal and serosal surfaces, and in the lungs and kidneys. In cases suffering with marked hemolysis, hemosiderosis may be observed in the liver, spleen, and kidney. The chronic case usually shows only chronic, focal, interstitial nephritis. Clinical pathological studies have been conducted on a few cases (8), and revealed reduction in erythrocyte count and hemoglobin, transitory neutropenia and lymphopenia near the time of fever, proteinuria associated with the nephritis, and hemoglobinuria in those cases in which the erythrocyte counts decreased rapidly. Leptospira were present in the blood during the incubationary period in some subjects, and during the fever in all subjects studied; after the fever they were usually localized in the kidneys (2,8).

**Epizootiology.** Bovine leptospirosis can cause rapidly-spreading enzootics, and epizootics as well as slowly-spreading enzootics. Most of the explosive outbreaks have occurred where animals were kept in congested, unsanitary environment, such as crowded feed or wintering lots, or marshy or muddy pastures. Apparent spread along watersheds has been noted. Dry, uncongested
<table>
<thead>
<tr>
<th>Symptom or Sign</th>
<th>Likely Time of Onset</th>
<th>Probable Duration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>1 to 2 weeks after infection</td>
<td>3 to 5 days</td>
<td>Peak of 104° to 107°, usually nonrecurrent.</td>
</tr>
<tr>
<td>Anorexia</td>
<td>Time of fever</td>
<td>1 day to 1 week</td>
<td>Usually quite transitory.</td>
</tr>
<tr>
<td>Depression</td>
<td>Prefebrile or febrile period</td>
<td>1 day to 1 to 2 weeks</td>
<td>Dependent upon severity of infection.</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Febrile period</td>
<td>Few hours or several days</td>
<td>Matery, usually not fetid.</td>
</tr>
<tr>
<td>Anemia</td>
<td>Prefebrile period</td>
<td>5 or 6 weeks</td>
<td>Hemolytic type.</td>
</tr>
<tr>
<td>Icterus</td>
<td>Near time of fever</td>
<td>1 to 3 weeks</td>
<td>Most marked in severe cases.</td>
</tr>
<tr>
<td>Hemoglobinuria and</td>
<td>Febrile period to 7 or 10 days later</td>
<td>Few hours to several days</td>
<td>Degree depends upon severity of Hemolytic anemia.</td>
</tr>
<tr>
<td>Hemoglobinemia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oligogalactia or</td>
<td>Febrile period</td>
<td>Few days</td>
<td>Thickened, yellowish milk Full production may not be gained for several weeks.</td>
</tr>
<tr>
<td>Aglactia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td>Febrile period</td>
<td>1 to several weeks</td>
<td>May retard growth in calves.</td>
</tr>
<tr>
<td>Abortion</td>
<td>Acute stage</td>
<td></td>
<td>More liable to occur after mid term.</td>
</tr>
</tbody>
</table>

From "Bovine Leptospirosis," Army Medical Center Symposium on Leptospirosis, December 1952.
ranges do not seem to favor the rapid dissemination of disease. A number of disastrous outbreaks have occurred after herd assembly, or introduction of new stock sales channels.

The means of transmission, or the route of infection, has not been definitely established. It has been found that contact with convalescent or chronic renal carriers, or environment contaminated by them, serves to expose susceptible individuals. The role of biting insects has not been adequately investigated, but preliminary studies indicate that ticks may serve as vectors or reservoirs (4).

It is known that cattle suffering from chronic leptospiral nephritis may give off virulent organisms in the urine as long as three months. Other farm animals may serve as reservoirs. The duration of the carrier state in equine leptospirosis is not known, but it is known that hogs can be chronic renal carriers for longer periods of time than cattle. There is evidence that pathogenic leptospirae can remain in natural waters and damp or marshy environment for several weeks. The role of rodent reservoirs of bovine leptospirosis has not been investigated adequately in the United States. However, it is known abroad, that leptospira pathogenic for bovines are also found in field rodent populations.

Prophyaxis. Proved immunization procedures for bovine leptospirosis do not exist. Until bioprophylactic measures are available, the only means of control are practical hygienic measures involving isolation, and segregation. Control procedures are discussed in several papers (1, 7, 9). It must be emphasized that the widespread incidence of bovine leptospirosis precludes consideration of eradication by test, and slaughter methods, because such an approach would be economically unsound, nor would it eradicate leptospirosis with certainty.

Economic Importance. Because the full magnitude of the leptospirosis problem has not been defined, figures relative to economic loss cannot be established. The principal losses do not lie in the deaths of adult animals, but rather in the loss of production of calves, meat, and milk, and the maintenance of unthrifty animals. If we postulate, upon the basis of the scant surveys performed, that 4 per cent of the cattle population of the United States is newly infected each year, then the economic loss must be tremendous. It is believed by those working in the field, that leptospirosis in farm animals is one of the major contemporary livestock disease problems.

Problems and Prospects. One of the greatest needs at present is the establishment of services for diagnosis of lepospirosis at state and regional levels, for quickly-available, serodiagnostic service is necessary to allow veterinarians and livestock sanitarians to recognize the disease and to apply reasonable hygienic control measures. Federal and state research programs upon the nature, diagnosis, epizootiology, prophylaxis, and control of leptospirosis, need to be initiated, continued, and expanded for the eventual elimination of lepospirosis as a major livestock problem.
BIBLIOGRAPHY ON LEPTOSPIROSIS


JOHNE'S DISEASE (PARATUBERCULOSIS)

Johne's disease has been known to be present in the United States for 45 years and during this period it has been reported from almost every State. Each year breeding stock from diseased herds finds its way into clean herds, causing a gradual increase in the number of infected farms. The disease may eventually become a serious threat to profitable livestock production.

Johne's disease is almost always acquired through the purchase of apparently normal infected animals. The following precautions would prevent further spread:

(1) Purchase animals only from farms where the entire herd shows a completely negative Johnin test.

(2) Refuse to purchase animals from any herd in which reactors have been found recently.

(3) Closely observe all purchased animals even though negative to a Johnin test, after their introduction into the herd, especially following parturition, since it is at this time that clinical symptoms are most frequently seen.
(4) Do not allow visitors to walk down feed alleys as they may have previously visited infected premises and be carrying the causative agent on their shoes.

There are several factors to be considered in controlling the disease in herds where it has already become established. Johnin testing alone will not control Johne's disease, but it does furnish information in regard to the extent of the infection, and if used periodically indicates the progress being made toward eradication. If the number of reacting animals is not large, they should be removed at once and slaughtered. However, if many reactors are disclosed, the owner may decide to take immediate steps to eliminate only those animals showing clinical symptoms, and to dispose of the remaining reactors by slaughter as rapidly as young animals can be raised for replacements. This procedure involves a risk as reacting as well as non-reacting infected animals may spread the disease even though they show no symptoms. No breeding stock should be sold as long as reacting animals remain in the herd.

The manure of infected animals is the primary source of infection and every possible precaution should be taken to prevent the ingestion of contaminated manure, and it should be stored where animals cannot come in contact with it or drainage from it. Hay and grain should be fed in racks and mangers so constructed that they cannot be contaminated with manure, and at the same time will not allow the feed to spill on the stable floor. Drinking water should also be protected from fecal contamination. Equipment used to clean the stable of manure should not be used in feed rooms, mangers or feed alleys. Calf rearing quarters should have separate cleaning and feeding equipment and it should never be exchanged with equipment used for the mature animals.

Calves should be removed from their dams within 12 hours after birth and reared in quarters separate from grown animals and on areas that receive no drainage from an area inhabited by older animals or from manure piles. The portable pen developed at the Regional Laboratory, Auburn, Alabama, has proved to be an excellent piece of equipment for raising healthy dairy calves away from their dams. Research work indicates that calves are very susceptible to the disease but appear to develop a degree of immunity as they mature. In this connection, it has been observed that offsprings of dams that died of Johne's disease appear to develop the disease more often than the other cattle in the herd. Whether this is due to close confinement with the dam during early life or to a hereditary tendency was not determined.

Although the measures just outlined are designed primarily for the control of Johne's disease, they have been found to be well worth the effort in reducing the incidence of many other diseases as well.

No satisfactory method has been found for treating animals affected with Johne's disease. Various drugs that have shown marked therapeutic value against other diseases caused by acid-fast bacilli have been investigated,
but none of them has proved to be of value in the treatment of Johne's disease.

Vaccination experiments against Johne's disease have been conducted, and, although a vaccine may produce a partial immunity, vaccinated animals are apt to react to the tuberculin test making vaccination impractical.

Johnin preparations, prepared by chemical fractionation of Mycobacterium Paratuberculosis culture filtrates, are being tested experimentally for the purpose of developing a product superior to regular Johnin for the diagnosis of the disease.

The Middlebrook-Dubos hemagglutination test for the diagnosis of human tuberculosis has been modified experimentally and shows promise as an adjunct in the diagnosis of Johne's disease.

**MUCOSAL DISEASE**

F. K. Ramsey and W. H. Chivers, Iowa State College, have reported recently on a condition which they have tentatively named "Mucosal disease of cattle." It was first recognized in 1951 and has been observed in 43 herds since then with a morbidity rate of 5 to 20 per cent in individual herds and a high mortality rate in all herds. It was most common in late winter and early spring. The signs of the disease were a transitory initial increase in body temperature (106°F), complete anorexia, constant or intermittent watery diarrhea sometimes with blood, profuse salivation, emaciation, dehydration and depression but without paralysis or central nervous system involvement. A foul smelling muco-purulent exudate hung from the nostrils and muzzle. Erosions or ulcers of various sizes and shapes were present in the oral cavity, on the muzzle and in the nostrils. Ulcerative and cystic lesions of the alimentary canal often associated with congestion and hemorrhage but without cellular infiltration were a common finding. The cecitis, colitis and proctitis varied in degree from catarrhal inflammation to hemorrhagic, ulcerative or fibrino-necrotic inflammation. The course of the disease was 3 to 11 days. All treatments were ineffective. Transmission trials failed. The cause is still entirely unknown. The condition may be infectious somewhat like virus diarrhea of cattle where it is usually impossible to transmit the virus disease to the ordinary bovine because of natural resistance; or it may be toxic somewhat like that of bracken, trichlorethylene extracted soybean meal, highly chlorinated naphthalene, the "burning" with oil vehicles in fly sprays and a host of others.

**REFERENCE**

RINDERPEST

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Rinderpest is an acute, febrile, infective disease of cattle that is characterized by a rapid course and by inflammatory and necrotic changes in the mucous membranes. Caused by a filtrable virus, it is transmitted occasionally from cattle to other ruminants. Officials of the United States and of all the other countries in this hemisphere are well informed about rinderpest and the ever possible threat of its introduction. Their constant guard thus far has been successful but faster transportation has complicated disease prevention. With the possibility that it may be introduced into the United States, the following information about the eradication of rinderpest is presented.

Incidence. As far as we know, this disease is not present in the western hemisphere. Once it was introduced into Brazil but was eradicated. Australia has had one introduction but quickly eradicated the disease. The earliest records of the disease suggest that it originated in Asia or Eastern Europe and its incursions into Western Europe followed the paths of invading armies in the periodic sweeps of barbarous tribes from the East. Each time this has happened, Europe has freed itself of the disease. Rinderpest reached Africa in the latter half of the 19th century and after spreading throughout that continent with disastrous effect, was eventually cleared from the southern half but remains endemic in the northern portions; its southernmost extension being in Tanganyika Territory. Other than Africa, the disease at present occurs in India and in Asia. In all these areas, rinderpest is considered a major obstacle in the way of development of the livestock industry, and in unmechanized sections, particularly those in which the water buffalo is used as the principal beast of burden, agriculture in general is retarded.

Clinical Features. When infection is introduced into a herd of susceptible animals, after an incubation period of 3 to 5 days, signs of illness appear. Early signs are depression, loss of appetite and a staring coat. These are accompanied by a pyrexia generally of the order of 105° to 107° F. In the mid-course of the disease, ocular and nasal discharges and salivation with buccal ulceration and a disagreeable fetid odor are characteristic. Profuse diarrhea with progressive emaciation and dehydration occur, often with dysentery and eventually marked tenesmus. In many cases, a cutaneous, eruptive condition termed streptothricosis develops on the back and flanks. In the terminal stages of fatal cases, prostration, coma and death supervene generally after 10 to 14 days.

Pathological Features. Autopsy of such an animal shows involvement of the

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mucous membrane of the entire alimentary tract. This is usually most marked in the mouth, where ulcers containing cheesy deposits are often found, and in the abomasum, ileum, cecum, colon and rectum, where deep congestion and sometimes ulceration occur. In the lower bowel the congestion is often in well-defined, dark streaks and has been referred to as "zebra marking." Pneumonia frequently is seen as a complication, and often cystitis and vaginitis are present.

**Epidemiological Features.** Spontaneous infection occurs principally in cattle, and most outbreaks of the disease are limited to this species, although it occasionally occurs among sheep and goats. The susceptibility in cattle varies considerably in the different breeds of animals. In areas constantly infected, the indigenous animals are more resistant than those introduced from uninfected regions. Age has no influence on susceptibility, except in the case of acquired or congenital immunity, which appears to exist in the suckling calves of immune mothers. Recovery from rinderpest usually confers permanent immunity.

Buffaloes as a rule are less susceptible. During the occurrence of an enzootic they are rarely affected, and even young animals are sometimes resistant to artificial infection, but sometimes the disease may assume an epizootic character even in buffaloes. Zebu cattle and yaks, as well as camels, are usually affected in a mild degree. Besides sheep and goats, wild ruminants, such as deer, gazelles, etc., may be spontaneously infected, and possibly also swine, wild boars and wart-hogs.

The affected animals spread infection on their way to market, especially as they excrete infectious material, even when their symptoms are quite mild. The virus is contained in various evacuations and secretions, but chiefly in the urine, in which it may be present in large quantities, as early as the second or third day after the initial rise of temperature. Infection through the air does not appear to occur and susceptible animals can be protected from infected animals simply by wooden partitions.

Natural infection usually takes place from the digestive tract, sometimes from the nasal passages or from the conjunctiva, probably even when the mucous membrane is normal. According to the latest experience, infection is chiefly conveyed by infected animals and their fresh raw products, especially meat and hides, and perhaps also by fresh manure. In frozen meat, the virus may be distributed to remote places. Indirect contagion through the medium of persons, animals or inert substances such as food, drinking water, stall utensils, clothing, etc. appears to take a subordinate part. Whether and to what extent virus excretions from carriers take part in the spread of infection is uncertain.

**Diagnosis.** Rinderpest may be suspected on the clinical appearance and autopsy findings, but, since these may be very similar to those found in certain other diseases, serological tests are necessary for confirmation. On one occasion a transmissible disease of cattle simulated the signs of rinderpest except for a high mortality. Fortunately, it was possible to obtain sufficient serological evidence that clearly showed the newly recognized
disease was not rinderpest and it came to be known as virus diarrhea.

Diagnosis, therefore, will not be simple for rinderpest presents neither characteristic signs of illness nor pathognomonic lesions. When disease occurs in cattle and rinderpest is suspected, serological methods must be used for differentiation and this means either cross protection and/or neutralization tests. Where will this be done? Danger lies in doing the test for rinderpest in cattle in infected countries since it would be impossible beyond all doubt to differentiate rinderpest from another infection it might simulate. Indeed, a doubtful factor would exist if done with cattle from uninfected areas but if adequate numbers were used and reciprocal test made with other known agents, a conclusion certainly can be reached.

CONTROL

The best method of control is to prevent the introduction of rinderpest and, obviously, every known effort to this end has been made since the disease has never been introduced into the United States as yet. Conditions change, however, and the purpose of this section of the paper is to outline insofar as possible, procedures that might be followed should this eventually occur. In early diagnosis lies the key to control of rinderpest, for the longer it exists unrecognized and uncontrolled, the greater and more costly becomes the problem of eradication and only eradication will suffice.

When disease occurs and rinderpest is considered possible, strict quarantine measures should be initiated with the view in mind of reducing spread of disease. This would be good practice whether the disease was rinderpest or something else. If the conclusion was reached that it was rinderpest, then all measures now advocated for foot and mouth disease should immediately be initiated and this would involve slaughter of animals. The slaughter method of eradication, as used in the United States for foot and mouth disease, includes the following points: quarantine of premises where the outbreak occurs; disposal of infected and exposed animals by slaughter and burial or burning; cleaning and disinfection of premises and all equipment; and testing the infectivity of the premises by restocking with susceptible animals. This work should be actively undertaken by the Bureau of Animal Industry, United States Department of Agriculture, in cooperation with officials of the State in which the outbreak occurs. The expense of eradication should be shared by the Federal Government and the State.

Quarantine. Because of the contagious character of rinderpest, strict quarantine regulations should be put into effect and removed only when the disease has been determined to be other than rinderpest or when there is reason to believe that the outbreak has been eradicated and that the virus no longer exists on the premises or in the locality.

Until the disease has been brought under control, restrictions should be placed on the movement of animals, animal by products, feed, and other materials which may carry the contagion. Unauthorized persons should be forbidden access to quarantined premises, and the movements of employees and other persons from quarantined premises supervised. Unnecessary
visiting between people in the area where the disease exists should be discouraged because, next to infected animals, human beings are considered important factors in the spread of the disease. The close contact that farmers have with stock and the fact that the virus can be carried by persons, on their hands or clothing, emphasizes the necessity of strict quarantine measures to control spread of the disease.

_Disposal of Infected and Exposed Animals by Slaughter and Burial._ The objective of slaughter is to remove the greatest source of active virus. Even though the disease spreads rapidly, involving practically all cloven-footed animals, it frequently takes from one to several weeks before all susceptible animals in a herd have contracted the disease and in turn have passed through the infectious stage. During this entire period each animal or group of animals becomes a source of danger.

Animals may discharge virus in large quantities even before fever or other indication of the disease appears. Therefore, all animals should be slaughtered and buried in a group as soon as possible after the presence of rinderpest has been established in a herd. Since the disease is infectious, it is necessary to destroy not only affected animals but all that have been exposed to the infection. The carcasses of both infected and exposed animals should be totally destroyed by cremation or by burying in a trench at least 6 feet deep and covering them with air-slacked lime before they are covered with earth. The slaughter method also disposes of possible carriers of the virus such as animals that might otherwise recover from the disease and carry or spread the infection to other animals.

_Cleaning and Disinfection._ The objective of cleaning and disinfection is the destruction of the virus on infected premises. These procedures should be carried out in a very thorough manner. While in some instances the virus dies rather quickly outside the animal body, under certain conditions it may remain alive for considerable periods, and be capable of producing the infection, especially when infective material finds favorable conditions. In general the virus of rinderpest can resist the influence of cold more readily than that of heat. It is quickly destroyed by heat. For example, 140° F. (60° C.) will destroy the virus in from 5 to 30 minutes. Wherever possible steam should be used.

Care should be exercised in selecting suitable disinfectants. Those found suitable for foot and mouth disease should serve for rinderpest. Sodium hydroxide in the form of commercial caustic soda or lye is the most suitable for general disinfection. The caustic soda or lye should contain at least 90 per cent of actual sodium hydroxide. When caustic soda is unavailable or cannot be used because of its corrosive properties, some other disinfectant may be employed. Sodium carbonate, commonly referred to as washing soda, is considerably less caustic and irritating than lye and may be used in a 4 per cent solution. It is more rapidly effective if the solution is hot or at least warm.

Three other disinfectants have been used in past outbreaks of foot and
mouth disease and have been useful under certain conditions. These are formalin (40 per cent solution of formaldehyde) used in a 3 per cent solution; saponated cresol solution, U.S.P., in a 3 per cent solution (or a similar product, cresylic disinfectant, in the same strength); and chloride of lime, U.S.P. (30 per cent of available chlorine), in the proportion of 1 pound to 3 gallons of water.

It is of extreme importance that thorough cleaning be undertaken before disinfection is begun. Cracks or crevices should be thoroughly cleaned, and old boards, manure, and materials that interfere with proper cleaning removed and proper disposition made of them.

*Testing Infectivity of Premises and Restocking.* In order to determine that premises, after slaughter of infected and exposed animals and other cleaning and disinfection, are free from the virus, the premises should be tested by placing a few animals on them 30 days after the date of final disinfection. Such restocking, however, is practicable only if no active infection is present in the locality. Frequent inspection of these animals should be made, and if they remain healthy, further restocking may be conducted gradually. As a further safeguard, inspections of new stock should be made at regular intervals.

*Vaccination.* Obviously, rapid recognition of this disease influences the number of animals which may be exposed. The number of animals affected, in turn, influences the economic loss. Should widespread infection occur before accurate identification of this disease, vaccination in combination with quarantine measures might be considered. After quarantine measures are established, this should be followed by vaccination of first an encircling zone and then within the quarantined zone. This would only be feasible, of course, if there were available a vaccine consisting of modified live virus that would not spread disease or establish a focus of infection. There is no certainty that such a vaccine is available. The egg propagated virus developed on Grosse Isle apparently met these specifications, although it was not subjected to all the tests which should be made. For example, in calves approximately 6 months of age, the egg propagated virus did not spread disease or establish a focus of infection. However, it was not tested in young calves whose age was a matter of days.

REFERENCES

SOME OBSERVATIONS ON BLUETONGUE IN SHEEP

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INTRODUCTION

Bluetongue, sometimes referred to as catarrhal fever, is a virus disease of sheep characterized by fever, depression, hemorrhagic inflammation and ulceration of the buccal and nasal mucosa, edema of the head and throat, nasal discharge, stiffness, lameness, extreme loss of condition and weight. Under certain conditions the morbidity and mortality can be quite high and the economic results very serious. Until 1951 the disease had not been described other than in South Africa, Cyprus, and Palestine. The only known method of natural transmission is by insect vectors, principally the Culicoides, commonly known as gnats.

HISTORY

Bluetongue was first identified as a virus disease by Theiler in 1905 in South Africa where it had been recognized since the beginning of the sheep breeding industry in that country.1

A disease of sheep first recognized in Texas in 1948 was given the name of “sore muzzle” in 1951, by Hardy and Price.2 The description of this disease is identical to that of bluetongue reported by South African workers and by McGowan in 1953 in the California outbreak.3 In 1952 there were reports of a similar but not proved condition in sheep in Utah and New Mexico, and confirmation of the existence of the disease has also been established this year in Arizona.

For a number of years an unrecognized condition in sheep has been observed in California which we now believe was bluetongue. The condition usually appeared in feeder lambs shipped into the Sacramento Valley in late summer and early fall. About two weeks after arrival some of the lambs were quite depressed, lost weight rapidly, and some were stiff and lame. The average morbidity was about ten per cent, and usually one to ten per cent of the affected animals died. The condition was also observed in the ewes but was not so severe as in the lambs and was usually confined to the younger ewes. In 1947 this condition was found about September 1st on many ranches, and also affected older ewes. The death loss increased in many flocks. Additional symptoms such as fever, nasal discharge, lung involvement and torticollis were noted. Unsuccessful attempts were made at that time to isolate a virus. From 1947 to 1951 there were only occasional

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BLUETONGUE OF SHEEP

reports of this entity. In 1952 it appeared in an explosive manner over a larger area in epizootic proportions. All of the classical symptoms finally made their appearance; the morbidity and mortality increased. During this outbreak McKercher and McGowan of the University of California, Davis, isolated a virus from infected sheep. Due to similarity of the symptoms with South African bluetongue the virus was sent to Dr. R. A. Alexander, Director of Veterinary Services, Onderstepoort, South Africa, an authority on bluetongue. Dr. Alexander reported that the agent submitted had been identified as a mild strain of bluetongue.

Following the report from Dr. Alexander that bluetongue existed in this country, prompt action was taken to develop some means of control. Accordingly, on January 23, 1953, at a meeting represented by the sheep industry, University of California veterinarians, and State Department of Agriculture veterinarians, it was decided to request the United States Bureau of Animal Industry to arrange for Dr. Alexander to visit this country, study the disease as it existed under our conditions and advise us regarding its control. On April 27, 1953, Dr. Alexander arrived in California and spent considerable time in making observations. He was accompanied on these trips by Dr. C. L. Davis of the United States Bureau of Animal Industry. Dr. Alexander advised that we should not risk the importation of the vaccine culture from South Africa, which is composed of four different strains of attenuated virus. At that time and up to the present writing we have only established two strains in California, and Dr. Alexander and the Federal and State veterinarians all agreed that we should prepare a vaccine from the strains isolated here. Accordingly, the University of California veterinarians continued with the start they had already made to prepare a vaccine. Some fifty egg passages are required to attenuate this virus to the point where it will not reproduce the disease. The California workers have now completed this work. The next steps are to test the vaccine for attenuation and then for immunogenicity. It is estimated that sometime in early October a commercial vaccine will be available for limited field trials.

THE DISEASE AS OBSERVED IN CALIFORNIA

The most constant and outstanding symptoms observed here are marked depression and rapid emaciation. The following may or may not be found: temperature normal to 105°F. or higher, particularly in the very early stage; edema of the ears, lips, tongue, throat and brisket; flushing or hyperemia of buccal mucosa which may become cyanotic; eroded areas on the dental pad, tongue and gums. Erosions and ulceration may appear on the margin of the lips or in the corners of the mouth. The papilla of the lips may be inflamed and bleed easily (this has been mistaken for contagious ecthyma). There may be inflammation of the nasal mucosa with nasal discharge that may become thick and tenacious, later crusting and causing inflammation of the muzzle. There may be a discharge from the eyes and edema and con-
gestion of the lungs with pneumonia. Loss of appetite, diarrhea, stiffness to extreme lameness, torticollis, severe emaciation and wasting of muscles followed by months of convalescence may all be observed. A rather characteristic symptom in lame sheep is a pink to reddish line at the coronet, which may extend into the horny wall. This is, of course, not observed in black legged sheep.

The post-mortem findings are as variable as the symptoms. There may be an edema or yellow gelatinous material between the muscles with hemorrhages on the various membranes of the musculature and frequently on the pulmonary arteries and aorta. Small whitish areas of degeneration may be found in the muscles of the back, neck, and elsewhere. There may be edema of the lungs and occasional pneumonia, also flushing and bluish areas of the skin under the forelegs and in the flanks.

To date, this disease has been confined pretty well to sheep in areas of intensive irrigation or periodic inundation. This has been the case in the Sacramento and San Joaquin Valley areas. It has occurred on all types of pasture such as rice and grain stubble, permanent pasture, beet tops and alfalfa, but always in or near areas of periodic inundation where insect life thrives during the late summer and fall. In 1952 this disease first appeared in September, but in 1953 it was observed as early as July. It disappeared with the frosts in December of 1952, and we expect it to disappear with the frosts this year. To us as in South Africa, it is a disease that goes hand in hand with the period of greatest insect activity.

In July 1953, two months earlier than last year, the disease again made its appearance in Yolo County in the north central part of California, and immediately following was reported in Riverside County in the southern part of the State. A rather extensive outbreak followed in August in the Fresno area in three counties in the southern part of the San Joaquin Valley.

In 1952 the disease was reported in 196 flocks of about 310,000 sheep in eleven counties. It was estimated that two to twenty per cent of the sheep in the various bands were infected and the mortality was approximately five per cent, or 12,000 to 15,000 animals. This year, to date, it has been reported in six additional counties.

**Some Peculiarities of Bluetongue**

According to Neitz ten antigenetically different strains were isolated over a period of forty years. We now understand from Alexander that an eleventh strain has been added. Two strains have been isolated in the United States, but there is reason to suspect that other strains may exist.

For years the South African workers suspected that insects such as mosquitoes and gnats were vectors. In 1943 duToit isolated the C 43 strain from a species of Culicoides (gnats) trapped at Onderstepoort. The Culicoides is now regarded as the principal vector. Species of Culicoides (gnats) are widespread in the infected areas in California and possibly elsewhere in the United States. Whether the species are the same as those in South Africa
BLUETONGUE OF SHEEP

has not been determined to date. There seems to be little known about the life history of the Culicoides, its control and its place as a vector. It has not been propagated in captivity. Mosquito life abounds in the infected area. It is reasonable to suspect that mosquitoes could act as mechanical carriers. It has not been established in California that the Culicoides or mosquitoes are the vectors, or whatever the means of spread may be, but the circumstances point to these insects. This disease is not spread by direct contact. The only known method of natural transmission is by insect vectors.

It is reported that both cattle and goats act as reservoirs of the virus, but that symptoms are not observed in these animals. Two of the eleven known strains of the virus were isolated from cattle by South African workers, one from a suspected case of foot and mouth disease and the other from a case of redwater. There is some disagreement among research workers as to whether cattle show symptoms or merely act as a reservoir without demonstrating clinical evidence of the disease. In California we have no proof that the disease exists in any species but sheep.

Those who have studied this disease closely, caution us that it appears in many different forms and degrees of virulence, from merely a slight stiffness with no death loss, to all of the pronounced classical symptoms attended by extreme degrees of morbidity and mortality.

We are also reminded of the similarity to big-head or photo-sensitization, contagious ecthyma (sore-mouth), stiff lamb disease and founder.

CONTROL

Diagnosis. A clinical diagnosis of typical cases of bluetongue is not particularly difficult and is probably sufficient in most areas where the disease and the type of the virus have been confirmed by animal inoculation. The mild and unusual forms present a diagnostic problem. Definite diagnosis is established by Doctor McKercher in California by the inoculation of blood or spleen material into susceptible sheep. It is important to bear in mind that, at the present writing, this is the only known test for bluetongue. Such a procedure is costly and time-consuming. We are forced to limit it to outbreaks where the disease has not previously appeared, or where there is some reason to suspect a different type of the virus. We think it is important to carry out the procedure under those conditions.

The procedure is as follows:

If bluetongue is suspected, we examine suspicious looking animals for typical lesions. If these are found, we do not draw blood from the animals. Instead, we take temperatures of other sheep and bleed only those showing a high febrile reaction (106° to 107.5°F.). The blood should be defibrinated or oxalated. Samples can then be pooled and forwarded to the laboratory for confirmation of bluetongue diagnosis.

It is important that the specimens should be obtained at the height of fever. There is greater possibility of obtaining the virus from a sheep showing high temperature and no other symptoms than one showing advanced
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symptoms or lesions after the fever has declined. It is not necessary to refrigerate the specimens and they should definitely not be frozen. The virus may be recovered from spleen material but it is not necessary to submit it to the laboratory. Properly selected blood specimens are sufficient.

The Vector and Reservoir Problems. From the standpoint of control the vagaries of possible vectors and reservoirs present a problem. We know little about them. Considerably more research is necessary before we can proceed intelligently in this regard. Quarantines and restrictions on owners seem rather hopeless and can add a burden and expense on the growers without any promise of favorable results.

Vaccination. The first vaccine to be available will be from only two strains attenuated by egg passages. Should other strains appear this vaccine may not protect against them. Workers have experienced this difficulty in South Africa. They have found that a mixed vaccine of four strains will protect against ten known strains, but recently an eleventh strain appeared and caused trouble.

We should give our research people the very highest degree of cooperation by submitting material from different localities to enable them to discover other possible strains without delay. A vaccine that will immunize against all strains that might exist in this country seems our best solution to the control problem.

Vector Control. We have recommended that when the disease shows up in a flock the owner spray with Lindane and DDT. We do not know that this will be effective but it seems logical that it might prevent some degree of spread.

Treatment. Limited attempts at treatment with drugs and antibiotics have not resulted in any tangible benefits. Heat and excessive handling appear to aggravate the condition. We recommend isolation, providing shade and good nursing, but moving or handling the animals as little as possible.

Restriction of Movements. We are quarantining infected bands. We question that this will be beneficial. There is no control of the vectors, or the cattle and goats, or other possible carriers.

Summary

Bluetongue is a virus disease of sheep, transmitted by species of Culicoides commonly referred to as gnats. The disease is characterized by fever, inflammation and cyanosis of the buccal membranes and tongue, followed by ulceration, edema of the lips, ears, throat, and brisket; stiffness, lameness, a pink to reddish band at the coronet; flushing of the skin, nasal discharge with crusting of the muzzle, extreme depression, rapid loss of weight, and sometimes a high rate of mortality.

The disease has been recognized in South Africa for over forty years and, with the exception of Cyprus and Palestine, had not been reported outside of South Africa until it was officially recognized in California in 1952.
Before this date it was reported in Texas as “sore muzzle.” It has been reported in Utah, New Mexico and Arizona. There is reason to believe that the disease has existed in California and Texas for a number of years but that it had not been recognized as bluetongue.

Isolation of the virus was made in 1952 by California workers who forwarded it to South African workers, who identified it as bluetongue. The symptoms and lesions observed in California are identical to the description reported from South Africa. In 1952 the disease broke out in epizootic form in eleven valley counties in California, involving over 300,000 sheep, with an estimated twenty per cent morbidity and five per cent mortality. In 1953 the disease appeared several weeks earlier and was reported in new counties, apparently in a milder form.

Peculiarities of bluetongue are that it is transmitted by insect vectors only. It is seasonal, occurring at the time of high insect activity in or near areas of heavy irrigation and inundation. Cattle and goats are reservoirs, but evidence of the disease in these species has not been observed in California. The disease appears in a wide variety of forms, some of which closely resemble other diseases of sheep.

Control of bluetongue presents many problems. Diagnosis is established only by inoculation of blood or spleen material obtained from sheep at the peak of fever. Little is known about the life history or control of the vectors and further research is urged. The disease is successfully controlled in South Africa with a mixed vaccine of four different strains of the virus. It is believed an experimental vaccine from only two strains, will be available for field trials some time in October. It is probable other strains or types of the virus may exist in the United States and we should make diligent effort to determine whether there are other strains in order that a more complete vaccine can be made should it be found necessary. Some attempts are being made to control vectors by spraying sheep in infected flocks with Lindane and DDT. Quarantines are also being placed on infected flocks, but little confidence is placed in either vector control or quarantine.

Due to the fact that the disease has existed in this country for a number of years, there is reason to suspect that it could be fairly well established, especially in the western and southwestern states. Vaccination seems to be the only method of control.


REPORT OF COMMITTEE ON EXOTIC DISEASES


PROBLEM

This committee was appointed this year. Its problem is the study of the threat of foreign animal diseases that may be introduced into the United States and Canada, either by accident or by deliberate acts of sabotage and to recommend measures expected to be helpful in preventing such introduction or control or eradication in the event these diseases do appear. Approved measures would provide a uniform program for future control problems.

The purpose of this report is to review the general problem and to suggest that supplemental reports treating specific foreign animal disease problems that are considered potential threats to the United States and Canadian livestock industry be prepared in an effort to provoke serious advance consideration of appropriate measures.

The prevalence of animal disease is an important limiting factor in the production of livestock and livestock products in any country. Failure to develop and maintain adequate disease control measures can lead to heavy annual losses and contribute to high production costs. In addition to the loss of livestock resources, the restriction of agricultural commerce entailed by necessary quarantines may seriously affect the general economy and welfare of a nation.

The over-all philosophy in the United States and Canada to eradicate whenever possible, rather than live with, the diseases which affect animals has helped to maintain our high standard of living and determines, to a great extent, the economic status of these countries. It is essential that this philosophy be extended and emphasized at this time.

Disease travels as man and his animals travel—as they travel faster, infection does likewise. Today's rapid intercontinental air transport, with the possibility of traveling to almost any place in the world in forty-eight hours, provides a greater hazard than when we depended upon slower means of travel.

All available precautions must be taken to prevent the introduction, accidentally or by design, of disease agents into our countries. Quarantine, isolation and import restrictions are extremely useful weapons to assist in preventing the entrance of foreign animal diseases. Import restrictions.
as practiced by the Federal governments, have been of incalculable value
in helping to keep these countries free of some of the dangerous foreign
plagues. For the possible catastrophic consequences that can result from
relaxing established import restrictions, for only a very short period or
for a single exception, one has only to review the early history of the foot-
and-mouth disease outbreak in Mexico. Some foreign animal diseases have
gained entrance into the United States and Canada in the past. The Federal
Bureau of Animal Industry of the United States Department of Agriculture
was initially established for the express purpose of controlling and eradicating
such a disease—contagious bovine pleuropneumonia.

Investigations of past outbreaks of foot-and-mouth disease, fowl plague,
contagious bovine pleuropneumonia, anthrax, blue tongue and scrapie have
indicated that disease can be introduced and spread, by means of raw garbage,
contaminated animal feeds and other materials, biologics, undeclared foreign
laboratory cultures, smuggled livestock and birds, insect vectors and animals
imported in a carrier state or during the period of incubation.

Recent experiences with vesicular exanthema illustrate how rapidly a
highly communicable disease can spread throughout the livestock population
of this country. This is due, to a great degree, to our livestock marketing
practices and the rapid means of transporting livestock to and from marketing
centers. These factors make the control of such diseases extremely difficult
in spite of our increased technological knowledge.

There will always exist the threat of the accidental introduction of foreign
animal diseases. It must be remembered that in addition to this threat is the
current biological warfare threat dealing with the possibility of deliberate
introduction and spread of diseases. Thus, any improvements in animal
disease control brought about through the stimulation given by the needs
for BW defense will result in worthwhile improvements in the protective
health services for livestock whether the next damaging outbreak is due to
enemy action or to the ever present danger of accidental introduction and
spread.

The willful introduction of disease can cause many problems. The animal
host, disease, time and place can be selected. An enemy can increase the
problem by using several agents of similar diseases, simultaneously. The
possibilities of the use of several types of foot-and-mouth disease virus
illustrate this point. The combining of disease agents of different types might
produce more than one disease in the individual host with contradictory
symptoms and varying incubation periods. Such combinations might act
synergistically to make others more effective. Unfortunately, there are a
number of animal diseases, native and foreign, benign and highly fatal,
that present similar symptoms, all of which increase the diagnostic problems.

Successful disease control depends upon:

1. Prompt detection and reporting
2. Accurate diagnosis
3. Knowledge of the epizootiology of the disease
4. Eliminating the causative organism from the host or its environment
5. Isolation and quarantine
In addition one or both of the following may be needed:
1. Development of a protective biologic
2. Effective treatment or cure

Prevention is the ideal means of combatting disease. Its success depends to a great extent on the application of strict quarantine measures and under some circumstances, preventive immunization. The history of sanitary control suggests that successful quarantine is possible only under favorable conditions, and over relatively short periods of time. Public understanding and support is an essential part of workable quarantine. The carrier and the atypical case should be given proper consideration. Under the conditions of modern transportation, there seems little possibility of preventing, permanently, the introduction into any part of the inhabited world of any disease agent which is prevalent in another. Once the barrier is passed, the subsequent course of events will depend upon conditions existing within the country or community into which the infection has been introduced.

In addition to the established principles of disease prevention and control the results of a successful control program for foreign animal diseases will depend upon: (1) knowledge of the disease in question, (2) immediate application of approved control measures, and (3) the accessibility of personnel, equipment, supplies and funds with which to conduct an effective program for diagnosis and control. Experience and active participation by veterinarians of the United States and Canada, in research and field work with exotic diseases is necessary to provide the know-how in diagnosing and controlling these diseases.

One of the first essentials of a country dealing with exotic diseases is placing responsibility in the hands of a centralized authority. In Canada the responsibility is placed directly under a centralized authority who possesses the necessary powers under Acts of Parliament and Order-in-Council to deal with an outbreak and enforce all necessary restrictions in the country, irrespective of a Province or Municipality involved. The regulatory work and control of exotic diseases is centralized in the Health of Animals Division of the Dominion Government, the laboratory work, etc. being centralized in the Division of Animal Pathology of the same Government. There are many supplementary factors in disease control that fall under a central authority of this kind. It has proved an exceedingly efficient piece of machinery to deal with disease control problems. It is recommended that this highly efficient system be retained. The committee is of the opinion that the organization in Canada is ideal for combatting exotic diseases. It would seem advantageous in the United States that the central authority be vested in the Bureau of Animal Industry whose duty it would be to supervise, coordinate and direct a control program against foreign animal diseases in all States. While State livestock officials would retain supervision and control within their respective
States, this would have to be done in complete coordination with Federal supervision, otherwise the war against exotic disease would be lost.

RESPONSIBLE AGENCIES

The principal agencies responsible for animal disease control in the United States are the United States Department of Agriculture Bureau of Animal Industry and the States Livestock Sanitary offices of the several States with the collaboration of the veterinary practitioners. Part of the responsibility of these protective services is to be alert for any foreign or unusual animal diseases.

To help prevent the introduction of foreign animal diseases into the United States the Bureau of Animal Industry has a force of inspectors stationed at certain sea, air and border ports of entry. This protective service is assisted by inspectors of the U.S.D.A. Bureau of Entomology and Plant Quarantine as well as officers of the U.S. Public Health Service and the U. S. Customs Inspectors. There should be an increased number of BAI inspectors assigned to such duties in order to afford greater protection to the livestock industry against the possible entry of exotic diseases.

The Quarantine Inspectors of the Bureau of Medical Services, Public Health Service, Department of Health, Education and Welfare, aid in preventing the introduction of communicable diseases into the United States and its possessions by enforcing the foreign quarantine regulations covering sea, land and air traffic.

The Bureau of Customs cooperates with other Government agencies in enforcing the preventive, sanitary and other laws relating to articles brought into the United States.

The Federal Meat Inspection Service is important in the detection of unusual or foreign animal diseases. Inspection is provided at plants located in all parts of the country where more than 80 per cent of the meat animals commercially slaughtered are given both ante and post-mortem examinations on the day of slaughter. Any unusual symptoms or disease are reported to the appropriate Federal disease control official who with the cooperating State officials make an immediate field investigation.

The Veterinary Service of the United States Public Health Service, Department of Health, Education and Welfare, conducts epidemiological investigations of those animal diseases of public health significance, as well as programs of communicable disease control, with primary emphasis on the control of animal diseases transmissible to man.

The United States Federal and State Food and Drug officials aid in the removal of contaminated animal feeds and veterinary biologics from the commercial markets. The Federal Foods, Drugs and Cosmetic Act regulates interstate movement of animal feeds and provides for Federal seizure to remove offending stocks of feeds from interstate commerce.

The Fish and Wildlife Services, Department of the Interior, provides an intelligence service for the animal disease control agencies in the prompt
reporting of unusual numbers of deaths among wild animals or unusual circumstances resulting in such deaths.

The United States Army and United States Air Force Veterinary Services are available for assistance and support to the fullest extent consistent with Department of Defense policy.

The Federal Bureau of Investigation is responsible for detecting and apprehending saboteurs.

The Central Intelligence Agency is responsible for acquiring, correlating, and evaluating intelligence information from foreign countries relating to our national security and providing the information to the appropriate government agencies.

The Federal Civil Defense Administration is responsible for coordinating the activities of the several Federal agencies relating to BW defense for animals and establishing policies, developing plans, and programs necessary for national civil defense.

REQUIREMENTS

General

An absolute protection against the entrance of foreign animal diseases into the United States and Canada is impossible. Dangerous foreign animal diseases that have gained entrance into these countries in the past, have been successfully eradicated. Under modern conditions, however, a highly communicable exotic disease might be so widespread initially, that the past policy of eradication would not be economically sound. Under such circumstances it might be necessary to resort to slower and less immediately effective methods, including the use of vaccines or other biologics.

Existing legislation provides the United States Secretary of Agriculture with the authority to declare an emergency when the livestock industry of the nation is threatened. Ordinarily this authority is used only during an outbreak of dangerous foreign animal diseases. This action is taken in cooperation with the various livestock regulatory authorities. During such emergency, the USDA will determine the policy on possible manufacture and use of vaccines against foreign animal diseases. The FCDA has provided funds to the USDA for the purchase and stockpiling of critical laboratory equipment which might be necessary for the production of vaccines during an emergency.

PREVENTIVE MEDICINE

Unfortunately, preventive medicine is not a dramatic procedure and thus it often does not receive the support necessary in the animal health field. The success of disease prevention requires the efforts of the Federal, State, Provincial and local governments and of every citizen and his community. It is a community problem and requires community support.

Administrative measures must be directed toward a general reduction in the opportunities for spread of infection from host to host. This can be
accomplished with improved sanitation, including clean water, bedding and feed supplies, reduction of insect vectors and the controlled movement of susceptible animals. Present knowledge emphasizes the importance of the susceptible host. Any measures which increase the average resistance of a herd, whether it depends upon specific immunization, or on some factor which confers an increased resistance less specific in its range, will exert a direct influence on the incidence of the disease in question.

REPORTING

The need for and the importance of an established nation-wide animal disease reporting system cannot be over-emphasized. Such a system would be extremely helpful in detecting the presence and extent of a foreign disease outbreak. The United States Livestock Sanitary Association Committee on Morbidity and Mortality has repeatedly pointed out the need for this information and has continually attempted to assist the Federal Bureau of Animal Industry in establishing a system for the collection and dissemination of such data in cooperation with the State livestock sanitary officials. Disease prevention and disease control can be much more effective and efficient when a disease reporting system is established and operates on a country-wide basis. It provides the Federal and State veterinary officials as well as the veterinary practitioner with important information on the location and extent of disease outbreaks within each State and throughout the country.

The need for an approved manual on nomenclature, improved diagnostic procedures and the importance of utilizing the principles of epizootiology for more effective disease prevention and control has been recommended by the same committee. These are necessary and essential weapons with which to effectively combat disease.

Every effort should be made to assure reporting of any disease of undetermined character, or any unusual incidents in connection with diseases already existing within a State or Province. Such occurrences become subject to immediate investigation and receive such technical assistance as may be considered necessary by the Federal, State, Bureau of Animal Industry officials.

REPORTING

ANIMAL FEEDS AND FERTILIZERS

The potential threat of the accidental or intentional contamination of animal feeds at the processing plants and distribution points is a problem of the feed industry and the Federal and State Food and Drug agencies. Animal feeds, such as supplemental feeds with animal protein and bonemeal contents, can spread animal diseases unless very carefully processed and handled to assure a safe product. Anthrax and other spore-borne infections may be spread by this means. Chemical poisonings from this source should not be overlooked.

The USDA has recently amended the regulations governing the sanitary
control of animal byproducts offered for entry into the United States. For feed and fertilizer purposes only steamed or special steamed (degelatinized) bonemal is permitted to enter the country. Such processing destroys all infectious agents including spore-borne organisms. All other imported animal bones are permitted entry subject to handling in a manner to prevent spread of disease to livestock. This will aid in preventing the dissemination of anthrax and other spore-borne infections from foreign countries.

**RENDERING PLANTS**

The careless and unsanitary practices that have existed in many unsupervised rendering plants provide many opportunities for the spread of animal diseases. Most States should follow the action taken by those after the unusual outbreak of anthrax in the midwest during the spring of 1952 involving contaminated bonemal and meat scraps used in animal feeds when more effective laws were adopted to regulate the operations of local rendering plants.

**GARBAGE FEEDING**

Danger of introducing and spreading disease is always present in raw garbage feed. Raw garbage has been largely responsible for widely disseminating the current outbreak of vesicular exanthema among swine. The 1924 and 1929 outbreaks of foot-and-mouth disease in the United States started from the feeding of raw garbage. Hog cholera, trichinosis, tuberculosis, Newcastle disease and other diseases and parasites also can be spread by this means.

Bureau of Animal Industry, United States Department of Agriculture regulations provide that garbage containing meats or meat products and originating in any country where foot-and-mouth disease or rinderpest is known to exist shall not be unloaded into the United States or within the territorial waters thereof except when presented in water tight receptacles and unloaded for incineration under the direction of a BAI inspector. Proper disposal of garbage from this source is an important factor in helping prevent entrance of exotic diseases into the United States.

**TRANSPORTATION**

Transportation presents a potential means of disease spread. All premises and facilities used for livestock and poultry commerce should be cleaned and disinfected after use. In the control of exotic diseases all conveyances in the declared infected area must be cleaned and disinfected following each movement of livestock and poultry. Public carriers for livestock and poultry should establish a system and provide the necessary facilities for periodic cleaning and disinfecting all conveyances.

**SALESBARNs, STOCKYARDS, ETC.**

Conditions and practices found in some salesbarns, among some livestock dealers, and even in some stockyards, provide opportunities for the spread
REPORT OF COMMITTEE ON EXOTIC DISEASES

of exotic animal diseases if these should gain entrance into our countries. Livestock markets dealing in the transfer of livestock should employ regular cleaning and disinfecting practices following each day's sales. These establishments should be licensed and if they are repeated sources of disease, the license should be suspended until satisfactory preventive practices are employed.

BIOLOGICS

It is conceivable that a clever saboteur might use biological products as a means of spreading destructive diseases to this country's livestock and poultry. This potential threat has been brought to the attention of the biological industry. To aid in disease prevention it would be highly desirable for the Federal and State animal disease control officials to establish a cooperative program of requiring information from each biological production and distribution agency relative to those products, sold within the respective states, capable of initiating foci of infection and those antigens used for disease control or eradication programs.

In this connection it is pointed out that there are numerous laboratories for the production of biologics used by the poultry industry supposedly doing only an intrastate business and therefore are not under supervision of the Federal government. It is essential that these laboratories as well as others that might be doing intrastate business in animal products, be under the strict supervision by the State in which they are located to assure the production and distribution of a safe product.

WILDLIFE

The possibility of introducing diseases of man and animals by using wild animals and rodents must not be overlooked. Range animals would particularly be vulnerable to this method. Unusual diseases or numbers of deaths in wild animals and rodents can be reported by farmers, ranchers, hunters, fishermen and others to the Wildlife Service. Such information should be channeled from the Wildlife Service to the State livestock sanitary authority. Each unusual incident reported should be immediately and energetically investigated to determine the facts and the action to be taken.

EMERGENCY OPERATIONS

Veterinarians in charge of field activities should develop emergency plans for field operations, which should include a current list of the names and locations of all veterinarians within the State. Lists should be prepared including the pertinent information concerning stockyards, auction or sales-barns, rendering plants, dairies, cheese factories, milk collecting points, and slaughter-houses in the State. This information will be required if a prompt quarantine is required for disease control. Other lists should include persons or firms within the State who can furnish needed equipment and supplies, earth moving equipment, disinfecting equipment and the necessary disinfectants.
INFORMATION

The veterinarian is responsible for recognizing new diseases among the livestock of his community. This requires keen observation and adequate knowledge of the various foreign animal diseases. Information on foreign diseases has not been readily available in this country. All types of material on this subject should be provided as soon as possible. The USDA and FCDA have distributed a limited amount of written material and more recently movie films on foreign animal diseases. These visual aids are available for use by veterinary colleges and veterinary associations for orientation purposes. Additional information is being developed by FCDA, USDA, and USLSA. Several foreign and international veterinary journals provide current information on some of the foreign or exotic animal diseases. (i.e. International Institute of Epizootics Bulletin, African Veterinary Journals.)

DIAGNOSTIC SERVICE AND RESEARCH

Rapid and accurate diagnosis is an important requisite for effective disease control. The quicker the identity of the disease is known the sooner countermeasures can be taken. The Federal Bureau of Animal Industry has trained a group of diagnostic specialists and has placed them in strategic locations throughout the country. They are available at all times to assist in conducting the necessary investigations to establish the diagnosis, especially for diseases of a vesicular nature. State and Federal Bureau of Animal Industry officials should make immediate arrangements for assistance from these diagnosticians. Efforts will be made to conduct the diagnostic tests on the infected premises to aid in minimizing further spread.

Specimens from suspected cases of foreign animal diseases should not be forwarded to a laboratory without prior approval of the Chief, Bureau of Animal Industry, Washington 25, D. C. Only with such approval should material be shipped for examination and then only to a central laboratory having all the safeguards which render it practically impossible for infection to escape from the laboratory quarters either by direct or indirect means. There are at present only two laboratories for this service: Plum Island, in the United States, and Grosse Ile, in Canada.

The Federal Bureau of Animal Industry’s research laboratory at Beltsville and its several regional laboratories are available for diagnostic and consultant services. Request for assistance must be made by the State and Federal Bureau of Animal Industry official to the Chief, BAI, USDA, Washington 25, D. C.

Consultant service is available from the research institutes, State diagnostic laboratories, veterinary colleges, agricultural experiment stations, and some of the commercial biological laboratories.

Consultant service is also available from the laboratories of the United States Public Health Service and some of the State Health Departments who have highly qualified personnel especially for those diseases transmissible from animals to man.
In the past, support for veterinary research on disease control has usually been sought and obtained on an emergency basis. The emergency approach to research is usually inefficient and costly.

Much research is needed to provide solutions to some of the possible problems of preventing and controlling foreign animal diseases. There is a great need for improved diagnostic techniques which will permit more rapid and accurate results. There are available, rapid and precise diagnostic procedures for some of the dangerous foreign animal diseases. There are still other diseases in this group that need study and attention.

There must be continued research to develop new and improved protective treatments following exposure and more effective vaccines with longer-lasting immunity.

The acquisition of Plum Island by the USDA with the expected installation of adequate facilities and the provision of sufficient funds for personnel and operation is a forward step in research on foot-and-mouth disease and other foreign animal diseases. This laboratory will provide diagnostic facilities and a place for the typing of the viruses of all outbreaks of foreign diseases and also standby facilities for the production of vaccine if it is needed during an emergency.

In Canada the Grosse Ile Experimental Station has been in operation for several years. This Station is provided with every safety precaution and maintains the requisite facilities for not only research in exotic diseases but for prompt diagnosis. This latter service has been available and has been in use for several years.

**RECOMMENDATIONS**

Your Committee recommends that it continue to serve for another year during which time its work will be directed towards developing and providing information on specific foreign animal diseases and related problems considered as potential threats against the livestock industry of the United States and Canada.

It is suggested that this report be combined with additional information on handling specific foreign animal diseases and developed into a booklet for wide distribution. This publication would provide the Federal and State regulatory officials as well as each practitioner with a concise directive and essential information to be followed in coping with what is suspected as being an emergency. It would outline in 1, 2, 3, fashion what steps should be taken, who should be contacted first and what to do until the individual succeeds in contacting someone who would take over the situation. Such material, with the approval of this association and other agencies (federal and non-federal), would provide a uniform program throughout the United States and Canada for future control problems of foreign animal diseases, if such disease should appear within our countries. Most important, it would provide an agreed plan of attack prior to any emergency that may confront us.
OHIO'S ANIMAL DISEASE REPORTING PROGRAM

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In January of this year Ohio instituted a new animal morbidity reporting program. This program was put into effect by the Ohio Division of Animal Industry in cooperation with the Ohio Department of Health and the United States Bureau of Animal Industry.

The need for such a program had been paramount in the minds of regulatory officials for a good many years. Information concerning many disease conditions was meager and with little or no degree of exactness. In the opinion of those concerned, such data should be at the finger tips of animal industry, since it could be used to great advantage in programs for disease control as well as contributing valuable information to Civilian Defense.

Of course, the broad objective and the prime concern is to provide better animal health. To provide health, disease must be prevented and controlled. Satisfactory control and prevention is dependent upon knowledge of where and when disease occurs, how much occurs and how it spreads through space and time.

It has been embarrassing to discuss disease control programs at rural meetings and have some interested party inquire as to the number of cases of a given disease entity occurring in the state; or to be questioned concerning the geographic or seasonal pattern of a given disease entity. In the past, we have had largely hearsay with which to answer these questions.

With these points in mind, interest in the reporting program was stimulated and Ohio initiated an animal morbidity reporting program. The United States Public Health Service provided franked reporting forms and consultation service on technical and statistical procedures. It was agreed that reporting cards would be sent to each practicing veterinarian twice monthly by the Division of Animal Industry. The State had been divided into 23 Agricultural Areas in the past for regulatory programs.

Each of the 23 areas has a code number of 1 through 23, and each area has an area supervisor.

It was our desire to have this area supervisor stimulate activity in the reporting program as well as to follow up by investigating certain conditions which were reported.

Ohio has 88 counties. Each county was assigned a code number to facilitate the codification and make for ease in pin-pointing disease conditions.

At the start of this program, Ohio had 710 practicing veterinarians. Each veterinarian was assigned a Code number to identify that particular
OHIO'S DISEASE REPORTING SYSTEM
veterinarian, along with the county, and area in which he conducted his practice. Therefore, the codification of each veterinarian revealed the code number of the veterinarian, the code number of his county and the code number of his area.

For example, Dr. John Doe, 101 - 48 - 01, indicates Dr. Doe is number 101 veterinarian on the list, practicing in Lucas County, which number is 48, and is in Area No. 1.

It was agreed by the cooperators to print the following disease conditions on the reporting cards:

- Rabies
- Erysipelas
- Leptospirosis
- Encephalomyelitis
- Anthrax
- Brucellosis
- Psittacosis
- Hog Cholera
- Atrophic Rhinitis
- Influenza
- Infectious Bronchitis
- Blackleg
- Gut Edema
- Hyperkeratosis
- Scabies
- Vesicular Disease

The reporting card facilitates the work of the local veterinarian.

The card is a double-type postal card which the practitioner can complete simply by indicating the number of cases and the number of premises concerned with each disease condition. The card is then mailed to the office to the Ohio Department of Health. There, the returned cards are tabulated and the statistics are compiled for the full month’s report. The monthly statistical report is sent to the office of the Division of Animal Industry where it is checked and prepared for distribution to the local veterinarians.

In the very beginning of this program we agreed that such a program was dependent upon the cooperation of the local practitioner. Further, it was agreed that to obtain the highest degree of cooperation, we, in turn must afford the veterinarian some benefits for the effort he was putting forth. Therefore, it was decided that the Division of Animal Industry, with the Department of Health and the Bureau of Animal Industry, cooperating, would publish a monthly bulletin. This monthly bulletin was called “Animal Disease Trends” or A. D. T.
Animal Disease Trends not only contains the compilation of monthly statistics, but contains pertinent information relative to certain disease conditions. This publication usually contains four or six pages with discussions of timely disease conditions. Periodically, there are graphs and charts which contain information that the local veterinarian should find important.

A.D.T. is not only circulated to the participating local veterinarians, but also is sent to all veterinarians in Ohio, totaling more than 800. A.D.T. is sent to all regulatory officials in the 47 other states, as well as Canada, Hawaii,
INFECTION BRONCHITIS PROGRAM IN OHIO

A committee made up of representatives of the poultry industry, as well as regulatory officials, have outlined a plan which will be followed in projecting the infectious bronchitis immunization program in the State of Ohio this year.

ITEM 1: What is the bronchitis immunization plan?

It consists of infecting a small number (5 to 20) of 8 to 16 week-old birds with a virulent infectious bronchitis virus. These infected birds are liberated into the flock and spread the disease to the other birds naturally. Usually symptoms are over by the twelfth day. At this age there is little if any harm done to the birds which will continue to develop and grow normally. Recovered birds are immune and protection against infectious bronchitis is assured when the birds go into production.

and Puerto Rico. State Health Veterinarians in Ohio and other states receive copies of this bulletin each month.

After the first two issues of A.D.T., we had many requests from County Agricultural Agents in Ohio to be placed on the mailing list. After due consideration, we agreed that A.D.T. could well be a very beneficial liaison between the local veterinarian and the county agent. It was our honest opinion that the county agent should be informed of the incidence of disease entities in his particular county and area, as well as what was occurring throughout the state. Therefore, we also send copies to each of the 88 County Agents' offices.

All in all, 1200 copies of A.D.T. are sent out each month from the offices of the Division of Animal Industry.

In conjunction with our Reporting Program, we have emphasized the availability of a consultative field investigation service. Our area supervisors are available to the local veterinarian for consultation, and in addition, several special investigators trained in field diagnostic services. We also stress the availability of the laboratory service for the use of the local practitioner, as an aid in establishing diagnosis. Thus, we have the reporting program to provide routine data to answers where, when, and how much. Laboratory and investigative services contribute to finding how it spreads.

Our personnel are always available to speak and discuss disease problems
### Ohio Animal Morbidity Report

**Number of Premises**

<table>
<thead>
<tr>
<th>No. Reporting</th>
<th>660</th>
<th>48 per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Negative</td>
<td>502</td>
<td></td>
</tr>
</tbody>
</table>

**March 1953**

#### Agricultural Areas

| Diseases                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | Total |
|---------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| **Cattle Diseases**       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Actinomycosis             | 2 | 2 | 2 |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Blackleg                  | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Hyperkeratosis            | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Leptospirosis             | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Rabies                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| **Swine Diseases**        |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Atrophic Rhinitis         | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | 14 | 2 | 2 | 1 |    |    |    |    |    |    |    |    |    | 26 |
| Brucellosis               | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Cholera                   | 1 | 1 | 2 |   |   | 1 | 1 | 1 | 1 | 12 |   |   | 4 | 3 | 1 | 3 | 21 |   |   |   |   |   |   | 21 |
| Erysipelas                | 1 | 1 | 3 | 1 | 3 | 3 | 5 | 3 | 2 |    | 2 | 5 | 5 | 1 | 2 | 37 |   |   |   |   |   |   | 37 |
| Gut Edema                 | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Influenza                 | 3 | 2 | 1 | 2 | 5 | 5 | 1 | 3 |   | 28 | 1 | 15 | 5 | 53 |   |   |   |   |   |   |   |   | 53 |
| Leptospirosis             |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |     |
| **Dog Diseases**          |   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Hepatitis                 | 2 |   |   |   |   |   |   |   |   |    | 16 | 4 | 1 | 23 |   |   |   |   |   |   |   |   | 23 |
| Leptospirosis             | 6 | 6 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 1 | 1 | 6 |   |   |   |   |   |   |   |   | 31 |
| Mange                     | 2 |   |   |   |   |   |   |   |   |    | 2 | 1 | 1 | 11 |   |   |   |   |   |   |   |   | 11 |
| Rabies                    | 1 |   |   |   |   |   |   |   |   |    |    | 1 | 1 | 1 | 1 | 1 |   |   |   |   |   |   | 6 |
| **Sheep Diseases**        |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |    |    |    |     |
| Scabies                   | 3 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    | 6 |
| **Poultry Diseases**      |   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |     |
| Infectious Bronchitis     | 9 | 4 | 35 | 1 | 1 | 1 |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 1 | 52 |
| Newcastle Disease         | 1 |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    | 1 |

Other diseases reported (and premises) are:

- **Actinobacillosis**
  - Cattle 1 Johnes Disease
  - Cattle 2 Rabies
  - Feline 2

- **Chronic Respiratory**
  - Avian 1 Keratitis
  - Cattle 1 Tetanus (Dog 1, Horse 1, Sheep 1)
  - Cattle 1

- **Distemper (Canine)**
  - 6 Feline
  - 1 Leptospirosis
  - Feline 1 Necrobacillosis
  - Cattle 4

- **Gastro Enteritis**
  - Swine 3 Leucosis
  - Fowl 1 Necrophorous
  - Swine 4

- **Hyperkeratosis**
  - Elephant 1 Listerellosis (Sheep 1)
  - Cattle 2 Necrotic Enteritis
  - Swine 2

- **Infectious Bronchitis**
  - Cattle 7 Malignant Head Catarrh
  - Cattle 6 Paralytic Meningitis
  - Canine 6

- **Influenza Like Disease**
  - Cattle 4 Mange (Horse 1, Swine 1)
  - Cattle 1 Pneumonia
  - Swine 1
  - Ringworm (Dog 1) 1
  - Cattle 6
  - Shipping Fever 1
  - Cattle 3
in local meetings at the request of the local practitioner. Our office also has motion pictures and slides on certain disease problems which are available at all times for the use of the local veterinarian.

In considering these factors we have attempted to maintain that this disease reporting program is in reality the practitioners' own program. The local veterinarian can make the program or he, by the same token, can weaken the program. So by affording as many benefits as possible for the local veterinarian, the Division of Animal Industry is quite sure the local practitioners will respond and cooperate as they have done on disease programs in the past.

The program was started on January 1, 1953, which affords us with only a little more than six months to make an appraisal of the reporting program. We of course, realize that this is not sufficient time to obtain any conclusive data. Since this was the initial six months, many adjustments had to be made. As stated earlier, we started with 710 participating veterinarians. Since that initial reporting period, by combining partnerships and removing inactive or retired practitioners, we now have 610 veterinarians participating in the reporting program.

The most important phase of this program of course, is that of the active participation of the local veterinarian.

**PRACTITIONER PARTICIPATION**

**BY PERCENTAGE RATES**

<table>
<thead>
<tr>
<th>Period</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>1st Period</td>
<td>54.2%</td>
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<tr>
<td>2nd Period</td>
<td>56.3%</td>
</tr>
<tr>
<td>3rd Period</td>
<td>52.3%</td>
</tr>
<tr>
<td>4th Period</td>
<td>50.6%</td>
</tr>
<tr>
<td>5th Period</td>
<td>51.2%</td>
</tr>
<tr>
<td>6th Period</td>
<td>49.1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52.3%</strong></td>
</tr>
</tbody>
</table>

For the first monthly period we had 54.2 per cent participation. The second period, 56.3 per cent. The third period, 52.3 per cent. The fourth period, 50.6 per cent. The fifth period, 51.2 per cent. The sixth month period, 49.1 per cent. For the total percentage of participation for the six month period, we operated the program on 52.3 percentage.

It might seem that the percentage is a little low, but we are of the opinion the percentage is adequate for the initial six months of a new program. There has been no attempt to "over-sell" the practitioner on this program and we have not engaged in any type of "high-pressure" stimulation. However, we do feel that we are now ready for proper stimulation for a higher percentage of participation. It is our desire to raise the percentage of participation to 60 per cent and maintain it at that rate.
In making an analysis of specific disease conditions, it is well to point out that Ohio has a hog population estimated at well over 3,000,000. Therefore, as one would expect, swine diseases are of prime importance in protecting a valuable source of income of the state’s agricultural economy.

The reporting program has demonstrated that we have five endemic swine diseases which have occurred in sufficient numbers to be worthy of discussion. Swine Erysipelas was reported in 4,504 Ohio swine, which indicated this disease involved more swine than any other disease. By plotting the seasonal incidence, we can demonstrate a higher incidence of the disease in May and June.

Swine Influenza was reported in 3,679 hogs for the six month period running a close second to Erysipelas. It is of interest to note the monthly incidence of this disease. The greatest number of cases of Swine Influenza occurred in January, February and March.

At the same time the condition was being reported in its greatest numbers, Ohio was experiencing a human epidemic of influenza. We realize that this subject is one of great discussion, but studies are being conducted in Ohio to correlate this phenomenon.

Hog Cholera was reported in 2,048 swine in the six month period showing a slight increase in monthly incidence in April, May and June.
OHIO'S DISEASE REPORTING SYSTEM

DISTRIBUTION OF SWINE ARTHROPILAE

SEASONAL DISTRIBUTIONS OF SWINE INFLUENZA IN OHIO
Atrophic Rhinitis is endemic in Ohio. Our local veterinarians reported the condition in 1,460 swine for the six months period. An interesting sidelight to this condition is the fact that the participating local veterinarians reported more cases after a feature article on Atrophic Rhinitis was published in our Animal Disease Trends. We feel that this indicates the real potential of such a reporting program in affording information to the local veterinarian, making him more cognizant of looking for specific disease conditions. In conjunction with the reporting program, we have made available to the local veterinarian information relative to the rhinoscope in diagnosing Atrophic Rhinitis and instructions for its use.

Edema disease or “Gut-edema” so called, has been reported with some relative significance. In the six month reporting period, a total of 259 cases have been reported. In plotting the monthly incidence, it is observed that the incidence of “Gut-edema” is highest in April, May and June.

In order to obtain more information concerning Edema disease, a survey was conducted in conjunction with the reporting program. An Edema questionnaire was sent to all local veterinarians reporting the condition. Field investigations were also made whenever feasible with the desire to gain information relative to the etiology of this disease. The information concluded from these questionnaires and investigations, revealed that on the first 30 premises involved it was the opinion of the local veterinarians that Edema disease was the result of some change in the normal habitat or
routine of the swine involved. These changes were that of radical feed-ration change; moving to different pastures; being confined in different barns and pens; and resulting after some types of treatments. Of course, it is conceded that there is much to be desired in our knowledge of this condition and we report this information with that in mind.

A total of 22 different swine diseases were reported in the first six months involving 13,648 swine.

A total of 29 different diseases of cattle was reported by the practicing veterinarians involving a total of 551 cattle.

The reports revealed that only 35 cattle died of Blackleg in the six month period. However, by plotting these cases on a geographic map of Ohio, it is readily observed that Blackleg is endemic in those counties comprising three river valleys.

**DISTRIBUTION OF BLACKLEG**

![Map of Ohio showing the distribution of Blackleg](image)

The reporting cards revealed incidence of 34 cases of X-disease, 22 cases of Malignant Catarrhal Fever, 26 cases of Listeriosis; 35 cases of Leptospirosis, and 18 cases of Rabies. One condition we found of great interest was the reporting of 91 cases of an Influenza-like disease in cattle. These 91 cases occurred at the same incidence of time as the human Influenza epidemic and at the same time the greatest number of Swine Flu was being reported. Virus-blood studies were made on these cattle, but the data is not complete enough at this time to make a report.

A total of eight sheep diseases were reported involving 637 sheep. Our Sheep Scab control program in Ohio is greatly dependent upon the condition being reported by our local veterinarians. In every premise becoming infected
with Sheep Scab, our follow-up investigations revealed the addition of breeding animals to the native flock.

Another interesting sheep condition reported was 218 cases of Contagious Ecthyma. Once again the investigation of these cases, a direct importation of new animals into the flock indicated the source of infection.

In discussing the poultry diseases reported, it is interesting to note a total of 34,268 birds were involved with Infectious Bronchitis in the past 6 months.

This is of particular interest to the workers in Ohio because of the newly instituted live virus inoculation program that was put into effect in March of this year. It is also of interest to note that from an initial survey involving 57,000 birds in 30 flocks having been inoculated with live infectious bronchitis virus, the survey reports a mortality of .32 per cent which the flock owner attributed to the inoculation.

Two diseases which we felt should be grouped in an all species report were Rabies and Leptospirosis.

A total of 98 cases of Rabies was reported. These cases can further be broken down to: 18 cases in cattle, 3 cases in swine, 65 cases in dogs, 3 cases in cats, 3 cases in skunks, and 7 cases in fox.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>18</td>
</tr>
<tr>
<td>Swine</td>
<td>3</td>
</tr>
<tr>
<td>Dogs</td>
<td>65</td>
</tr>
<tr>
<td>Cats</td>
<td>3</td>
</tr>
<tr>
<td>Skunks</td>
<td>3</td>
</tr>
<tr>
<td>Fox</td>
<td>7</td>
</tr>
</tbody>
</table>

Three hundred and twenty-five cases of Leptospirosis were reported. By species breakdown these indicate: 283 cases in dogs, 3 cases in cats, 4 cases in swine and 35 cases in cattle.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogs</td>
<td>283</td>
</tr>
<tr>
<td>Cats</td>
<td>3</td>
</tr>
<tr>
<td>Swine</td>
<td>4</td>
</tr>
<tr>
<td>Cattle</td>
<td>35</td>
</tr>
</tbody>
</table>

From our reporting program we have compiled data sufficient to calculate attack rates for our 23 agricultural areas. These attack rates are based per 100,000 population for all reported diseases combined; by animal and
agricultural area. We feel that this type of data is significant only to workers in Ohio, but we did feel that it was worthy of mention in this report.

In further discussions of the participation by the local veterinarian, we have computed data in regard to the number of veterinarians in a given area, the percentage of participation for the different areas, the number of cards, either positive or negative returned by each veterinarian, the percentage of negative cards and the percentage of late cards.

In summarizing, we can only state that, based on the data we have presented, admitting that it is based only on a six month period, a wealth of disease incidence knowledge has been afforded that never before was at our fingertips. We would also like to state that such a program is completely dependent upon the participation of the local veterinarian.

With our reporting program, combining our laboratory services and investigative services, we have integrated thinking which combines the where, when, how much, and how spread. This integrated thinking combines this knowledge with other facts to develop methods for prevention and control.

When all of these things are accomplished—animal health results.
REPORT OF THE COMMITTEE ON MORBIDITY AND MORTALITY

C. E. Wicktor, Los Angeles, California, Chairman; W. L. Bendix, Richmond, Virginia; C. G. Bradt, Ithaca, New York; M. R. Clarkson, Washington, D. C.; Raymond Fagan, Kansas City, Kansas; H. J. O’Connell, Madison, Wisconsin; A. P. Schneider, Boise, Idaho; K. F. Wells, Ottawa, Ontario, Canada

The Committee on Morbidity and Mortality has felt that the national reporting Agency for morbidity and mortality statistics of animals belongs within the United States Bureau of Animal Industry. We have waited for one year in the hope that they could make the necessary arrangements to begin this operation. Thus far we have no concrete evidence that the United States Bureau of Animal Industry will be in a position to inaugurate a national reporting agency this coming year.

Accordingly, the majority opinion within the Committee favors the inauguration of a system whereby this association, through its Executive Secretary, will receive reports from the various States, tabulate them, and return a monthly tabulation to the State Livestock Sanitary Officials. While it is recognized that this does not afford anything like a comprehensive system of morbidity and mortality reporting, it does provide a means whereby information now available in the various State offices can readily be interchanged.

This year the committee worked on the simplification of forms which state agencies would submit to the Executive Secretary and those forms which would be returned to state agencies. This was done with the thought that the activity would remain within the United States Livestock Sanitary Association until such time as the United States Bureau of Animal Industry is prepared to assume the responsibility.

The list of reportable diseases presented by this committee last year remains unchanged; namely, anaplasmosis, anthrax, atrophic rhinitis, bacillary hemoglobinuria, blackleg, coccidiosis, contagious ecthyma, contagious pleuropneumonia, dourine, equine encephalomyelitis, foot and mouth disease, fowl pest, glanders, hog cholera, hyperkeratosis, infectious equine anemia, Johne's disease, leptospirosis, listeriosis, malignant catarrhal fever, psittacosis, rabies, rinderpest, scabies, swine erysipelas, Texas fever, trichomoniasis, tularemia, vesicular exanthema, vesicular stomatitis, vibriosis, and such other diseases of poultry as are thought advisable. These names will appear on the form that will be submitted by the state official to the national reporting agency. The purpose of a standard form is to simplify the tabulation at the national reporting agency.

This committee feels that the primary interest of a state livestock sanitary official, as to what occurs in another state, is, what diseases are occurring
and to what extent. For the time being, therefore, the recapitulated report
that would be returned by the national reporting agency to the state
sanitary officials would give the disease, the number of outbreaks, and the
states in which they occurred. If further information is desired, the party
so interested may communicate with the state sanitary official in question
or with the national reporting agency. The chief aim of this committee is
to simplify these reports and still furnish enough information to benefit
livestock sanitary officials. In the event researchers or others desire more
comprehensive information on a particular disease, such information may
be obtained from the state reports on file in the national reporting agency.

The Committee on Morbidity and Mortality does not consider this as
the ideal in morbidity and mortality reporting. However, it is a start.

The cooperation of state regulatory officers with the secretary of the
United States Livestock Sanitary Association in making this report possible
is earnestly requested.

DR. WICKTOR (continuing): You know that our busy Secretary, Dr.
Hendershott, has agreed to take on this national reporting agency. He is
a very busy man, and we hope that the sanitary officials will give him 100
per cent cooperation so that it can be of value to them and to the livestock
industry.

Mr. President, I recommend that this report be submitted to the Executive
Committee for consideration.

PRESIDENT CHILDS: Thank you, Dr. Wicktor. The report will be referred
to the Executive Committee.

MR. WILLIAM KNOX (Fort Atkinson, Wisconsin): Gentlemen, I was telling
Dr. John Pickard a story that I picked up in one of the British publications
the other day.

Among the foreign aid money that we have sent over to Great Britain,
some portion of it has been allocated to the improvement of agricultural
production. In the publication there was a very fine editorial entitled
"Thank You, America." The editorial thanked the people of America for
providing funds for the encouragement of agricultural production in Great
Britain.

On this last grant, a major portion of it is going to set up and establish
a system of morbidity and mortality reporting in Great Britain with the
money we have sent over. I just wonder if we might be able to get some
foreign aid from the Union of South Africa or some other country to help
us set up a reporting system here in this great country of ours. That may
be the way that we will get the job done. (Laughter and Applause).

PRESIDENT CHILDS: Thank you, Mr. Knox. That was rather timely.
CLINICAL PARASITISM IN CATTLE IN THE SOUTHEAST

JOHN S. ANDREWS, Sc. D., W. L. SIEPEL, V.M.D., and D. J. JONES

Tifton, Georgia

Since the establishment of the Department of Animal Diseases at the Coastal Plain Experiment Station, Tifton, Georgia, in March 1945, the Bureau of Animal Industry has co-operated in making parasitological examinations of animals submitted by local veterinarians for diagnosis. Prior to June 30, 1950, the number of cattle autopsied and found to be suffering from parasitic disease was practically negligible. During the fiscal year 1950-51, however, six percent of all cattle autopsied were found to be suffering from clinical parasitism. During the next two years this percentage increased to 11 and 17, respectively.

The purpose of this paper is to bring to the attention of those interested in the welfare of the livestock industry the increasing economic importance of internal parasitism in cattle in the Southeast, to outline some of the major factors involved in bringing about clinical parasitism in bovines, and to suggest procedures which might decrease the severity or even prevent similar outbreaks in the future.

GENERAL DESCRIPTION AND PREVIOUS HISTORY OF CATTLE SUBMITTED FOR AUTOPSY

Between March 21, 1952, and June 2, 1953, 14 bovines, from six months to 10 years old, were submitted to the diagnostic laboratory by practicing veterinarians who suspected that they may have been suffering from parasitism but were unable to arrive at a positive diagnosis because of (1) the failure of the animals to respond to anthelmintic or other medication, (2) the absence of large numbers of worm eggs in the feces of the majority of the cattle, (3) the belief that adult cattle were not susceptible to parasitic disease, and (4) the lack of facilities for screening the contents of the digestive tract for parasites. These cattle came from 10 farms grazing from 14 to 900 head each, and together with others that died on the farms from which they came, represented a death loss of approximately five percent of the 1,900 animals involved. Nine of these farms were located in the coastal plain area and one in central Georgia.

All of the animals that came to the writer's attention were emaciated. Some of them were able to stand, others were down and could not get up, and some were moribund. The sub-mandibular swelling, so-called "bottle-
PARASITISM OF CATTLE IN SOUTHEAST

jaw," was present in those animals having severe anemia. The number of
worm eggs per gram of feces varied from none to 23,000 but was of no
diagnostic value in 80 per cent of the cases. All of these cattle were autopsied
following death while in the laboratory, some being killed when they
neared death.

CASE REPORTS

Case 1. Hereford Calf, 7 to 12 months old. Autopsied March 21, 1952.
The owner had 105 Purebred Hereford cattle. Several cows had been im-
ported from Texas in 1950 and bred to local bulls. These cows which dropped
the calves in 1951 were known to be suffering from parasitism at the time
the calves were suckling them. The disease in the calves began in January
1952 and had a fatal termination in two to four weeks following onset of
diarrhea, anorexia and loss of weight, on a good pasture. The affected calves
were from 7 to 12 months old. Five or six cows and 25 to 30 calves had
been lost from this disease which was considered to be parasitism.
Postmortem Findings. Lobular Pneumonia. Nodules were present in the wall
of the large intestine. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Organ</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>None</td>
</tr>
<tr>
<td>Abomasum</td>
<td>6,900 <em>Ostertagia ostertagi</em></td>
</tr>
<tr>
<td></td>
<td>7,300 <em>Trichostrongylus axei</em></td>
</tr>
<tr>
<td>Small Intestine</td>
<td>25,800 <em>Cooperia punctata</em></td>
</tr>
<tr>
<td></td>
<td>200 <em>Bunostomum phlebotomum</em></td>
</tr>
<tr>
<td>Large Intestine</td>
<td>750 <em>Oesophagostomum radiatum</em></td>
</tr>
<tr>
<td>Total</td>
<td>40,950</td>
</tr>
</tbody>
</table>

Case 2. Grade Hereford Calf, 7 months old. Autopsied May 9, 1952.
The owner had 400 grade Hereford cattle. The disease which was thought
to be parasitism occurred in six-month-old weanling calves which had been
brought in from Texas in 1951. Mature cows born locally and grazing the
same pasture were treated for the removal of internal parasites in March
1952 when sickness was first noted in the calves. Prior to this time three
or four cows had been lost from parasitism. All the animals presented a
history of having lost weight although grazing excellent pastures. A large
acreage which was part of the pasture consisted of swampy land.
Postmortem Findings. A few nodules were present in the wall of the large
intestine. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Organ</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>5 <em>Dictyocaulus viviparus</em></td>
</tr>
<tr>
<td>Abomasum</td>
<td>36,750 <em>O. ostertagi</em></td>
</tr>
<tr>
<td></td>
<td>8,300 <em>T. axei</em></td>
</tr>
<tr>
<td>Small Intestine</td>
<td>200 <em>C. punctata</em></td>
</tr>
<tr>
<td></td>
<td>1 <em>Setaria labiato-papillosa</em></td>
</tr>
<tr>
<td>Large Intestine</td>
<td>300 <em>O. radiatum</em></td>
</tr>
<tr>
<td>Total</td>
<td>45,556</td>
</tr>
</tbody>
</table>

The owner had 105 cattle from one to three years old which were
presumably, of native Georgia stock. These animals, the majority of them yearling steers, had access to a wooded area surrounding a pond. The pastures on both sides of the woods were relatively well drained. The trouble began in March 1952 with symptoms of coughing and the appearance of a frothy exudate in the nose and mouth openings. There was no diarrhea. The animals lived 10 days to two weeks following the onset of symptoms. Twelve calves had been lost from respiratory disease.

Postmortem Findings. Necrotic pharyngitis complicated by verminous pneumonia. The mucosa of the abomasum was congested throughout. Nodules were present in the large intestine, omentum, and spleen. Extensive hemorrhage had occurred in the peritoneum. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>Several thousand <em>D. viviparus</em></td>
</tr>
<tr>
<td>Abomasum</td>
<td>600 <em>O. ostertagi</em></td>
</tr>
<tr>
<td></td>
<td>1,000 <em>T. axei</em></td>
</tr>
<tr>
<td>Small Intestine</td>
<td>200 <em>Haemonchus contortus</em></td>
</tr>
<tr>
<td></td>
<td>2,840 <em>C. punctata</em></td>
</tr>
<tr>
<td>Large Intestine</td>
<td>350 <em>O. radiatum</em></td>
</tr>
<tr>
<td>Total</td>
<td>4,990 (plus <em>D. viviparus</em>)</td>
</tr>
</tbody>
</table>


The owner had 150 head of native Georgia cattle and 10 Brahman cows that had been brought in from Florida. The cattle ran together on a 300-acre pasture which provided abundant grazing. The location of the farm indicated that it probably was not well drained and that natural water holes were present on the pasture. Only the Brahman cow became sick. They first began to show symptoms of gastro-intestinal distress, namely anorexia and diarrhea, in February 1952. The affected animals lived about five weeks after these symptoms were first noticed. Two cows had been lost from this condition which was suspected of being due to internal parasites.

Postmortem Findings. A few nodules were present in the wall of the large intestine. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>None</td>
</tr>
<tr>
<td>Abomasum</td>
<td>100 <em>O. ostertagi</em></td>
</tr>
<tr>
<td></td>
<td>27,700 <em>T. axei</em></td>
</tr>
<tr>
<td>Small Intestine</td>
<td>7,500 <em>C. punctata</em></td>
</tr>
<tr>
<td></td>
<td>6,400 <em>C. pectinate</em></td>
</tr>
<tr>
<td>Large Intestine</td>
<td>10 <em>O. radiatum</em></td>
</tr>
<tr>
<td>Total</td>
<td>41,710</td>
</tr>
</tbody>
</table>

Case 5. Grade Hereford Calf under 18 months. Autopsied August 5, 1952.

The owner had imported 320 grade Hereford calves from West Virginia and Kansas. When symptoms of anorexia and diarrhea were noted, the animals were 18 months old or younger. They had been grazing different pastures of lespedeza and Bermuda grass. Grazing was not plentiful, and the symptoms were not confined to animals on any one pasture. Twenty-six
heifers were sick at the time this calf was brought in for examination. The family milk cow confined with the sick animals showed no sign of illness. Five calves had died from this condition which was thought to be parasitic gastro-enteritis.

Postmortem Findings. The sub-maxillary, cervical and inguinal lymph nodes had dark centers, but no pus was present. There were areas of red hepatization on the anterior surface of the lungs. The wall of the abomasum was edematous. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Species</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>20 D. viviparus</td>
<td></td>
</tr>
<tr>
<td>Abomasum</td>
<td>62,370 O. ostertagi</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20,000 T. axei</td>
<td></td>
</tr>
<tr>
<td>Small Intestine</td>
<td>8,900 C. punctata</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1,000 T. axei</td>
<td></td>
</tr>
<tr>
<td>Large Intestine</td>
<td>10 O. radiatum</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>92,300</td>
<td></td>
</tr>
</tbody>
</table>

Cases 6 and 7. Grade Hereford Heifers 18-20 months old. Autopsied October 13 and 14, 1952.

The owner had approximately 900 cattle on his farm. The heifers belonged to a group of 60 registered and grade Herefords born on the farm in the spring of 1951. Prior to April 1952 they had been scattered over the farm on different pastures. During April, May, and June 1952 they occupied a pasture of clover, Coastal Bermuda, and Kudzu, of very poor quality during most of this period because of the hot dry weather. The animals obtained their drinking water from a pond. In July 1952 they were moved to a pasture consisting of 37 acres of Coastal Bermuda and four acres of Bahia grass. The pasture had not been used extensively for grazing cattle and was in excellent condition. It sloped gradually down to an artificial pond having an area of four or five acres when full. A fence was put across the shallow end of the pond, thus limiting the portion of the pond accessible to the cattle to a relatively small area. Because of the dry weather the pond had decreased to a small fraction of its original size, thus further limiting the moist area near the pond to which the cattle had access.

At the time they were transferred to the pasture of Coastal Bermuda and Bahia grass, the cattle appeared to be in excellent physical condition. About two months later a few animals were noticed to be losing weight. They were treated for lice but did not improve. About October 1, 1952 a diagnosis of hookworm and nodular worm disease was made by the local veterinarian as a result of a fecal examination. The six animals showing the poorest physical condition were treated with phenothiazine, without any noticeable improvement, however. On October 13, 1952 two of these heifers were sent to the laboratory in Tifton, two were retained by the veterinarian for experimental treatment, and the other two died later on the farm. The two heifers sent to the laboratory died within 24 and 48 hours, respectively, after their arrival.
This heifer (Fig. 1) was one of the two which were retained by the

FIGURE 1.

FIGURE 2.
veterinarian for further treatment. Both animals had been given 20 cc. of tetrachlorethylene plus other supportive treatment, but had failed to respond favorably.

Postmortem Findings. There were nodules in the wall of the large intestines (Fig. 2) of all three heifers. In addition, the cecum of the first two animals autopsied was inflamed and edematous. Parasites were found as follows:

<table>
<thead>
<tr>
<th></th>
<th>Heifer 6</th>
<th>Heifer 7</th>
<th>Heifer 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Abomasum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O. ostertagi</td>
<td>190,000</td>
<td>440,000</td>
<td>89,000</td>
</tr>
<tr>
<td>T. axei</td>
<td>0</td>
<td>23,000</td>
<td>1,000</td>
</tr>
<tr>
<td>H. contortus</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Small Intestine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O. ostertagi</td>
<td>41,000</td>
<td>87,500</td>
<td>2,000</td>
</tr>
<tr>
<td>T. axei</td>
<td>1,000</td>
<td>6,250</td>
<td>0</td>
</tr>
<tr>
<td>C. pectinata</td>
<td>200</td>
<td>6,250</td>
<td>0</td>
</tr>
<tr>
<td>C. punctata</td>
<td>200</td>
<td>0</td>
<td>4,000</td>
</tr>
<tr>
<td>B. phlebotomum</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Large Intestine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O. ostertagi</td>
<td>5,800</td>
<td>5,000</td>
<td>100</td>
</tr>
<tr>
<td>C. punctata</td>
<td>0</td>
<td>0</td>
<td>3,200</td>
</tr>
<tr>
<td>O. radiatum</td>
<td>2*</td>
<td>*</td>
<td>3*</td>
</tr>
<tr>
<td>B. phlebotomum</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>H. contortus</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>S. labiato-papillosa</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>239,202*</td>
<td>568,000*</td>
<td>99,308*</td>
</tr>
</tbody>
</table>

*Plus larvae of O. radiatum in intestinal wall.


The owner had 14 to 16 head of crossbred Jersey cattle native to Georgia. These animals had been grazing a wooded pasture before being transferred to a field on which cotton, oats, tobacco, and corn had been grown about 14 days before the bull was submitted for autopsy. Ten days previously a veterinarian had been called to treat the bull for anorexia and apparent drowsiness. No improvement resulted from the treatment. None of the other animals were affected and no previous symptoms of illness had been noted.
Postmortem Findings. Nodules were present in the wall of the large intestine. Parasites were found as follows:

**Lungs**
- None

**Abomasum**
- 5,000 *H. contortus*
- 2,000 *O. ostertagi*
- 500 *T. axei*
- 2,500 *C. punctata*

**Small Intestine**
- 40,000 *C. punctata*
- 7 *B. phlebotomum*
- 1 *S. labiato-papillosa*

**Large Intestine**
- 2,400 *O. radiatum*
- 2,500 *C. punctata*

**Total** 54,908

Case 10. Aged Grade Hereford Cow. Autopsied January 8, 1953.

The owner had about 600 head of cattle, principally grade cows and purebred Hereford bulls. The cows lived 30 days or longer after first showing symptoms of diarrhea and anorexia. The feces contained occasional flecks of blood. The greatest losses occurred when the pasture was short. Drinking water was supplied by a running stream. Twenty sick animals had been sold, 25 to 30 more were passing watery feces, and 10 animals, the majority 8 to 10 years old, had been lost. Parasitism was suspected as the cause of this condition.

Postmortem Findings. Nodules were present in the wall of the cecum and colon. Parasites were found as follows:

**Lungs**
- 36 *D. viviparus*

**Abomasum**
- 46,000 *O. ostertagi*
- 3,000 *T. axei*

**Small Intestine**
- 200 *O. ostertagi*

**Large Intestine**
- *O. radiatum*

**Total** 49,236 (plus larvae of *O. radiatum*)

*Larvae of *O. radiatum* in nodules in intestinal wall.

Case 11. Grade Hereford Calf less than 12 months old. Autopsied April 2, 1953.

The owner had about 50 head of grade Hereford calves. Thirty of these animals had been purchased and brought to the farm in the fall of 1952. Twenty to 25 calves were born and raised on the premises. The purchased calves were in poor physical condition on arrival at the farm. They had been on the present pasture since the middle of February 1953 where their source of drinking water was a pond the grassy borders of which were not protected from fecal contamination. Four of the calves brought to the farm had been lost after having shown symptoms of gastro-intestinal disturbance; diarrhea and anorexia.

Postmortem Findings. The lymph nodes were swollen, watery, and pale. The body tissues were blanched. A foamy exudate containing little mucus filled the trachea and larger bronchi and bronchioles. Verminous pneumonia
was present in the anterior portion of the lungs. An excessive amount of straw-colored fluid was found in the peritoneal cavity. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>200* D. viviparus</td>
</tr>
<tr>
<td>Abomasum</td>
<td>28,300 T. axei</td>
</tr>
<tr>
<td></td>
<td>6,250 O. ostertagi</td>
</tr>
<tr>
<td>Small Intestine</td>
<td>1,400 T. axei</td>
</tr>
<tr>
<td></td>
<td>100 C. punctata</td>
</tr>
<tr>
<td></td>
<td>100 O. radiatum**</td>
</tr>
<tr>
<td>Large Intestine</td>
<td>160 O. radiatum</td>
</tr>
<tr>
<td>Total</td>
<td>36,510</td>
</tr>
</tbody>
</table>

*Incomplete count.
**Larvae in wall of intestine.


The owner had 39 head of Brahman cattle. Nineteen were brought from Florida in the fall of 1950, and 20 from Texas in December 1951. Evidence of sickness was first noticed February 1, 1953. The sick animals had a constant diarrhea, could not gain weight, were sluggish and incoordinated in their movements and developed a rough hair coat. One animal lost 50 pounds in two weeks. In the summer of 1952 the animals had been placed on a pasture of rye grass and clover and had access to a water hole fed by wash from the pastures surrounding it. This pond was gradually drying up and good grazing was available at its upper shallow end, where the grass was supplied with moisture from the pond. There was evidence that this area had been extensively grazed. Four cows from Texas and one calf were lost during the three-month period beginning in April 1952 after showing symptoms as noted above. Four more cows were lost from the same condition between December 1952 and April 1953.

Postmortem Findings. Gelatinous infiltration of the mesentery in the region of the pyloris was present. The folds of the abomasum were thickened and edematous with nodules and petechial hemorrhages over the entire inner surface. The mucous membrane of the abomasum was dark pink to red and showed diffuse congestion throughout. The cecum was markedly thickened, edematous, and congested. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td>113 D. viviparus</td>
</tr>
<tr>
<td>Abomasum</td>
<td>400,000 T. axei</td>
</tr>
<tr>
<td></td>
<td>6,000 O. ostertagi</td>
</tr>
<tr>
<td>Small Intestine</td>
<td>4,200 C. punctata</td>
</tr>
<tr>
<td></td>
<td>1,200 T. axei</td>
</tr>
<tr>
<td></td>
<td>100 O. radiatum</td>
</tr>
<tr>
<td>Large Intestine</td>
<td>4,100 T. axei</td>
</tr>
<tr>
<td></td>
<td>1,000 O. radiatum*</td>
</tr>
<tr>
<td></td>
<td>200 C. punctata</td>
</tr>
<tr>
<td>Total</td>
<td>417,013</td>
</tr>
</tbody>
</table>

*Fourth stage larvae.

The owner had 140 to 150 head of grade Guernsey cattle. Ninety were about seven and one half months old, and the others were a year old or older. Fifty-five of the younger group had been imported from Wisconsin in October 1952. The calves were first noticed to be sick about the middle of May 1953. They suffered from anorexia and diarrhea, grew progressively weaker, became more emaciated, and finally died. Ten to 12 calves had been lost after developing the above mentioned symptoms of gastro-intestinal distress. In the owner's opinion more Wisconsin calves were among the 25 animals sick than native stock when this study was made. In the spring the calves had access to a small feed lot which became heavily contaminated with feces. A luxuriant growth of grass surrounding stump holes in the area which held water for long periods after rains furnished grazing for the calves occupying the area. This grass had been kept short by grazing.

Postmortem Findings. Nodules were present in the wall of the large intestine and the mucosa of the abomasum was congested and edematous in both animals. Parasites were found as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Heifer 13</th>
<th>Heifer 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lungs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>D. viviparus</em></td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>Abomasum</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>O. ostertagi</em></td>
<td>30,000</td>
<td>15,000</td>
</tr>
<tr>
<td><em>T. axei</em></td>
<td>10,000</td>
<td>34,000</td>
</tr>
<tr>
<td>H. contortus</td>
<td>0</td>
<td>7,000</td>
</tr>
<tr>
<td>Small Intestine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. punctata</em></td>
<td>430,000</td>
<td>350,000</td>
</tr>
<tr>
<td><em>C. pectinata</em></td>
<td>20,000</td>
<td>10,000</td>
</tr>
<tr>
<td>B. phlebotomum</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Large Intestine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>... <em>O. radiatum</em></td>
<td>800</td>
<td>1,500</td>
</tr>
<tr>
<td><em>C. punctata</em></td>
<td>5,900</td>
<td>700</td>
</tr>
<tr>
<td><em>C. pectinata</em></td>
<td>300</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>497,025</td>
<td>418,260</td>
</tr>
</tbody>
</table>

*Fourth stage larvae in lumen of intestine.

Discussion and Summary

Four important facts emerge from the data presented in this paper, as follows: (1) During the past three years clinical parasitism in cattle on south Georgia farms has almost tripled; (2) the number of worm eggs per gram of feces is not a dependable aid in ascertaining which animals are suffering from parasitosis; (3) the anthelmintics now available for treating cattle are not efficient in removing certain pathogenic parasites from the
digestive tract of cattle, and (4) the contents of the digestive tract of bovines suspected of suffering from clinical parasitism must be screened for parasitic worms before a positive diagnosis can be made.

Bailey and Herlich (1) reported a like difficulty in making an antemortem diagnosis of parasitic gastritis in mature cattle on a farm in west Georgia.

In the present study the following species of parasites were considered responsible for the cases of clinical parasitism on the 10 farms from which data were available:

<table>
<thead>
<tr>
<th>Parasite</th>
<th>No. of Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. axei</td>
<td>8</td>
</tr>
<tr>
<td>C. punctata</td>
<td>8</td>
</tr>
<tr>
<td>O. ostertagi</td>
<td>7</td>
</tr>
<tr>
<td>O. radiatum</td>
<td>4</td>
</tr>
<tr>
<td>C. pectinata</td>
<td>3</td>
</tr>
<tr>
<td>H. contortus</td>
<td>2</td>
</tr>
<tr>
<td>D. viviparus</td>
<td>2</td>
</tr>
</tbody>
</table>

H. contortus played a relatively minor role in the cases we studied. Bailey and Herlich (1953) found H. contortus to be the major species producing illness and death in their cases. Since most of the cattle seen at Tifton had previously been treated with phenothiazine or other drugs, H. contortus may have been removed from some of the animals prior to autopsy. However, the worms recovered postmortem were present in sufficient numbers to produce the condition observed and appeared to be either difficult or impossible to remove with currently available anthelmintics. In the case of the nodular worm, the immature parasites had invaded the tissues of the host and therefore, could not be removed by treatment.

According to information made available by the Georgia State Agricultural Extension Service, the number of beef cattle in south Georgia has decreased about 1.25 per cent since 1950. Perhaps the increase in parasitic disease observed by the writers may account at least in part for the decrease in the cattle population of this section of the state.

The principal factors which appear to the writers to be involved in bringing about the outbreaks of parasitosis in cattle described in this paper are as follows: The sole source of drinking water provided for the cattle on nine of the 10 farms was a pond or water hole the edges of which were subject to contamination with their droppings. The cattle on three farms were not provided with adequate supplemental feed during periods when the nutritive value of the pasture had been reduced by continued dry weather, thus predisposing them to parasitic disease by weakening their natural resistance to infection. Overstocking of pastures was a factor in bringing about conditions favorable to the development of heavy parasitism on at least two farms. On six of the farms, cattle had been imported from areas, namely, Wisconsin, West Virginia, Kansas, Texas, and Florida, where the climate and geography were in many respects different from those of
Georgia. Where comparisons could be made, the imported animals appeared to be more susceptible to the species of internal parasites found in native cattle than were cattle born and raised on Georgia farms. Of interest in this connection is the report of the outbreak of parasitic gastritis by Bailey and Herlich (1953) which occurred in a herd of cattle brought in from Montana.

CONCLUSIONS

The increase in the number of cases of clinical parasitism in cattle submitted for diagnosis and autopsy to the Department of Animal Diseases of the Coastal Plain Experiment Station, Tifton, Georgia, which occurred between July 1, 1950, and July 1, 1953, appeared to be caused by (1) poor management practices on the individual farm, and (2) the greater susceptibility of cattle imported from other geographical areas to infection with species of trichostrongyles present in cattle on southern pastures as compared to those native to Georgia.

Future losses from parasitism may be reduced by: (1) providing a sanitary source of drinking water protected from contamination by livestock; (2) draining low swampy areas of pasture, fencing them off from well-drained pastures, or using them for very short periods of grazing interspersed with long rest periods; (3) supplying adequate pastures for the number of cattle on the farm; (4) following a system of pasture rotation to avoid excessive contamination of the grazing area; (5) feeding adequate amounts of supplement to cattle grazing pastures of low nutritional value; (6) observing cattle carefully for loss of condition on good pasture; (7) screening the contents of the digestive tract of a sick animal for parasitic worms when parasitism is suspected, and (8) avoiding the source of infection and following the advice of the veterinarian as to treatment and subsequent handling of the herd.

REFERENCES

Recent years have witnessed many developments in measures for controlling parasites of livestock and poultry. Significantly, these measures have arisen with, if not from, a better understanding of the nature and gravity of parasitism. Despite the fact that parasites have been diagnosed in ever increasing instances as principal agents in the causation of somewhat mysterious outbreaks of disease associated with more or less heavy death losses, it is now more generally realized than at any previous time that parasites are a ubiquitous hazard to efficient, profitable livestock production; that the heaviest losses come from the unspectacular, insidious undermining of the health of food animals; that parasitism is sometimes a determining factor in economic production of livestock; and that vigilance against parasites is an essential aspect of efficient livestock management. In the aggregate, internal and external parasites cause a heavy loss annually, much of which is preventable by known means.

It is not within the scope of this report to review all the measures that have lately been devised to combat these varied, abundant and widespread marauders of livestock and poultry. The present objective is to outline, or indicate, general measures that are specifically useful for controlling the commonly injurious parasites of cattle, sheep, and hogs. These measures depend on the basic principles of sanitation and medication. Newer viewpoints in parasitology have been far more evident recently than basic changes. Chief among them is the emphasis on prevention rather than cure, and a broadening of the concept of parasite control to include all feasible steps that may be taken to minimize the economic losses they cause. A corollary viewpoint is that antiparasitic chemicals can be best and most efficiently employed as adjuncts to other control measures rather than as substitutes for them, and that these chemical agents, however necessary and useful for the treatment of heavily infested animals, are most profitably employed in conformity with promising or proved programs of systematic, preventive medication. Another significant concept is that sound management practices, particularly good feeding and surveillance, in addition to proper hygienic measures and drugs, are as important to parasitic control as they are to efficient production.

CATTLE

Numerous protozoan and helminthic parasites occur commonly in cattle and cause significant economic losses, as emphasized in last year's report.
Serious parasitism may occur in cattle of all ages and breeds, but particularly in animals up to two years of age. The losses are varied, and often difficult to diagnose and properly evaluate. These include death losses, condemnation of parts and entire carcasses under federal and other effective meat inspection, growth retardation, unprofitable feed consumption, and increased susceptibility to other diseases and adverse conditions. The annual dollar loss to the multi-billion dollar cattle industry that is caused by parasitic diseases is not known, but it has been estimated at a very substantial sum. It is large enough to warrant increased efforts to control cattle parasites.

The fundamental bases for effective control may be summarized as follows: (1) sound management practices in regard to breeding, feeding, and sanitation; (2) good management practices in all their variety should be integrated with adequate consideration of the life cycles, modes of transmission, and other important biological aspects of the various important species of injurious parasites; (3) the most effective antiparasitic medications should be employed at the right time, in approved quantities, and by approved methods of application or administration, both for prevention of infection and for the alleviation of the effects thereof.

The importance to cattlemen of a working knowledge of the fundamentals of the biology of cattle parasites, to enable them to maintain good parasite control in their stock at the minimum cost, cannot be over-emphasized. For example, the microscopic parasites of coccidiosis are ingested by cattle during normal feeding activities, when feed or pasture is contaminated with the small resistant stages of the parasites deposited thereon by an infested animal in its manure. Trichomoniasis, however, is transmitted venereally, while anaplasmosis is transmitted by ticks, horse flies, and other biting anthropods. Many species of injurious gastrointestinal roundworms, such as stomach worms, the "cooperids," hookworms, and nodular worms, as well the common lungworm, have so-called "direct" life cycles; others have life cycles involving an intermediate host. A knowledge of these fundamental facts about cattle parasites leads to a more intelligent approach to parasite control than would otherwise be possible. Add to this a general knowledge of the longevity of infective stages of the parasites on pasture, under favorable and unfavorable conditions, and the basis for partial control of cattle parasites by good management is available. Effective control of cattle parasites, however, can seldom be accomplished on a continuing basis unless an adequate program of antiparasitic medication is employed in conjunction with good management practices.

Regarding the use of phenothiazine in cattle, the methods of free-choice and low-level administration are promising but still in the experimental stage. Data are adequate to show that a minimal daily intake of phenothiazine, namely, one-half gram per 100 pounds, up to a total intake of 2 to 5 grams per head for animals over 500 pounds, will achieve control of the common stomach worms, hookworms and nodular worms, and that this rate of dosage is safe. Suitable formulations of free-choice mixtures for general
use have not been devised, however, nor have other feasible means been found for administering the chemical in low-level, daily dosages. Ordinarily, reliance must be placed upon the employment of therapeutic doses. These should be given to calves, yearlings, and two-year olds immediately before each grazing season. In instances of outbreaks where there is intensive exposure, the best results have been obtained by repeated dosing at intervals of three weeks.

The external parasites of cattle are as numerous and damaging as the internal. Their practical control rests almost entirely upon the judicious employment of effective chemical sprays, which were summarized in last year's report.

**SHEEP**

Protozoan and helminthic parasites similar or closely related to those found in cattle occur in sheep and goats and inflict proportionately heavier losses in these animals than in cattle. However, certain important parasitic diseases of cattle do not occur in sheep, such as trichomoniasis and anaplasmosis. In many areas of the country, sheep cannot be raised profitably without an effective program of parasite control. However, the general principles of control that have already been described apply also to the control of parasites of these host animals.

Although the external parasites of sheep are as varied and numerous as those that infest cattle, and are generally susceptible to the same basic measures of control, it is probable that the damage caused by them falls short of the very great loss occasioned in sheep by internal parasites. Lindane is the treatment of choice against screwworms, blowflies and fleeceworms, for which use smear EQ-335 is the best available preparation; lindane is also the surest, quickest remedy for common scab, which can be eradicated by dipping in 0.66 per cent lindane, or its equivalent in gamma BHC if the technical product is used. However, instances of infestation by the itch mite, Psorergates, which has been found to occur in the United States, the only effective remedy appears to be lime-sulfur dip. Sheep keds and lice are easily eradicated with many insecticides, including rotenone, lindane, DDT, toxaphene, chlordane, TDE, methoxychlor, and BHC. For destroying sheep bots, the instillation intranasally, under mild pressure, of 3 per cent saponated cresol solution is the only recommendation that can be made.

In general, dependence for the control of many swine parasites should be placed primarily on preventive measures. The reasons for this are twofold. First, certain widely distributed and injurious parasites, among them being kidney worms and lungworms, localize in situations in the body of the pig where they are beyond the reach of most present-day anthelmintics. Second, for many parasites the stage which follows immediately after infection, and is associated in some degree with tissue penetration, is responsible for a considerable proportion of the damage done by these pests. Certain of the most injurious, and in some cases the most widely distributed of the para-
sites, notably ascarids, intestinal threadworms and kidney worms, fall within this group, marked damage to lungs, liver, skeletal and heart muscle, resulting from invasion by the migrating larvae.

Environmental sanitation is perhaps the most important single factor in the control of swine parasites. Worms do not multiply, as a rule, within the body of the host. One infective stage entering the body can only become a single adult. The eggs and larvae produced by adult worms must, in most cases, spend some time outside the body before entering a pig, and a heavy infection, therefore, must depend on a large number of these infective forms entering the body, usually by way of the mouth. To overcome the disadvantages of inability to multiply within the body of the host and the hazards of life outside the host, parasites lay tremendous numbers of eggs. These eggs pass from the host in the feces, and in the urine in the case of kidney worms. There they embryonate, and those of kidney worms, nodular worms, intestinal threadworms, and others hatch and the larvae become infective within a few days thereafter. In the case of other species such as ascarids and whipworms, a larva develops to infectivity within the egg, but does not hatch therefrom. In the case of still other species, thorn-headed worms, lungworms, and others, the eggs, when swallowed by invertebrate intermediate hosts, such as grubs of June beetles, earthworms, and dung beetles, hatch in the gut of the invertebrate, and the larvae migrate into the body cavity, encyst, and become infective to pigs. Pigs, particularly those fed inadequate or poorly balanced rations, may search for and consume insects, insect larvae, and earthworms, many of which carry larval stages of swine parasites within their bodies. Eggs and larvae of most swine parasites, since they are expelled with the droppings, are always concentrated in and around feces, as are many of the parasite-carrying invertebrates. In the case of pastures, it is usually around deposits of feces that the best growth of vegetation occurs, which, in turn, serves to bring the grazing animal in close association with the parasite infective eggs and larvae.

In this connection, the control of swine parasites is greatly complicated if swine are maintained on permanent pastures, without employing adequate rotation schemes to provide time for the infective stages of parasites to die or become scattered by rain and other factors. It was the late Maurice C. Hall, a former Chief of the Zoological Division of the Bureau of Animal Industry, who coined the phrase, "Permanent Pastures Perpetuate Parasites." Permanent pastures are dangerous because eggs and larvae of certain species are very hardy, and are able to survive for long periods under pasture conditions. For example, it is known that eggs of ascarids and lungworms are capable of living for a number of years on soil, and there are indications that under certain conditions in the South, larvae of kidney worms and nodular worms may be able to survive over winter. It can be seen, therefore, that permanent pastures and lots, through a cumulative process, are likely to be teeming with eggs and larval of parasites.

The formulation of effective control measures against swine parasites must
be based on a thorough understanding of their life cycles, including the length of time necessary for the eggs and larvae to develop to infectivity on soil, their ability to withstand sunlight and drying, the length of time they can survive on pastures and elsewhere, their distribution thereon, and an understanding of the habits of such invertebrates which serve as intermediate hosts.

The classic example of a scheme for the control of swine parasites is the swine sanitation system. This system, which was devised by the late B. H. Ransom several decades ago, on the basis of laboratory experimentation coupled with field trials in McLean County, Illinois, is to this day standard for the control of swine parasites. It was later adapted for the control of swine parasites in the South, and was again modified still further for the control of kidney worms.

Among the more specific measures that may be employed for controlling gastrointestinal parasites of swine, are special dietary management and judicious medication. Many parasites can be controlled by feeding pigs exclusively on milk, or skimmed milk, or whey for periods of 3 successive days at intervals of two weeks, or by feeding one of these products daily in lieu of one grain feeding.

Medication is exceptionally efficacious for controlling large roundworms; the standard sodium fluoride treatment should be given to pigs after weaning and again about two months later. In pigs, phenothiazine is specific only against nodular worms.

Sucking lice and sarcoptic mange mites are easily eradicated with lindane, BHC, chlordane, or toxaphene.
PRESENT STATUS OF PULLORUM DISEASE ERADICATION

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Pullorum disease has been an economic problem to the poultry industry for many years, and its control and eradication has been a constant challenge to the livestock sanitary officials. The disease is widespread in the United States and Canada; however, in some sections the incidence of outbreaks is far less than in other areas. Scientific investigations through the years have aided the industry and the livestock sanitary in controlling and eliminating the disease from poultry flocks.

The following significant developments have contributed greatly to progress in control and elimination of the disease:

1. The isolation of the causative agent by Rettger(1) in 1899 made it possible to study various aspects of the disease and led to future discoveries of equal significance.

2. The discovery of the infection cycle of the disease by Rettger(2) in 1909 revealed that the disease was transmissible through the egg. The infected adult hen was in most instances responsible for outbreaks of the disease in chicks hatched from infective eggs. This discovery revealed that from the standpoint of control, the disease appeared most vulnerable if the adult hen, a carrier, could be detected and eliminated. The validity of this concept has been demonstrated in subsequent years, but unfortunately, today there are still some persons in charge of pullorum disease control programs who either do not understand or are unwilling to accept this very basic principle for the control of the disease.

3. The application of the agglutination test to detect carriers is credited to Jones(8) in 1913. Without this very important diagnostic test which has saved millions of dollars, the poultry industry would be in a precarious situation today. However, this valuable tool must be used intelligently if it is to be effective in controlling pullorum disease.

4. In 1928, the Northeastern Conference of Laboratory Workers in Pullorum Disease Control was organized to standardize and bring about uniformity of methods in the control of the disease. Much has been accomplished by this organization through the years, and its results have benefited workers in other sections of the country.

* Contribution No. 911 from the Department of Veterinary Science, Massachusetts Agricultural Experiment Station, Amherst, Mass.
5. Also in 1928, Hinshaw et al.\(^{4}\) announced a set of control and eradication measures specifically designed for pullorum disease. These measures clarified the requirements for the successful control and eradication of the infection.

6. The introduction of the whole-blood-test by Schaffer et al.\(^{5}\) in 1931 has made possible more extensive testing of flocks in certain sections of the United States and Canada.

7. The formulation of standard diagnostic methods by the Conference of Research Workers in Animal Diseases of North America and subsequent adoption of these techniques by the United States Livestock Sanitary Association\(^{6}\) in 1932 have guided the workers engaged in the control of pullorum disease.

8. The inauguration of the National Poultry and Turkey Improvement Plans in 1935 and 1943, respectively, has contributed much to the organization and operation of control programs in many states. Today, 47 States are participating in the National Poultry Improvement Plan.

**Testing Progress in the Past Fifty Years**

Thirty years ago, official testing programs were initiated in a few states. The early testing results revealed a high incidence of reactors. In 1920-21, Massachusetts tested 108 flocks representing 24,718 birds that revealed 12.5 per cent reactors. Only 9.77 per cent of all birds tested were in negative flocks. Other states reported similar results. In 1952-53, Massachusetts tested 371 flocks representing 1,168,739 tests, of which 0.04 per cent were reactors, and 99.27 per cent of all birds tested were in nonreacting flocks.

Twenty-one years ago, 15 states (enrolled in the Northeastern Pullorum Disease Conference) tested 3,945 flocks, representing 1,412,352 birds. A total of 495 flocks which included approximately 25 per cent of all birds tested was classified as clean. In 1952-53, 14 states (enrolled in the Northeastern Pullorum Disease Conference) tested 12,755 flocks representing 12,603,064 birds. A total of 11,150 clean flocks, which included 10,558,971 birds or 83.78 per cent of the total birds tested, was detected. During 1952-53, no reactors were detected in Rhode Island, and only one in New Hampshire. Table 1 indicates the progress made during the past 25 years in the various states and provinces enrolled in the Pullorum Conference.

In 1936, the states participating in the National Poultry Improvement Plan tested 4,329,364 birds, of which 3.66 per cent were reactors. In 1952, 39,704,243 birds were tested, of which 0.38 per cent were reactors.

These results definitely reveal that progress has been made in the control and eradication of pullorum disease and that pullorum infection can be eliminated from poultry flocks and hatcheries.

**Important Aspects in the Control and Eradication of the Disease**

1. Testing of flocks annually. As long as reservoirs of infection exist, "breaks" in previously negative flocks may occur. Annual testing is necessary
to determine whether "breaks" have occurred in negative flocks. In Massachusetts, the percentage of "breaks" has varied from 1.63 to 12.96 per season. The average for a 20-year period was 5.12 per cent among 4,257 negative flocks. The results reveal that the incidence of "breaks" increased noticeably during a period of stress and strain for the poultrymen and hatcherymen. This increase was very evident during World War II.

Fortunately, the "breaks" in the majority of flocks were not serious—0.5 per cent or less reactors were detected on the first test. In 30 per cent of the "break" flocks only one or two reactors were detected. The majority of the "break" flocks were able to pass one or more negative tests the same season infection was detected. "Breaks" occurred in flocks with long negative testing histories, as well as in flocks with short negative testing histories. Many of the "breaks" could not be explained, but it is believed that a weakness in precautionary measures is the chief reason for the reinfection of flocks.

It has been suggested by certain industry members and testing officials that a program of intermittent testing be instituted for certain flocks or areas that appear to be free of pullorum infection. Although considerable progress has been made in reducing and eliminating pullorum infection from flocks, it does not appear prudent at this time to abandon annual testing of flocks because of the foci of infection that still exist as revealed by "breaks," and because it would disrupt effective testing organizations that have taken years to develop. The poultry industry has not arrived at the point where it can curtail its efforts in the control and eradication of this disease. Such a curtailment would be a definite step in the wrong direction.

(2) Replacing infected flocks with stock from pullorum-clean sources. Rapid progress can be made in eradicating pullorum disease from a premise by replacing infected flocks with known pullorum-clean stock. This procedure was followed in some of the New England States and proved to be very effective and most economical. However, in this method the new stock should be placed in an environment that is free of infection. If this plan were followed in states where pullorum infection is quite general in many flocks, great progress would be made in decreasing the incidence of infection among breeding flocks and also among broiler and laying flocks.

We must recognize that the infected breeding flock is the principal source of infection, which is disseminated to other flocks by way of the hatching egg. Therefore, every breeder-hatcher and hatcheryman should recognize the full significance of selecting hatching eggs from infected flocks. Pullorum disease would soon be eliminated from flocks if only pullorum-clean breeding flocks were used for breeding purposes.

(3) Recognizing only Pullorum-Passed and Pullorum-Clean flocks. No official recognition should be given to flocks or hatcheries that may be infected or contaminated with pullorum disease. The National Poultry Improvement Plan was started in 1935. For years it recognized two pullorum classes that tolerated pullorum infection. In 1948-49, the Pullorum Tested class was deleted from the Plan. Official lists of tested flocks in different states reveal
that 24 states still recognize the Pullorum-Controlled class and that there are many flocks and hatcheries that can qualify only in the lowest class. It would seem that after 17 years the National Poultry Improvement Plan should have educated, persuaded, and convinced the hatchery industry in this country that in order to control and eradicate pullorum disease from our flocks we must use only eggs that come from known pullorum-free flocks and not perpetuate the disease by selecting hatching eggs from known infected flocks. There is ample evidence now, and there has been for a long time, to prove beyond the slightest doubt that pullorum infection can be eradicated from flocks and hatcheries. As has been revealed in certain sections of this country, pullorum infection has been reduced to a very low average.

The Industry Advisory Group and General Conference Committee of the National Poultry Improvement Plan have made a recommendation that only one pullorum class be recognized with no tolerance of infection. The full requirements for such a class have not been presented. All livestock sanitary officials should take an interest in this proposed change in the pullorum phase of the Plan. It is recognized that a flock is either free or not free of the infection. However, our testing methods to detect infection may have their limitations, and other factors must be considered to arrive at a sound classification of infected and noninfected flocks.

(4) Organization of more effective programs. It is evident that in all states higher standards for the eradication of the disease should be adopted. Are we justified in raising the standards? It is estimated that the poultry industry, state, and federal agencies are spending several million dollars annually for the control of pullorum disease. Spending this amount of money each year, it would appear that we should become concerned about future results. Has the die been cast? Does the industry intend to spend this amount or even greater in the years to come with no definite objective toward elimination of the disease? This organization might well consider giving additional support to the control and eradication of pullorum disease. Any agency unwilling to recognize sound and effective eradication measures will only serve to deter progress in the control and eradication of the disease.

PULLORUM TESTING DATA SUBMITTED BY STATES AND CANADIAN PROVINCES IN THE PULLORUM CONFERENCE

<table>
<thead>
<tr>
<th>State</th>
<th>Year</th>
<th>Birds Tested</th>
<th>Per Cent Positive</th>
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<tbody>
<tr>
<td>Connecticut</td>
<td>1925</td>
<td>20,743</td>
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<tr>
<td></td>
<td>1952</td>
<td>630,018</td>
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<td>Delaware</td>
<td>1925</td>
<td>4,300</td>
<td>5.7</td>
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<tr>
<td></td>
<td>1953</td>
<td>546,379</td>
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<td></td>
<td>1953</td>
<td>1,365,314</td>
<td>0.027</td>
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<tr>
<td>Maryland</td>
<td>1927</td>
<td>3,725</td>
<td>21.0</td>
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<tr>
<td></td>
<td>1953</td>
<td>815,250</td>
<td>0.18</td>
</tr>
</tbody>
</table>
State | Year | Birds Tested | Per Cent Positive
--- | --- | --- | ---
Massachusetts | 1921 | 24,718 | 12.50
 | 1953 | 1,155,359 | 0.04
New Hampshire | 1926 | 35,237 | 2.50
 | 1953 | 1,512,219 | 0.00006
New Jersey | 1926 | 52,611 | 7.86
 | 1953 | 1,025,449 | 0.035
New York | 1926 | 59,576 | 6.2
 | 1953 | 810,619 | 0.0035
North Carolina | 1932 | 64,702 | 4.02
 | 1953 | 1,668,830 | 0.056
Nova Scotia | 1929 | 2,041 | 7.00
 | 1952 | 81,357 | 0.00
Ontario | 1928 | 15,000 | 8.00
 | 1952 | 1,086,026 | 0.05
Pennsylvania | 1924 | 2,077 | 15.00
 | 1952 | 1,882,712 | 0.2
Rhode Island | 1925 | 8,175 | 6.97
 | 1952 | 61,948 | 0.00
Vermont | 1928 | 8,555 | 7.4
 | 1953 | 234,282 | 0.09
Virginia | 1925 | 13,000 | 20.00
 | 1952 | 1,001,364 | 0.37
West Virginia | 1928 | 9,005 | 6.0
 | 1952 | 201,968 | 0.069

BIBLIOGRAPHY

THE IDENTITY OF CANARY POX AND “SCHNAPPKRANKHEIT” WITH NOTES ON VACCINATION AND MODIFICATION OF THE VIRUS*

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REVIEW OF LITERATURE

One of the earliest records of what may now be identified as passerine pox is that of Shattock (1) reported in 1898. In November of the previous year he had examined a bunting sparrow with a spheroid tumor under the mandible which showed, histologically, typical “molluscous bodies” arranged in acinoid groups in the epithelial cells. About a month later the mate to this bird was presented with the history that it had developed a growth in front of the left eye after the death of the first specimen. The histological appearance was identical with the first case. In Shattock’s opinion, there was no question of the contagiosity of the disease, but he wrongly assumed that it was the same as molluscum contagiosum in man.

In 1928, Musselman (2) reported the occurrence of a disease of the feet in Chipping sparrows banded at Thomasville, Georgia. In a period of six weeks during February and March of 1923, he banded 519 new birds and had 44 returns from the previous season which showed an infection incidence of 42 per cent. According to him, Baldwin (The Auk. Vol. 39, No. 2, Apr., 1922, p. 219) recorded the same disease in about 10 per cent of the birds handled in 1921, and Talbot (The Auk. Vol. 39, No. 3, July, 1922, pp. 344-345) recorded about 25 per cent infection in 1922. The disease was rare in 1924-25. Repeated trapping of the same birds allowed some observations on the course of the disease which was occasionally no more than a month. The author was of the opinion that wet weather not only caused an increase in the incidence but shortened the length of time the scabs adhered to the feet. A healthy bird infected with a needle showed discoloration of the site in about 10 days, and four days later an unmistakable lesion appeared which reached maximum proliferation of epithelium by the 18th day. Apparently the same disease was seen by Stoddard at Beachton, Georgia in a field sparrow. A bird inoculated by pricking developed a red spot in about 14 days which reached maximum size 7 days later. Musselman also cites that

* Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, The State University of New Jersey, Department of Poultry Husbandry.

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what appeared to be the same disease was found by Murbach in Vermont in 1925.

Although inoculation of material from fresh cases appeared successful, infection was not possible when scabs or material from old cases were used. Thus, in Washington, canaries could not be infected from birds that had passed the bleeding stage. Ward, of the University of Illinois, was not successful, and the author himself failed in three trials when scabs were used.

One case was recorded in 1922 with an infected middle toe. The same bird in 1923 showed an infection of the first toe, thus suggesting that a permanent immunity was not established. According to Musselman, the disease was rarely fatal. About one out of a hundred birds showed a pox wart on the lower mandible. He also made the interesting observation that mercurochrome is a harmless and effective treatment.

On the basis of material sent to him by Murbach, as well as material from Thomasville, Tyzzer diagnosed the disease as bird pox.

LaHaye (3) described contagious epithelioma in canaries in 1929. In order to distinguish it from other avian pox diseases, he designated it as passerine pox, and moreover, demonstrated that it was immunologically different. He was unable to infect canaries or finches with fowl or pigeon pox virus. Guinea pox, which has the properties of fowl pox, was also non-infectious for finches. The canary virus was infectious for finches, and passage through these birds did not change the virus for canaries. On the other hand, neither canary nor finch virus was infectious for pigeons or fowls. Canaries and finches which recovered from the infection were immune to canary virus or this virus after passage through finches.

Kikuth and Gollub (4) encountered a contaminating agent in birds inoculated with Plasmodium praecox. The agent caused an increase in the mortality from the average 20 per cent expected in malaria to about 100 per cent. Associated with malaria, the agent increased the acuity of the latter infection and also the parasite count. Malarial birds treated with plasmochin or atebrin were cured of malaria but died in 7 to 12 days from the intercurrent disease. Intramuscular injections of blood (3-4 drops in 0.3 cc. of saline) regularly caused symptoms in 4 to 8 days and death in 7 to 12 days. Occasionally the bird gasped, and the inoculation point took on a yellowish brown color. On autopsy, some enlargement of the pancreas was noted, and occasionally nodules were found in the lungs, but usually these organs were normal.

Blood diluted 100 times and stored under refrigeration for 3 months was still infectious in a $10^{-6}$ dilution. However, when red cells were washed twice they failed to infect. The filterable nature of the agent was established when 0.5 cc. of a Berkefeld N filtrate was inoculated into each of 3 birds. The material filtered consisted of 0.1 cc. of blood in 10 cc. of water. Seitz filtrates were negative, and birds so treated were susceptible to inoculation 6 weeks later. Immunity of recovered birds could not be tested since none
recovered, and it was not possible to produce immunity with injections of
dead virus.

These authors also infected birds with food mixed with infected organs,
however, the incubation period was much prolonged. It was also demonstrated
that as the disease progressed the virus concentration in the blood increased.
Thus, a bird was inoculated daily and from the third to the eighth day,
its blood was subinoculated into other canaries with the result that these
died in a progressively shorter time; that is, in from 12 to 6 days, respectively.
The disease could not be transmitted to chickens or pigeons but was in-
fected for sparrows and Java sparrows. A similar disease of canaries was
found in Giemsa's laboratory.

Kikuth and Gollub never suspected the pox nature of their virus, and it
is to be noted that they made no mention of cutaneous lesions other than
at the site of inoculation. On the contrary, they likened the disease to the
plague-like infection described in blackbirds by Maggiora and Valenti
in 1903.

In this, as well as in a second paper by Kikuth (5), attention is called
to the presence of certain bodies that appeared in the blood 1 to 2 days
before death. These irregular bodies showed 1 or 2 vacuoles or, in place of
these, a light red stained chromatic mass in Giemsa preparations. It was
concluded that these "X forms" originated from damaged thrombocytes, and
that in blood containing them there were few normal thrombocytes and,
correspondingly, the coagulation time of the blood was lengthened.

Tietz (6) records that de Jong (Tijdschr. v. Veeartseijkunde, 1912, p.
734) described an "epitheliosis contagiosa" in a tame bullfinch (Pyrrhula
vulgaris). The bird showed epithelial tumors and several diphtheritic patches.
Inoculation on the scarified breast of one pigeon resulted in the formation
of a few hard papulous nodules, while a second pigeon showed no reaction
on the breast but developed epitheliomata on both sides of the scarified upper
beak. Histologically, the original material showed the typical structure of
bird pox. Tietz also records that Wolffhiigel reported pox in canaries (Rev.

Tietz attempted to infect several passerine birds by cutaneous application
of an 80 per cent glycerin suspension of pigeon or fowl pox virus or by
intramuscular or intravenous inoculation of a one per cent suspension. One
of two canaries inoculated cutaneously with fowl pox developed some follicle
swelling, but no reaction was produced in four inoculated with pigeon pox.
One siskin showed several swollen follicles after fowl pox inoculation, but
another gave negative results with pigeon pox. One of two linnets inoculated
with pigeon pox showed several pin-head-sized nodules and two inoculated
with fowl pox were negative. Two rice birds inoculated with pigeon and two
with fowl pox were negative. Two sparrows resisted fowl pox, while one
of two given pigeon pox showed three swollen follicles. A starling showed
several follicle swellings when given pigeon virus, but an intravenous in-
jection was negative. Fowl virus applied cutaneously to a starling was negative. Two blackbirds resisted pigeon virus, and one of two showed slight follicle swelling after application of fowl virus. Two canaries and two rice birds which had resisted cutaneous inoculation with pigeon virus were reinoculated intramuscularly three to four weeks later and remained healthy. And, two rice birds and a siskin which had resisted cutaneous inoculation of fowl pox were reinoculated intramuscularly with fowl virus. The rice birds remained healthy, but the siskin died on the fourth day and showed a small swelling at the site of inoculation. In no case were the histological findings positive for pox.

Eberbeck and Kayser (7) cite the report of Stadie (Deutches Weidwerk, Ausg. A, 1931, H. 21, 572) of an epizootic of pox in pigeons which also affected canaries and bullfinches. The authors obtained the head of a canary in December, 1931, that showed suspicious pox lesions and small patches in the mouth. This material inoculated cutaneously into two canaries resulted in a swelling of the follicles which showed pox corpuscles histologically. One of the birds recovered and was resistant to a second inoculation two months later which produced the disease in two control canaries. When two green finches, two starlings, and a bullfinch were inoculated, the starlings and one greenfinch developed transient swellings which were histologically negative. Chaffinches and sparrows developed swellings of the follicles in six to eight days, and specific corpuscles were demonstrated. Two fowls and two pigeons developed limited swellings on the breast after inoculation, but specific inclusions were lacking. In another case of two lots of inoculated pigeons, one lot showed a limited reaction, while in the other it was severe and pox corpuscles were demonstrated. When both lots were reinoculated four weeks later with pigeon virus they exhibited no immunity.

The authors point out that their previous investigations had shown that a monopathogenic virus on its homologous host provoked typical inclusion bodies, but that on a heterologous host the reaction is nonspecific and consists essentially of a strong cell infiltration of the corium which heals quickly and without the formation of inclusion bodies.

With virus obtained from Kikuth, Burnet (8) had no difficulty in confirming the findings of Kikuth. He found that intramuscular injections into young chickens, pigeons, and budgerigars were without effect, but sparrows were killed with typical lesions although after a more prolonged course. The epithelial cells in the skin over the inoculation point showed cytoplasmic inclusions resembling Bollinger bodies. Intramuscular inoculation of fowl pox virus from egg membranes into canaries produced death in six to eight days with lesions grossly and microscopically almost identical with those produced by canary virus. However, the canary virus gave only nonspecific lesions with no inclusion bodies when inoculated into the feather follicles of chicks. The type of lesion was studied in relation to the mode of inoculation.

Intramuscularly, the canary virus provoked epithelial proliferation with
inclusions and eventual necrosis with an edema of adjacent subcutaneous tissue and muscle and with collections of mononuclear cells which showed characteristic cytoplasmic changes. By intraperitoneal or air sac inoculation death occurred a day or two earlier with the same changes already mentioned and, in addition, a yellow inflammatory exudate on the serous membranes and fluid in the sacs or cavities. The lungs usually showed some consolidation which, histologically, was shown to come from an intense proliferation of large mononuclear cells containing specific cytoplasmic inclusions. These cells were thought to have derived from the alveolar epithelium. From the histological studies Burnet concluded that this virus had the capacity of affecting a wider variety of cell types than fowl pox virus, that on the basis of inclusion bodies as evidence of virus, this virus was capable of attacking cells of all three germ layers.

By means of filtration through "gradocol" membranes the virus was found to pass membranes of 0.3 microns A.P.S. so that the virus particles were estimated to be of 0.125-0.175 microns in diameter.

Burnet was the first to cultivate the canary virus in embryonated eggs. The typical lesion, after six days incubation, was described as a plaque of greyish yellow thickening. Although the entodermal and mesodermal layers exhibited certain changes, it was concluded that virus infection appeared to be confined to the ectoderm.

Burnet was unable to infect canaries with pigeon virus. One strain of fowl pox virus produced death in canaries by intramuscular inoculation, and the heart blood of one of those produced the disease in two subinoculated canaries. However, the pooled blood from two canaries failed to produce pox when put on chickens. This led Burnet to think that the original fowl pox virus had a contaminating canary virus in it, and the fowl infecting agent was lost by passage in canaries since two other strains of fowl pox failed to infect canaries.

Intramuscular injection of the canary virus into pigeons failed to produce any effect, but feather follicle inoculation resulted in the production of a transmissible disease. Still, no inclusions were present. Passage through the pigeon did not increase the virulence for pigeons, and the virus was still capable of infecting canaries after six pigeon passages. Two chickens repeatedly inoculated with active canary virus developed no immunity to fowl pox, and their sera failed to inactivate canary virus in vitro.

Burnet points out that the high pathogenicity of this strain is in contrast to that described by La Haye which permitted recoveries, as did the strain described by Eberbeck and Kayser. Still, he insists that the strain belongs to the pox group in spite of the superficially different lesion produced in the canary and the invasion of other types of cells.

Herzberg (9) cultivated the canary virus in a medium consisting of 0.3 cc. of a suspension of minced chorioallantoic membrane and embryo (minus eyes) in 10 cc. of Tyrodes solution at pH 7.7 in 100 cc. flasks. After
two days' incubation the medium was inoculated with one drop of heart's blood from an infected canary, and the incubation continued five days more. In each passage 0.25 to 0.5 cc. of culture was used. The first, third, sixth, seventh, and tenth passages were tested by inoculating 0.2 cc. intramuscularly into canaries which produced death in eight to ten days. The inoculum, as well as the bird's blood, were shown to be germ-free. Blood from the bird killed by tenth passage virus was diluted to $10^{-2}$ with one per cent dextrose broth and passed through a Berkefeld V filter. An intramuscular injection of 0.3 cc. of the filtrate killed a canary in ten days. Canaries died in 12 days after an inoculation of $10^{-3}$ and $10^{-4}$ dilutions of the tenth passage virus; a $10^{-5}$ dilution was noninfective, but the bird was later shown to be immune. Herzberg used Paschen's method to demonstrate corpuscles which he considered to be the cause of the disease, since these can be demonstrated only in infected birds. He was unable to infect three chickens by comb, wattle, or corneal inoculation. Three pigeons inoculated on the breast showed redness and swellings after two to three days, but the reaction disappeared after eight to ten days. Epithelial damage to the cornea in pigeons was seen after inoculation of virus but not when sterile material was used.

In smears made from the edema of breast muscle immediately after death from an intramuscular injection of 0.2 cc. of Kikuth's virus, Herzberg (10) was able to show a gradual enlargement of the inclusion body (a term which he avoids) and with it some enlargement of the cell. With enlargement of the body the virus particles appeared within and were finally liberated as seeds from a pod upon rupture of the inclusion. Herzberg concluded that the X forms described by Kikuth are the same as the virus-containing histocytic cells seen by him. Kikuth examined Herzberg's microphotographs and agreed with this interpretation.

In these studies smears were air dried for 24 hours, soaked 15 minutes in 0.85 per cent salt solution and air dried, after which Loeffler's mordant was used for seven minutes and then placed in 0.3 per cent antiformen for one minute. Finally, the smear was stained with carbofuchsin for eight to ten minutes. Gentle warming was used with Loeffler's mordant and the stain. He also found that smears could be stained with Victorian R 4—an aged three per cent aqueous solution—without a mordant. The cells stained blue while the vesicles remained clear or took the stain lightly, but the virus in them, as well as outside, stained dark blue violet.

In another paper on staining reactions of various viruses Herzberg (11) found that while canary pox by Victoria blue staining took a deep violet stain, ectromelia virus took an intermediate blue, and varicella a violet stain only in the vicinity of the cell and required a half-hour's staining.

Irons (12) never found pox in the many starlings, English sparrows, and ground sparrows, or in a small number of other species trapped for observation. Starlings resisted virus of turkey, fowl, and pigeon origin, and these viruses could not be adapted to them. Moreover, the local inflammatory
area failed to reveal Bollinger bodies or yield the virus. A strain of pox from a wild pigeon (G strain) inoculated into a canary resulted in the disease 10 days later. Irons claimed never to have seen the natural disease in canaries but reported that Dr. Gingrich of the Medical School of the University of Texas had seen it. All strains of fowl pox were negative for English sparrows as were pigeon strains, except that from the wild pigeon. The first passage of the G strain in two English sparrows by feather follicle inoculation was negative on the 10th day when they were killed and excised portions of inoculated skin ground with fresh original material for a second passage in two birds. Ten days later these birds showed discrete nodules, and Bollinger bodies were found. After two or three additional passages in this species the incubation period was shortened and fairly constant. The first lesions appeared in three to four days and were fully developed by the sixth or seventh; that is, a little shorter than in pigeons or chickens. Secondary lesions were common. The virus was infectious for sparrows in a 10^-6 dilution and produced a 50 per cent mortality compared with less than 5 per cent in chickens and pigeons and less than 2 per cent in non-inoculated sparrows. At the height of infection virus was often recoverable from the brain, liver, spleen, and lungs. Adaptation to the nervous system by subdural passage failed. After 11 passages in sparrows the virus was greatly attenuated for pigeons and chickens and in the latter the lesions were atypical and Bollinger bodies were not found. Two attempts to infect crows and 3 to infect blackbirds failed. A total of 20 attempts to infect starlings failed presumably after serial passage in sparrows. However, the G virus was mildly infectious for snow buntings, ground sparrows and canaries and Bollinger bodies were found. After 9 passages in English sparrows, virus G produced infection in pigeons which, after 25 days, were refractory to challenge with the same virus and later reciprocal tests exhibited the presence of cross immunity.

Stafseth (13) diagnosed a case of canary pox in 1932, 2 in 1943 and 4 in 1949.

Gaede (14) purified a suspension of canary pox skin lesion by intra-cerebral inoculation. The blood of 2 birds each inoculated intra-cerebrally and cutaneously, on intramuscular inoculation produced typical symptoms (with difficult breathing) and autopsy findings of Kikuth’s canary disease and on cutaneous inoculation typical pox. Blood from the second intracerebral passage also produced Kikuth’s disease by intramuscular inoculation and brain material produced pox on cutaneous inoculation. Blood from 2 birds inoculated cutaneously and from a bird of the second intracerebral passage was used in 2 series carried to 10, 21 and 35 passages by cutaneous and intramuscular inoculation. Three drops of blood were diluted to 2 cc. for the inoculation and in every case Kikuth’s disease followed intra-muscular inoculation, and after cutaneous inoculation skin lesions were seen in the majority of cases. The incubation period was shortened from 10 to 6 days after the 10th passage. In early passages by intra-muscular
inoculation secondary skin lesions were common but did not develop in later passages while the subcutaneous and muscle lesions of Kikuth's disease were intensified. The edema seen in intramuscularly inoculated birds was more confined in those inoculated cutaneously. Gaede observed a subsiding of dermatropic properties because of premature death when the virus was carried serially by intramuscular inoculation. He also observed the X forms of Kikuth and Gollub in only 4 of 58 blood smears and these were identical to those seen on a slide loaned to him by Kikuth. He succeeded in cultivating the virus in flasks using the method described by Herzberg and showed that the virus produced Kikuth's disease on intramuscular inoculation and pox on cutaneous inoculation. The virus passed Berkefeld V but not N candles.

The blood of intracerebrally and intramuscularly inoculated canaries applied to the skin of chickens and pigeons provoked only a nonspecific lesion of the corium which subsided in 14 days without the formation of pox corpuscles. Gaede secured Kikuth's virus from Herzberg and showed that it would produce pox by cutaneous inoculation. That the disease in pigeons acted differently was shown by the fact that 2 pigeons inoculated intramuscularly with germ-free pigeon (brain) virus failed to sicken, but developed an inoculation point lesion. And, blood drawn 10 days after inoculation failed to produce an illness or skin lesion by intramuscular and cutaneous inoculation, respectively. From these results Gaede concluded that canary pox and Kikuth's disease are alike.

Using Kikuth's virus, Burnet and Lush (15) found that while the virus is invariably fatal for canaries it produces no lesions in fowls. In quantitative virus titrations on the chorioallantoic membrane with hyperimmune fowl pox serum and the serum of rabbits given large doses of canary pox, these authors showed that while each serum was active the homologous virus was inactivated to a slightly greater degree. The canary pox lesions on the membrane consisted of conical elevations of the ectoderm 1-2 mm. in diameter while fowl pox lesions are larger and relatively flat with vaguely defined edges. With a virus obtained from McGaughey from a spontaneous outbreak in sparrows they had no difficulty in transmitting it to canaries by subcutaneous or intramuscular inoculation. The virus was less virulent than Kikuth's but produced almost identical pathological changes. One difference was noted in that while the subcutaneous tissue fluids produced by Kikuth's virus was satisfactory for colloidal membrane filtrates that from sparrow virus was almost useless, due, presumably, to a clumping of the virus particles in the latter disease as shown by microscopic examination. In both cases the virus particles were about the same size.

Burnet (16) described the chorioallantoic lesions produced by Kikuth's virus as having a general resemblance to those of fowl pox, but the individual foci are smaller, distinctly raised, and more opaque. Histologically, the regular organization seen in fowl pox lesions is lacking. Proliferation is more irregular and necrosis and inflammatory changes more evident. The cytoplasmic lesions are larger and abundant. According to Bierbaum and Weitzenberg (28) Siepel (1937) cultivated canary pox virus in eggs and
Nagel (1936) found that fowl, pigeon and canary viruses produced the same type of lesions in eggs.

Wittmack (17) obtained a strain of canary virus from Bierbaum to inoculate the breast and legs of a canary from which material was collected 9 days later and suspended in 10 parts of glycerin for inoculation of one-half the plucked breasts of 4 pigeons. In 5-8 days the follicles showed various degrees of swelling which were distinguishable from those produced by pigeon virus by their smaller size, more edema, a more rapid course (maximum in 4-9 days with complete resolution in 20-30 days) and the lack of encrustations. Pox corpuscles were not demonstrable, and the changes were confined to the corium. The inoculation produced no immunity to pigeon virus. The canary virus passed serially through five passages in pigeons (two to a passage) resulted in no visible change in the lesions with successive passage and no immunity to a reinoculation with pigeon virus. Virus from the 5th pigeon passage killed a canary on the eleventh day.

Reis and Nobrega (18) record that strains of passerine pox from the common wild canary (Serinus canarius) and a finch (Sporophila sp.) are not pathogenic for the fowl or pigeon, but that another strain from the common wild canary was pathogenic for the siskin (Sicalis flaveola), weaver finch (Oryzoborus angolensis), and the lined finch (Sporophila sp.) and produced specific inclusions, but was nonpathogenic for the blue bunting (Cyanocompsa cyanæa), sparrow (Passer domesticus), chick, and duck. However, they observed an outbreak that killed 98 of 100 birds (Serinus canarius and Sicalis flaveola) in which the virus caused specific inclusions in the chick, canary, and pigeon and which retained its tripathogenic properties after 15 serial passages in each species. When eight pigeons were inoculated on the right breast with the 12th canary passage all became infected. A month later when four were inoculated on the left breast with pigeon virus and the other four with tripathogenic canary virus, all were immune. Four controls inoculated in the one breast with pigeon pox virus and on the other with tripathogenic canary virus showed typical reactions. Five canaries inoculated with canary virus were refractory to reinoculation a month later. Five chicks inoculated with fowl pox were later immune to canary pox, and five chicks inoculated with canary pox resisted fowl pox a month later.

Durant and Mc Dougle (19-20) reported three outbreaks of canary pox in which 300 died in each of two aviaries and 250 in the third. They found that “the initial symptom—may be a gaping or gasping for breath.” Scabs were found at the base of the beak and on the eyes. Death occurred about the 14th day, and the disease was about 100 per cent fatal. An exudate was found in the corners of the mouth and at the entrance of the windpipe. Three recovered birds were found to be immune to inoculation. Of 22 canaries, 2 turkeys, 14 chickens, 2 sparrows, 3 quail, and 2 pigeons inoculated, a marked reaction was produced only in the canaries and turkeys. Chickens showed a less marked reaction, and those six to eight months old no reaction.
Microscopically, virus bodies were found in canaries with few, if any, polymorphonuclear eosinophiles with rods. No virus bodies were found in chickens and only a few polymorphs. Turkeys showed a marked infiltration of polymorphs with small bodies resembling virus bodies. Quail also showed a skin reaction, but these as well as chickens and turkeys after recovery were still susceptible to fowl pox. A vaccine applied to the feather follicles produced no immunity when refractivity was tested 30 days later. The authors do not explain why vaccination seemingly produced no lesions or deaths.

Schofield and Labzoffsky (21) observed two outbreaks in canaries during the winter which in one case killed over 100 birds; few recovered. Prior to this (1922) an active filtrate was demonstrated in a serious outbreak. At first the birds were less lively and had ruffled feathers. In a day or two, the birds showed difficult breathing, huddled, held the mouth open and gasped. The appetite was capricious, and diarrhea was present or absent. Pin-head or lentil-sized lesions were more numerous on the head and neck and tended to follow feather tracts which, when removed, revealed a serous exudate in the subcutis. Granular lesions on the eye lids and commissures of the mouth were occasionally seen. A few cases showed an easily detached yellow exudate on the pharynx. The spleen was usually greatly enlarged, pale yellow, and showing a finely granular appearance. In other cases the organ was large and dark red, with a third of the cases showing no enlargement. The liver was usually pale, occasionally showing a few tiny pale yellow foci of necrosis. The duodenum was frequently inflamed, and the kidneys were usually pale. A yellow serofibrinous exudate sometimes spread posteriorly over the liver or anteriorly over the heart. Pneumonia of one, both, or part of one lung, was usually present.

Aerobic and anaerobic cultures failed to reveal a specific organism. Tissue filtrates inoculated into 9-day-old embryonating eggs caused death of the embryo in 36 to 48 hours. The chick was hemorrhagic and the serosa edematous, slightly hemorrhagic, and showed scattered white or opaque areas. The authors were unable to obtain an active filtrate from the skin lesions, but a virus was readily recovered from blood, lungs, and spleen, by filtration. The virus retained its activity after holding three months in a frozen state.

Subcutaneous inoculation of tissue filtrates was successful in three cases and negative in five. Sterile suspensions of lung, spleen, and blood inoculated into canaries readily reproduced the disease with an incubation period of from 5 to 21 days.

Inclusion bodies were present in great numbers in epithelial cells. They were spherical or slightly elongated and about the size of a red blood cell nucleus. Similar structures which resembled Guarnieri bodies, were found in the epithelial cells of the kidney. Within the bodies numerous granules were seen.

Large doses of virus subcutaneously and intraperitoneally failed to infect
mice or guinea pigs, and pigeons were refractory. The authors state that they have not studied Kikuth's work, but unlike him they recognized that the virus, which differed from fowl pox, belonged to the group of "pox diseases."

Manwell and Goldstein (22) described two, and possibly three, forms of the disease. In one, the earliest evidence was a swelling of the marginal epithelium of the eyes. This increased and spread to cause closing of the eye. They also observed nodules around the nostrils and corners of the mouth. Death occurred in 7 to 10 days. In another form the bird began to gasp and died in a shorter time. Other birds showed scaly or warty growths around the toes and legs which caused death after weeks or months. The disease was readily transmitted to canaries by injection of tissue lesions or blood, or by direct contact. Only transitory lesions were produced in chickens.

Coulston and Manwell (23) found lesions of the pharynx and trachea in the gasping type of disease. They believed that the occurrence of a single case suggested air borne infection. However, they succeeded in infecting canaries by direct contact, subcutaneous and intramuscular injection of infected tissues or blood and by conjunctival instillation. The strains of virus used (one unknown, one from a canary) were not infective for starlings, cowbirds, and chickens, but were capable of producing a mild infection in song and English sparrows. Six recovered birds resisted reinoculation. The virulence of desiccated virus was reduced after seven to eight months and lost after eleven months. Eight birds recovered after infection produced by attenuated virus were reinoculated subcutaneously—four with attenuated and four with virulent virus. The former were resistant, but two of the latter died.


In addition to the outbreak to be reported below, our records show numerous diagnoses of canary pox since 1939 as listed below:

<table>
<thead>
<tr>
<th>Case</th>
<th>Date</th>
<th>Location</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>12024</td>
<td>7/19/39</td>
<td>Trenton</td>
<td>Lost 5 from a small flock. Swollen eyes and encrustations in corners of mouth.</td>
</tr>
<tr>
<td>13312</td>
<td>7/1/40</td>
<td>Freehold</td>
<td>Lost nearly all birds last year from pox. Only one presently affected. Dispnea.</td>
</tr>
<tr>
<td>13464</td>
<td>8/12/40</td>
<td>Teaneck</td>
<td>Few lost daily for 5 weeks. Scabs corners of mouth, top of head, and under mandible.</td>
</tr>
<tr>
<td>Case</td>
<td>Date</td>
<td>Location</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>---------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>15266</td>
<td>1/29/42</td>
<td>South River</td>
<td>10 died in 2 weeks. Gasping. Large areas of congestion in lungs.</td>
</tr>
<tr>
<td>15285</td>
<td>2/3/42</td>
<td>East Orange</td>
<td>Lost 5-10 per day for 3 weeks. Scabs in corners of mouth. Another showed only dispnea.</td>
</tr>
<tr>
<td>16180</td>
<td>10/20/42</td>
<td>New Brunswick</td>
<td>12 died of 200 in 1 week. Scabs on feet. Out-of-door aviary.</td>
</tr>
<tr>
<td>16248</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16182</td>
<td>8/29/42</td>
<td>South River</td>
<td>Same as 15266. Losing 4-5 a week from 150. Scabs on feet and corners of mouth. Dispnea.</td>
</tr>
<tr>
<td>25281</td>
<td>10/14/47</td>
<td>Millington</td>
<td>Quite a few birds with sores on feet.</td>
</tr>
<tr>
<td>27284</td>
<td>8/17/48</td>
<td>New Brunswick</td>
<td>9 died of 60 in 10 days. Scabs on toe.</td>
</tr>
<tr>
<td>27549</td>
<td>10/15/48</td>
<td>Little Silver</td>
<td>Scabs on feet.</td>
</tr>
<tr>
<td>27755</td>
<td>11/24/48</td>
<td>Paterson</td>
<td>Lost 550 of 750 in 5 weeks. Pox lesions about head.</td>
</tr>
<tr>
<td>30189</td>
<td>9/27/49</td>
<td>Milltown</td>
<td>Pox Lesions on head.</td>
</tr>
<tr>
<td>33780</td>
<td>3/6/51</td>
<td>Trenton</td>
<td>After 48 purchased birds added to own flock of 500 a disease appeared. Dispnea. Scabs in corners of mouth and diphtheritic patches in mouth.</td>
</tr>
<tr>
<td>38420</td>
<td>10/2/52</td>
<td>Brooklyn, N. Y.</td>
<td>Birds placed out-of-doors 5 weeks ago, and losses began 2 weeks later. Lost 36 of 125. Pox on toes and corners of mouth.</td>
</tr>
</tbody>
</table>

**Also infected with malaria (Plasmodium cathemerium).**  
* Suspensions treated with antibiotics and inoculated into embryonated eggs and growth of pox virus obtained.
Canaries are occasionally presented to poultry pathologists for diagnosis and while the majority show Salmonella infection, occasionally other diseases are found. One of these is a pox disease, two forms of which are readily recognized by the dermal and mucosal lesions. Occasionally associated with the typical disease, there is a clinically different malady characterized by gasping but without the pox or diptheritic lesions. It is known among bird breeders and dealers as “Schnappkrankheit.” The cause of this disease has never been determined except that Rühling (28) incriminated a Streptococcus.

In the cutaneous form warty growths are found around the base of the beak, eye lids, feet, legs, and occasionally on feathered parts of the body. Infection of the conjunctiva is not uncommon, and occasionally diptheritic patches develop in the mouth, pharynx, on the tongue and in the larynx. In the latter location the lesion causes difficult breathing, but in typical “Schnappkrankheit” there are no cutaneous lesions and no laryngeal lesions to account for the gasping. On autopsy these cases show various degrees of solidification in the lung.

Cases of the “Schnappkrankheit” form or diptheritic laryngitis are invariably acutely fatal. In other forms of the disease the mortality may also be high, but the rate of spread is slower and the course more extended.

The wide use of canaries in chemotherapeutic experiments in malaria should elicit more than ordinary interest in the diseases of this species. In fact, there is evidence that canary pox has often occurred as an intercurrent disease in birds used in malarial studies.

Cases of so-called “Schnappkrankheit” had come to us on previous occasions, but no attempt was made to determine the cause after a bacteriological examination had shown that at least a Streptococcus was not involved.

Birds from the outbreak under study were presented February 27, 1939. The owner was under the impression that his birds were affected by two diseases as represented by the two lots presented. In the one lot of three birds, one showed conjunctivitis and pox lesions on the foot and beak. Another showed only conjunctivitis, while the third showed no pox lesions. The other lot of 3 birds exhibited the rapid gasping symptoms peculiar to “Schnappkrankheit” with no pox or diptheritic lesions. Pox scabs were collected from one bird for filtration. Lungs, trachea, liver, and heart were collected from one of the “Schnappkrankheit” birds to be combined with the same organs from two of three similar cases brought in March 7.

The pox scabs collected February 27 were ground with sand and broth on March 1, centrifuged, and filtered through a Berkefeld V filter. The filtrate was tested for sterility on an agar plate and in broth. Each of four ten-day-old embryonated eggs was inoculated at 4 points in the chorioallantoic membrane with a total of 0.6 cc. of filtrate and the incubation was continued for six days. None of the embryos died, and on harvest a somewhat raised lesion about 4 mm. in diameter appeared at each point of inoculation. There were
no secondary lesions. Streaks on agar from the membranes showed them to be sterile. A second passage was initiated the following day, and five days later when the eggs were harvested some of them showed a diffuse thickening at the inoculation pole, while others showed the raised circumscribed lesions noted in the first passage. The inoculum for the above passage consisted of the serosa of an egg ground with sand and about 5 cc. of broth. The dose for each egg was 0.5 cc. In the third passage made 13 days later and with a dose of 0.4 cc. the inoculation lesions were somewhat yellowish, and many secondary lesions were found. The membranes were thickened and very fragile. This strain, to date, has been carried through 91 passages in which 1383 eggs were used.

The organs collected February 27 and March 7 from birds showing the Schnappkrankheit type and free of skin pox or diphtheritic lesions were ground with sand and suspended on March 7. After centrifugalization the supernatant was divided and one half passed through a Seitz disc and the remainder through a Berkefeld V filter. The filtrates in each case were shown to be sterile by inoculation in broth and on agar. Each filtrate was inoculated in a dose of 0.2 cc. into each of three eggs embryonated for 11 days. On harvest at six days, those that had received the Seitz filtrate showed no lesions while one of the three that received the Berkefeld filtrate showed two pole lesions about 2 mm. in diameter which could not be distinguished grossly from those produced by pox virus. Two days later the serosa of this egg was suspended and inoculated in a dose of 0.6 cc. into each of four ten-day embryos. Three of the embryos died within 24 hours but the fourth opened on the fifth day showed two pole lesions and a generalized edema of the serosa. Four days later the serosa of a 24 hour dead embryo was suspended and inoculated into each of five seven-day-old eggs in a dose of 0.5 cc. After seven days these eggs were opened and showed no evidence of growth; one had died on the sixth day.

The suspension of the infected serosa of the second passage was inoculated into five seven-day-old embryos. Only two of these lived to the fifth day; the others died on the first, third, and fourth days. None of the membranes showed well-defined lesions, but three days later one harvested on the fifth day was suspended and inoculated into five twelve-day embryos which showed, after five days’ incubation, the characteristic yellowish, raised inoculation as well as numerous secondary lesions. To date, this strain has been carried through 55 passages in which 471 eggs were used.

The establishment in which the outbreak took place started in 1938 with about 1000 breeders and had a very successful year. In 1939, the number of breeders was increased to 3000 and operations progressed well until an outbreak of what appeared to be two diseases began, and at which time specimens were presented for examination.

Soon after the virus was adapted to embryonating eggs occasional attempts were made to infect chickens by the follicle or scarification methods. No swelling of the follicles was seen, but after about four days the edges of
scarifications were slightly raised and of a yellowish color, giving the impression that within a few days an extensive lesion would appear. On the contrary, however, the lesion disappeared in a day or two. After several attempts it became evident that at least early passages of the virus were not infectious for chickens.

After additional passages a chicken was inoculated by the feather follicle method, and after a few days a marked swelling of the follicles was observed. The passage of virus used was not recorded (except that is was prior to the 69th passage) and the finding was dismissed as an accidental contamination, because three other birds had been inoculated with fowl, turkey, and pigeon pox viruses at the same time and housed in the same room but in different cages. The follicle swelling was identical to that produced by pigeon virus, and it was assumed that this was the contaminating virus.

Eventually, it was realized that in consequence of serial passage in hen’s eggs the canary virus might have acquired the property of infecting chickens. Accordingly, another strain of canary virus (Case 27284) was adapted to eggs and material of the second passage (C 12 - 9/4/48) was inoculated into the follicles of one chicken, and material from the 69th passage of the original canary virus (CP 1166 harvested 4/5/48) was inoculated in the same manner into a second chicken. The former showed no reaction, and the latter developed a marked swelling of the follicles. Since there were no other birds inoculated with other pox viruses in the room, the possibility of accidental infection could be ruled out. Moreover, the recovered bird did not resist a challenge with fowl pox. Whether all canary strains are susceptible to modification remains to be seen. Serial passage in chickens will be referred to later.

Outbreaks of fowl pox, particularly the cutaneous form, which occur largely in summer and late fall (usually mosquito-borne) are attended with very low mortality, but outbreaks which start after the first of the year in this climate are more likely to be of the diphtheritic type, spread more slowly because of the absence of mosquitoes, but usually cause a heavier mortality. In any event, it is possible to apply a fully virulent fowl pox virus by the feather follicle or wing web stick as a vaccine during the growing period without causing a prohibitive loss.

Natural outbreaks of canary pox usually cause a very high mortality, so that attempts to vaccinate by the procedure used for fowl pox are disastrous. Nevertheless, in desperation, the owner requested some trials which were made with virus of early egg passages. The result was that in one lot of 368 birds 139 died in 30 days, and in another lot of 100 vaccinated by a stick in the breast 80 died in 2 days. After additional attempts, this method was abandoned. In some of these trials the virus used was that isolated from cutaneous pox (CP); in others, the virus used was that from the Schnappkrankheit type (S). Regardless of the strain used, birds developed the local lesion at the point of vaccination, and in addition, some developed secondary lesions of the skin or mucous membrane, or the
Schnappkrankheit form. The latter form invariably caused death in less than two weeks. These results afforded additional proof of the identity of the agent causing pox and Schnappkrankeit. This latter form is undoubtedly the one encountered by numerous investigators and described as causing gasping, but none of them seems to have been acquainted with the bird-dealers name of the disease.

In 1941, 13 lots of inactivated virus were used as vaccine. Infected chorioallantoic membranes were ground and inactivated with formalin and used intramuscularly on several thousand birds hatched that season. There was no appreciable difference in the incidence of infection in vaccinated and controls. In these trials no virus was used that had undergone more than 23 egg passages.

Limited trials with live virus were again made in 1942, at which time the virus had undergone 42 egg passages. In these and subsequent trials a single needle was dipped in a virus suspension and thrust through the wing web. The loss incident to vaccination was still high—60 per cent in one lot—but never as high as in earlier trials. In 1943, virus of the 48th and 49th passages was used which gave a lower average loss than the previous year. In 1944, the average loss was still lower when 54th to 56th passage virus was employed.

Encouraged by the yearly decrease in mortality incident to vaccination the owner enlarged the number of breeders by selections from each year's hatch, so that by 1944 about 25,000 young were hatched. In 1945, virus of the 59th and 60th passages was used; in 1946, 62nd and 63rd; in 1947, 65th and 66th; in 1948, 70th and 71st, etc. until 1952 when virus of the 90th passage was used. A gradual reduction in the loss incident to vaccination was noted from year to year until it reached about six per cent in 1945, beyond which no further reduction occurred. The losses, incidentally, occurred from the 11th to the 27th day.

The immunity was apparently solid because a single vaccination protected birds as long as they were kept as breeders. Immunization had an immediate practical value in the commercial production of song birds at a time when foreign sources of supply were cut off by the war. Of perhaps far greater value, however, was the fact that the owners were able to supply pox-immune females to the numerous laboratories engaged in attempts to find better chemotherapeutic agents for malaria. It may be recalled that one of the earliest descriptions of the disease resulted from its occurrence as an intercurrent infection in canaries used for malarial research (4). Investigators using pox-immune birds frequently commented on the complete absence of infection. That this was not due to lack of exposure was shown during the past year when the supply of immunes was exhausted, and laboratories had to be supplied with susceptibles which in many laboratories promptly contracted the disease.

The yearly reduction in losses incident to vaccination might be attributed to two factors operating singly or collectively. Since this was a closed
breeding flock, that is, no introductions from the outside, vaccination served in a selecting capacity by killing off the weaker individuals, or, the serial passage of the virus in eggs modified its pathogenicity for the canary. That the results were not entirely due to a process of selection is suggested by the mortality rate in non-selected populations vaccinated since 1947 in New Jersey, Massachusetts, Pennsylvania, and North Carolina with virus that had undergone at least 65 egg passages. In these cases the disease had already appeared, but the loss attributed to vaccination was not as high as that experienced up to 1942 with early passage virus.

The evidence that the virus had actually undergone a change is that it had acquired the ability to infect the chicken by the feather follicle method of application. Consequently, it was decided to attempt further modification by serial passage in the chicken.

**FIRST SERIES**

1st Chicken Passage: 3077 was inoculated in the feather follicles at 60 days of age with a suspension of 79th egg passage virus (CP 1296—5/2/51). A definite swelling of the follicles, without inflammation, was noted on the third day. On the fourth day there was some inflammation, and the follicles were as large as on the sixth day of a pigeon pox inoculation. The bird was destroyed on the sixth day, the affected area excised, ground with sand and suspended in broth. One portion of about 1.5 cc. was frozen pending egg inoculation, and the other portion was inoculated intrafollicularly that day in bird 3344.

Two days after removal from 3077 the suspension was treated with antibiotics and inoculated into the chorioallantois of six ten-day embryos, of which one died after 24 and another after 48 hours. Of the 4 harvested on the 7th day all showed a diffuse edema of the serosa at the inoculated pole with dense yellow lesions at the points of inoculation. There was no generalization.

2nd chicken passage: 3344 was inoculated at 66 days of age with the suspension from 3077. On the 3rd day 6-8 follicles showed a slight swelling and many more were noted the next day. On the 5th day the swellings were about as in the first passage. The bird was destroyed and the excised lesions ground in 1 cc. of broth and inoculated into bird 250. The rest of the suspension was frozen pending egg inoculation.

Thirty-two days later the above suspension was inoculated into 6 eggs of which 3 were alive on the 7th day and all showed typical pole lesions.

3rd chicken passage: 250 was inoculated at 71 days of age with the suspension prepared from 3344. A slight swelling of follicles was noted after 2 days which increased in the next few days. This bird was destroyed on the 7th day and the excised lesions suspended for inoculation into a non-banded bird that day and into 6 eggs the next day.

Of the 6 eggs inoculated the 5 harvested on the 6th day showed typical lesions.
4th chicken passage: The non-banded bird 51 days old showed slight follicle swelling 3 days later. These were more pronounced on the 4th day and the bird was destroyed on the 7th day to prepare the usual suspension.

Four embryonated eggs were inoculated with the fresh suspension but none of the 3 harvested on the 7th day showed any lesions. Another lot of 6 eggs was inoculated 18 days later with the same suspension. Four were alive at harvest on the 6th day and showed suggestive pole lesions.

5th chicken passage: A non-banded bird 59 days old was inoculated on the comb and by the feather follicle method the day after the preparation of inoculum from the above bird. On the 6th day the comb showed no lesion and only one follicle showed a slight swelling. The bird was killed on the 6th day and the suspicious lesion was ground for egg and bird inoculation. A second bird 941 (65 days old) was inoculated with the same suspension but it provoked no visible lesions during 6 days of observation.

After holding one day the above suspension was inoculated into 6 eggs of which the 3 embryos harvested on the 6th day showed only small areas of opacity at the inoculation points of the serosa.

6th chicken passage: 906 (65 days old) was inoculated with a suspension prepared that day. Only one follicle appeared to be swollen 4 days later and this was removed without destroying the bird and prepared for inoculation.

Of the 7 embryos inoculated 3 days later all were alive after 6 days and showed small indefinite pole lesions of which the largest was about 3 mm. in diameter.

7th chicken passage: 939 inoculated when 72 days old with a suspension prepared 3 days previously from 906 provoked no visible lesions after 6 days but the inoculated area was removed the next day and suspended for egg inoculation. Two of 6 embryos inoculated died on the 3rd day, but the 3 that were harvested alive on the 6th day appeared to show small pole lesions.

SECOND SERIES

1st chicken passage: This series was initiated by the inoculation of 949 (65 days old) with a suspension of the serosa of one of the 6 embryos inoculated with the skin suspension of 3077 of the first chicken passage of the first series. After 2 days there was slight but definite follicle swelling which, the following day, was equal to a pigeon pox inoculation at its height. The bird was destroyed on the 4th day and the excised skin suspended in 4 cc of broth.

Six eggs were inoculated the same day of which one died within 24 hours and at harvest on the 6th day, when 2 more died, a heavy growth with secondary lesions was observed.

2nd chicken passage: 931 (69 days old) was inoculated intrafollicularly, on the scarified comb and by the stick method through the wing web on the day the preparation was made from 949. Three days later 8-10 follicles were swollen. The wing showed a slight reaction but the comb revealed
only the traumatic lesion. By the 6th day, 64 follicles showed marked swelling and the wing stick resembled a fowl pox infection. The comb was normal. The bird was destroyed on this day and the excised follicular lesions suspended for inoculation of bird 609 and eggs that day.

Of 6 eggs inoculated from 931 the day the suspension was prepared 3 died within 24 hours and of the 3 harvested alive on the 6th day all showed good pole lesions but no secondary lesions.

3rd chicken passage: 609 (75 days old) was inoculated into the follicles, scarified comb and through the wing web. On the 4th day 4 follicles were swollen and the wing showed a good reaction, but the comb was negative. The bird was destroyed on the 7th day when only 7 follicles were swollen. The comb was still negative. The suspension was made of excised follicles and the wing lesion.

Of 6 embryonated eggs inoculated the same day from 609, 5 were harvested on the 6th day and 4 showed less growth than the previous passage. One showed no lesions.

4th chicken passage: 2239 (56 days old) was also inoculated the same day. Only 2 follicles showed swelling by the 7th day when the bird died of coccidiosis. The two follicles were excised and suspended for inoculation into eggs that day and into 921 the next day.

Of the 4 embryos that lived 6 days of 6 inoculated, 2 showed no lesions and 2 showed some edema or slight diffuse clouding, that is, changes that could not be definitely ascribed to virus growth.

5th chicken passage: 921 (54 days old) was inoculated into the follicles and through the wing web with the day-old suspension from 2239. No lesions developed after 7 days but inoculated skin was excised and suspended for inoculation into 6 embryonated eggs that day. Four eggs came to harvest of which 2 showed what appeared to be slight pole lesions.

THIRD SERIES

1st chicken passage: This series was initiated with virus from the eggs inoculated with material from bird 931, that is, the second chicken passage of the second series. Bird 903 (56 days old) inoculated intrafollicularly and by wing stick showed 22 infected follicles on the 3rd day as well as an inoculation lesion on the wing. By the 5th day all inoculated follicles appeared infected. The bird died of coccidiosis on the 7th day and the skin was excised and suspended for inoculation into 6 embryonated eggs that day and into bird 988 the next day.

Four live embryos came to harvest on the 6th day and showed small but typical lesions.

2nd chicken passage: 988 (64 days old) inoculated in the follicles and wing gave the impression 4 days later that all the follicles would eventually show swelling. But, there was no change the next day and even on the 6th day only 4-5 showed swelling and these were not entirely typical. There was
no wing reaction. The bird was destroyed on the 7th day and 5 follicles excised and suspended for inoculation into bird 964 and 6 embryonated eggs that day.

Five of the eggs were harvested on the 6th day. Two showed small definite lesions, one was questionable, one showed edema and the last was negative.

3rd chicken passage: 964 (71 days old) inoculated in the follicles and wing showed 12 slightly swollen follicles on the 2nd day. On the 4th day only 5 showed definite swelling and the others appeared to be regressing. The bird was destroyed on the 7th day and the 6 swollen follicles excised and suspended for inoculation that day into 6 eggs and bird 933. There were no wing lesions.

Four of the 6 embryos harvested on the 6th day showed only suggestive lesions in two cases.

4th chicken passage: 933 (78 days old) showed very slight swelling of the follicles on the 4th day with a return to normal by the 6th day. The bird was killed on the 12th day and the inoculated area excised, suspended and inoculated into 5 eggs that day. All were alive on the 6th day and showed no definite lesions.

From the above tests it appears that in the first series the virus produced infection during six chicken passages on the basis of a typical swelling of one or more follicles. But, based on the results of subinoculations in eggs the results were definitely positive only after three passages and very questionable thereafter. In the second series, the results were positive only in the first four chicken passages and the embryos were positive only after three passages. However, the virus used to initiate this series had already undergone one chicken and one egg passage. In the third series, the first three chicken passages were positive, and the embryos only after two passages. Again, the virus used to initiate this series had previously been through three chicken and two egg passages. It also appears that with each chicken passage fewer follicles became infected.

In order to learn if any change in pathogenicity for the canary had occurred in consequence of the chicken passages, vaccine was prepared from the infected skin of each of five chickens. The excised skin was ground with sand and about 5 cc. of broth. After sedimentation, 0.1 cc. each of penicillin and streptomycin (representing 10,000 units and 10 mgs., respectively) were added to 1.5 cc. of supernatant. Vaccine was also prepared in the same manner from chorioallantoic membranes of eggs inoculated from the same chickens and harvested on the sixth day. The vaccine was applied September 19, 1951 by a single needle wing stick to 35 or 36 birds per sample. The following table indicates the vaccines made from birds and the eggs inoculated from them.
CANARY POX AND SCHNAPPKRANKEIT

TABLE I

Showing chickens and eggs inoculated from them as well as series and passage used to make vaccine.

<table>
<thead>
<tr>
<th>Chicken</th>
<th>Per cent Loss in Vaccinates</th>
<th>Embryos</th>
<th>Per Cent Loss in Vaccinates</th>
<th>Series</th>
<th>Passage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3077-6/13/51*</td>
<td>8.5</td>
<td>CPC 3-6/21*</td>
<td>27.7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No band-7/9/51</td>
<td>11.1</td>
<td>CPC 3-7/16</td>
<td>14.2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>906-7/26/51</td>
<td>20.0</td>
<td>CPC 4-8/9</td>
<td>20.0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>903-8/2/51</td>
<td>14.2</td>
<td>CPC 17-8/9</td>
<td>17.1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>964-8/17/51</td>
<td>8.5</td>
<td>CPC 15-8/23</td>
<td>14.2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

* Refers to harvest date.

The table shows that the loss incident to vaccination with material direct from the chicken was in general somewhat lower than that caused by vaccine made from embryos inoculated from the chicken. The "takes" in canaries vaccinated with chicken material were often not very pronounced and in some cases were probably negative, which might account for the lower mortality. The "takes" in canaries inoculated with embryo material were much more pronounced. Since the embryonated egg is a better medium than the chicken, the greater concentration of virus probably accounts for the increased mortality in canaries. In any event, the mortality in all cases was well above the average of six per cent usually obtained with virus after long passage in embryos. It would appear that a passage in the chicken restores the pathogenicity of this strain for canaries.

Since the "takes" in birds vaccinated with egg propagated virus were definite, it was decided to make more extensive tests with virus after chicken passage. Bird 931, representing the second chicken passage in the second series, had shown marked follicle infection and good growth in the eggs inoculated from it on July 20. A suspension of one of the eggs (CPC 18-7/26) was inoculated into 14 eggs on November 2. Two pools of vaccine were made from these embryos. The one consisted of material from eggs 21, 22, and 26 suspended in 31 cc., and another consisted of material from eggs 17, 18, and 25 suspended in 15 cc. A third vaccine was made from eggs 2 and 10 suspended in 5.8 cc. These two embryos differed from the above lot in that the eggs were inoculated with virus direct from bird 931.

The three vaccines were applied by technicians to five groups of birds. Here it should be pointed out that these birds had been imported from various places in Germany, whereas the average six per cent loss incident to vaccination referred to above concerned birds hatched and reared on the premises. Unfortunately, the vaccine applied to each group was not recorded except that groups I and V received vaccine from embryos inoculated with embryo material; that is, embryos inoculated with CPC 18-7/26. The results are recorded in Table II.
TABLE II  
**Showing mortality incident to vaccination in five groups of canaries.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Date</th>
<th>Dilution</th>
<th>Number Vaccinated</th>
<th>Died</th>
<th>Per cent Loss</th>
<th>Period of Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>11/19/51</td>
<td>1-15</td>
<td>40 F*</td>
<td>16</td>
<td>40.0</td>
<td>37 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-25</td>
<td>100 F</td>
<td>24</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-50</td>
<td>100 F</td>
<td>47</td>
<td>47.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1-75</td>
<td>100 F</td>
<td>40</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>11/19/51</td>
<td>1-15</td>
<td>960 M**</td>
<td>339</td>
<td>35.3</td>
<td></td>
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<tr>
<td></td>
<td>11/21/51</td>
<td>1-15</td>
<td>504 M</td>
<td>198</td>
<td>39.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11/24/51</td>
<td>1-15</td>
<td>482 M</td>
<td>217</td>
<td>45.0</td>
<td>40 days</td>
</tr>
<tr>
<td></td>
<td>11/26/51</td>
<td>1-15</td>
<td>456 M</td>
<td>221</td>
<td>48.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11/28/51</td>
<td>1-50</td>
<td>504 M</td>
<td>238</td>
<td>47.2</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>12/4/51</td>
<td>1-50</td>
<td>2208 M</td>
<td>1326</td>
<td>60.0</td>
<td>35 days</td>
</tr>
<tr>
<td></td>
<td>12/5/51</td>
<td>1-50</td>
<td>1512 M</td>
<td>1010</td>
<td>66.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12/7/51</td>
<td>1-50</td>
<td>1032 M</td>
<td>646</td>
<td>62.5</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>12/12/51</td>
<td>1-50</td>
<td>480 M</td>
<td>307</td>
<td>63.9</td>
<td>37 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>960 M</td>
<td>722</td>
<td>75.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1780 M</td>
<td>1086</td>
<td>61.0</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>12/?/51</td>
<td>1-15</td>
<td>720 M</td>
<td>280</td>
<td>38.8</td>
<td>32 days</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1680 M</td>
<td>613</td>
<td>36.4</td>
<td>32 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>720 M</td>
<td>271</td>
<td>37.6</td>
<td>31 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>720 M</td>
<td>167</td>
<td>23.1</td>
<td>30 days</td>
</tr>
</tbody>
</table>

* Females  ** Males

The table shows that in all lots the mortality incident to vaccination was very high. It is quite evident that passage through the chicken and repropagation in eggs does not modify the virulence for canaries.

Thanks are due Dr. H. Baskaya, guest worker from the University of Anagra, and Dr. J. A. Bivins for making the chicken passages.

REFERENCES


CANARY POX AND SCHNAPPKRANKEIT


H. Van Roekel, Amherst, Massachusetts, Chairman; F. R. Beaudette, New Brunswick, New Jersey; J. P. Delaplaine, College Station, Texas; L. C. Heemstra, Washington, D. C.; Erwin Jungherr, Storrs, Connecticut; P. P. Levine, Ithaca, New York; W. A. Moynihan, Ottawa, Canada; B. S. Pomeroy, St. Paul, Minnesota.

During the past year the economic status of the poultry industry has improved over the previous year. The incomes from the various segments within the industry have been very favorable. One factor that can influence the economic status of this important industry is disease. Too few producers in the poultry industry recognize the staggering losses the industry encounters annually from various disease entities. Persons engaged in disease control work can appreciate what a disease outbreak of either a fulminating or chronic nature can do to the livelihood of a flock owner, hatcheryman, or a broiler producer. The poultry industry should recognize that diseases are a major and constant threat to its successful development and existence.

We, as veterinarians and as livestock sanitarians, should also be cognizant of the fact that our responsibility to this problem is very vital. We must support improved and more efficient husbandry practices. Furthermore, we should develop and place into practice effective disease control and prevention methods.

In part, the poultry disease situation may be appraised as follows:

RESPIRATORY DISEASES

Respiratory infections constitute a major problem to the poultry industry in the United States and Canada. Newcastle disease, infectious bronchitis, and chronic respiratory disease are very prevalent and widespread in both Countries.

Newcastle Disease: During the past year new vaccines have been placed on the market and additional methods for the immunization of chickens have been described (1, 2). At the present time, poultry flocks can be protected effectively against Newcastle disease, if the available live virus vaccines are applied properly. In each state, livestock sanitary officials, veterinarians, poultry pathologists, together with industry members, should determine the extent of their Newcastle disease problem and make recommendations accordingly. Research workers and commercial vaccine companies should not advocate a method of vaccination or offer for sale a vaccine until it has been proved successful in protecting flocks against Newcastle disease.

Attached to this report is a list of references on Newcastle disease prepared by Doctor Beaudette.
Injectious Bronchitis: During the past year infectious bronchitis has appeared in widespread outbreaks in certain states resulting in serious egg losses in laying flocks. More states are adopting the method of inoculating young flocks with the live virus which produces an active outbreak of the disease and a subsequent immunity to future exposure to the infection. This method of preventing outbreaks of the disease is the only effective means at our disposal at the present time. Commercially prepared bronchitis vaccines are being offered at the present time by two commercial companies. These vaccines should not be used in states or areas where infectious bronchitis is no apparent problem.

Chronic Respiratory Disease: This disease has received considerable attention from research workers during the past year. Our knowledge of this disease has increased concerning its prevalence, the nature of its etiology, transmission, immunity, carriers, serology, pathology, and response to various antibiotics (3, 4, 5, 6).

ORNITHOSIS

The importance of turkeys in the occurrence of ornithosis (psittacosis) in man has been shown by Irons (7, 8) who described epidemics in poultry plant workers in Texas in 1948-1952.

The finding of an ornithosis infected turkey flock by Boney et al. (9) demonstrated the potential importance of such birds in human disease outbreaks. The infectivity of the turkey strain for humans was further demonstrated by infection among several laboratory workers. The findings of Meyer (10) showed that it was a highly virulent endotoxic strain.

Veterinarians in poultry disease research and diagnostic work should not overlook ornithosis as a problem in either turkeys or chickens. The turkeys from the flock from which the agent was isolated showed symptoms and lesions which could have been confused easily with the lower form of infectious sinusitis of turkeys.

Very little is known regarding the clinical picture and pathology of ornithosis in chickens and turkeys. How widespread it occurs under farm conditions is not known. The isolation of the agent from a flock may indicate wider distribution than presently recognized. Most workers believe these birds to harbor the infection and remain asymptomatic. Much research is needed to clarify this phase of the epidemiology of the disease.

BLUECOMB IN TURKEYS AND CHICKENS

In some areas bluecomb disease continues to be a serious problem in chicken and turkey flocks. The symptoms and lesions of the disease in chickens and turkeys appear quite similar.

Watanabe (11) in Japan reported preliminary studies on the disease in chickens and was able to reproduce the disease by using various tissues and intestinal material.

Pomeroy and Sieburth (12) observed field outbreaks and have repro-
duced experimentally the disease in turkeys of all ages, from poult less than a week of age to adult birds. The transmissible agent has been demonstrated only in unfiltered, intestinal material. This material does not produce a similar disease in young chicks. Antibiotics such as streptomycin, penicillin, aureomycin, and terramycin were found effective in altering the course of the disease in turkeys. Until more information is available on the etiology and specific diagnostic procedures, the problem in chickens and turkeys will remain confused because of the many terms that are used in various sections of the United States to describe the condition.

These studies reopen the question that bluecomb disease may be an infectious disease.

"HEMORRHAGIC DISEASE" IN POULTRY

During the past year a disease condition designated by some workers as "hemorrhagic disease" has received increased recognition. Outbreaks have been observed in all sections of this Country except in the far western states.

This disturbance appears to occur only in young chickens, approximately 3 to 12 weeks of age, with the majority of cases occurring in 5 to 7-week-old birds (13). Extensive hemorrhages may occur in various body tissues. The blood picture has been altered indicating a disturbance of the hemopoietic system. Death losses may be high. The etiology of the condition has not been determined. Vitamin K deficiency, associated with other factors, has been reported as the cause. Some workers have reported that sulfonamids, antibiotics, and other drugs might be responsible for this condition. Further investigation is necessary relative to its etiology, and its clinical and pathologic aspects before effective corrective measures can be recommended. Also, a more appropriate terminology for this disturbance should be based on an adequate knowledge of this disease.

SALMONELLA INFECTIONS

Pullorum Disease: Reports from testing agencies and diagnostic laboratories reveal that progress is being made in reducing and eliminating pullorum infection from our poultry flocks. Pullorum testing results for 1953 released by the Bureau of Animal Industry, United States Department of Agriculture, revealed the following: Chickens - tested flocks 86,300, tested birds - 35,654,526, per cent reactors - 0.23; Turkeys - tested flocks 4,164, tested birds - 2,753,966, per cent reactors - 0.18. These results revealed that the percentages of reactors for the chickens and turkeys were less than those of the previous season. It is evident that greater progress is being made in eliminating pullorum disease in certain areas than in others. It is gratifying that some states have been successful in reducing the amount of infection in breeding flocks to zero. In some states pullorum disease outbreaks in young and old stock are becoming increasingly rare. Other areas can obtain the same results through sound and effective measures.

Fowl Typhoid: In many areas fowl typhoid is of economic concern to the
industry. The importance of this disease has been recognized by the General Conference Committee of the National Poultry Improvement Plan. It is evident that often a focus of infection may lead to several outbreaks of the disease in a community. To reduce or prevent the spread of the infection, all affected flocks should be liquidated completely, or if only part of the flock is sold, the survivors should be tested with the macroscopic tube agglutination test to detect the presence of infected birds. The disposition and testing of infected flocks should be done under supervision. Regulatory officials should take an active interest and part in such a program.

Paratyphoid Infections: Paratyphoid and paracolon infections are primarily problems in turkey flocks, but laboratory reports indicate that there is an increased incidence in chicken flocks. At a conference of National Plans General Conference Committee and an industry advisory group in Cincinnati, Ohio, June 22-24, 1953, a recommendation was proposed that increased efforts should be made to reduce the incidence of all Salmonella infections of poultry. There is considerable interest on the part of the poultry industry for the development of control programs for paratyphoid and paracolon infections. A control program for these problems is more than a testing program because of the number (60 or more) of Salmonella and paracolon types that have been encountered in poultry. The first step in developing a program on a flock, area, or state basis is determination of the prevalent types of Salmonellas and paracolons. This requires cooperation between the diagnostic laboratory and the hatcheryman and poultryman, and serological typing of all Salmonella and paracolon isolates. On the basis of laboratory examinations of poults and chicks, recommendations may be made for a testing program or a flock elimination program. Because of the high incidence of S. typhimurium, control programs in a few states have been initiated for this type. The basis of the program is to pinpoint the infected breeder flocks. The final status of the flock is determined on the results of the bacteriological examination of reactors to the test and not on the serological tests alone. Individual breeding flock owners must then choose between an intensified testing and management program or elimination of the breeding flock.

The second phase of the program is to eliminate contact of the breeding flock with potential carriers of Salmonella infections such as dogs, cats, swine, cattle, horses, barnyard fowl, and pigeons. A vigorous rodent control program is a necessity on each poultry breeding farm. Safeguards should be taken to avoid contamination of the feed with rodent droppings.

No official status is given to the paratyphoid testing program and participation is on a voluntary basis. Because the antigens used in the program are not tested by any official governmental agency, the North Central Antigen Committee has initiated a program of standardization of paratyphoid antigens and procedures so that a sound basis for a control program may be developed.
IMPORTATION OF POULTRY

Regulations designed to protect the poultry industry of this country from dangerous foreign poultry diseases, particularly fowl pest (fowl plague) and lethal types of Newcastle disease, are administered by the Bureau of Animal Industry, Inspection and Quarantine Division.

Such regulations are briefly summarized as follows: (a) for poultry intended for importation from any part of the world, except Canada, the importer shall first obtain a permit from the Bureau. The poultry will be received at a specified port of entry within the dates prescribed for their arrival and will not be eligible for entry if shipped from any foreign port other than designated in the permit; (b) poultry offered for importation shall be accompanied by a certificate of a salaried veterinary officer of the national government of the country of origin stating that such poultry and their flocks or origin were inspected on the premises of origin immediately prior to shipment and found to be free of evidence of communicable diseases or exposure thereto, during the 60 days immediately preceding shipment; (c) if upon examination at the port of entry the birds are found to be apparently healthy, it is required that they be held in quarantine at the port of entry for not less than 15 days. Quarantine is not required for poultry less than 60 days of age, for hatching eggs, or for poultry imported from Canada.

The import regulations are applicable to chickens, ducks, geese, swans, turkeys, pigeons, doves, pheasants, grouse, partridges, quail, guinea fowl, and pea fowl, of all ages, including their eggs for hatching.

During the period from April 1, 1952 to March 31, 1953, 4,447 birds of various kinds, subject to the regulations, were released from quarantine. These birds were covered by 212 permits and originated in 27 foreign countries. Following quarantine, they were consigned to 22 States. In addition, 3,024 hatching eggs of various kinds were permitted entry.

Only 149 birds (3.2 per cent) died in quarantine. Many of such birds were submitted to recognized laboratories for postmortem bacteriological examination. In no instance was Newcastle disease or fowl pest diagnosed. Most of the deaths were due to parasitism and emaciation.

Approximately 90 per cent of the birds imported during the period covered by this report were transported by air from the country of origin to the port of entry. This fact emphasizes the importance of an adequate period of quarantine prior to actual entry into this country.

OUTSTANDING POULTRY DISEASE PROBLEMS IN CANADA

The less spectacular poultry diseases such as coccidiosis, leukemia, parasitism, and tuberculosis continue to account for considerable mortality in Canadian poultry flocks. The cumulative loss from leukemia alone requires continued research and investigation. Progress in the reduction of pullorum disease under the National Pullorum Control Program continues favorably
with approximately two and three-quarter million birds (chickens) being
blood tested annually; approximately three-quarters by the whole blood, rapid
method.

In the past year 42 flocks were destroyed for fowl typhoid. Paratyphoid
infections appear to be on the increase, particularly in the Western Provinces.
With the recognized hazard of human infection, efforts are being directed
towards developing serological tests. The problem has already been attacked
by examining procedures which would prevent the particular Salmonella
organisms involved from contaminating the egg interior and shell.

Respiratory infections, such as air sac infection or chronic respiratory
disease and infectious bronchitis, are causing considerable loss, more from
the standpoint of high morbidity and reduced market value than from actual
bird mortality. Chronic respiratory disease continues to be identified in
new areas each season and the lack of effective control measures is a
problem to the poultry industry which requires continued investigation.
The incidence of infectious bronchitis has been recorded through a nationally
conducted survey and has been identified as being present in practically
all poultry producing areas of Canada. Generally, the disease has been of a
low virulence but accompanied by a high morbidity. Considerable satisfac-
tion is being obtained through the use of infectious bronchitis vaccine
programs, both on broilers and replacement flocks. In many cases growers
are adopting the combined Newcastle disease, infectious bronchitis spray
vaccine. The incidence of Newcastle disease has declined remarkably and
the use of the attenuated live virus vaccine (Blacksburg strain) has pro-
tected young stock satisfactorily.

Erysipelas: An analysis of the incidence of Erysipelothrix rhusiopathiae
in poultry received by the two New Jersey laboratories indicates an increase
during the past six years. Of 22 outbreaks, 20 occurred in turkeys, 1 in ducks,
and 1 in pheasants. In New York aside from numerous outbreaks in turkeys,
1 outbreak was encountered in ducks and 2 in chickens. The epizootiology
of this disease is still not adequately known.

Coccidiosis: Two new non-pathogenic species of coccidia in turkeys have
been described; E. innocua and E. subrotunda. The coccidiostatic effect of a
number of drugs were tested under controlled conditions against the following
turkey species of coccidia: E. adenoeides, E. gallopavonis, E. meleagridis,
E. innocua, E. subrotunda, E. dispersa, E. meleagrimitis. Medication was
given 24 to 48 hours prior to inoculation with coccidia. Sulfamethazine in
the water (1:1000 and 1:2000) and acetylsulfaquinoxaline in the feed
(.0175% and .05%) were effective in preventing mortality and reducing
oocyst output. Nitrofurazone, 2-amino-5-nitrothiazole, nitrophenide, and sul-
fisoxazole had no effect upon the course of the experimental infections.

A study of the output of oocysts by the different species of chick coccidia
indicates that the species may be ranked in descending order as follows:
E. acervuline, E. tenella, E. brunetti, E. maxima and E necatrix. Contrary
to the original report by Tyzzer, it has been found that young chickens are more severely affected with *E. necatrix* than older birds.

Oocysts of *E. tenella* altered by ultrasonics, radium, and heat at 60° C did not confer immunity to chickens. Oocysts treated by freezing and by heating at 45° C induced some protection. It has been demonstrated that selective breeding can increase resistance of chickens to *E. tenella*. The coccidiostatic effect of nitrophenide on *E. tenella* is exerted on the second generation schizonts. Treatment between the 48th to 96th hour after exposure is effective.

REFERENCES


Doctor Beaudette prepared the following list of Newcastle disease references. This list is to supplement previous lists that have been published by Doctor Beaudette in the Proceedings of the United States Livestock Sanitary Association.


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70. HITCNER, S. B., AND REISING, G.: Flock Vaccination for Newcastle Disease by


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TRANSMISSIBLE DISEASES OF POULTRY


History records that even in medieval times, food production and distribution were matters of governmental concern. Since then, the increasing complexities of our civilization have demanded that we intensify our vigilance over the food industry. This is not merely for the sake of regulation, but principally because the age-old concept of caveat emptor—"let the buyer beware"—no longer seems to apply. One author stated that "it has been discarded as being without justification in the uneven balance existing between manufacturer and consumer."(1) All this adds up to the fact that, today, consumers of foods rely heavily on the concern of the food industry for their health and well-being, and on the integrity and honesty of the public servants who are employed to protect their interests.

For several years now, the matter of poultry hygiene, including inspection, has been considered by the veterinary profession, and by public-health authorities as well. Apropos of this, many well-meaning industry spokesmen have said, in all good faith, "why pick on the poultry industry?" Why this sudden interest in the so-called hazards of the poultry industry?

Perhaps we should begin here: Why this interest? In recent years, the poultry-processing industry has expanded at an unprecedented rate, and this expansion is directly associated with significant changes in processing, storage packaging and sales methods. There is considerable contrast with the old days when most market poultry was only incidental to the production of eggs. Strangely enough, these same changes in processing methods have brought to light many sanitation problems heretofore associated only with other large scale food-processing operations.

Although nutritious and appetizing when wholesome and properly processed, poultry and poultry products (like any other food) can transmit disease to man when contaminated with pathogenic organisms. Poultry meat which is derived from diseased birds, or which becomes contaminated with harmful organisms during processing or subsequent handling, is a hazard to human health. Epidemiologists are aware that poultry constitutes an important animal reservoir of disease organisms affecting man. Such diseases may be transmitted to him through contact with birds on the farm, during the processing procedure, or through the consumption of poultry or poultry products. In addition, we must not disregard the large number of

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food-borne-disease outbreaks which are not due to the food products themselves, but rather to their contamination by careless food service personnel.

Today, poultry-processing plants may be located hundreds or thousands of miles from points of consumption. Poultry and poultry products are handled by numerous workers, and often remain in storage for extended periods of time. How can the consumer in the Northwest, for example, determine through his regulatory agency the fitness of birds that have been processed on the eastern seaboard? Some local health departments in receiving areas, in an effort to control the wholesomeness and quality of poultry being sold in their jurisdictions, have inadvertently or otherwise adopted ordinances of a "trade-barrier" type. That type of ordinance was dealt with severely by the United States Supreme Court in 1951 in its decision in the case of the Dean Milk Company vs. the City of Madison, Wisconsin. The Court held certain provisions in a municipal ordinance to be discriminatory against interstate commerce. (These provisions made it unlawful to sell any milk within the municipality as pasteurized milk, unless it had been processed and bottled at an approved pasteurization plant within a radius of five miles from the central city square). The Court held that a municipality cannot curtail interstate commerce—even in the exercise of its unquestioned power to protect the health and safety of its people—when reasonable, non-discriminatory alternatives, adequate to conserve legitimate local health interests, are available. The alternatives outlined by the Court were: (1) inspection by municipal officials of distant milk sources, for which the receiving municipality could charge the actual and reasonable cost of such inspection to the shipping producers and processors; (2) adoption of the provisions of the Milk Ordinance and Code Recommended by the Public Health Service, which imposes no geographical limitation on location of milk sources and processing, but excludes from the municipality milk not produced and pasteurized conformably to standards as high as those enforced by the receiving city. Applied to the matter under discussion, the courts will be justified in holding as invalid any ordinance or set of regulations that will prevent the free movement of other wholesome foods in interstate and intrastate commerce.

Reduced to plain facts, we must consider that first, poultry is a food product that must be carefully processed and handled to be safe for human consumption; and, second, the society in which we live has designated public service agencies to protect the interests of consumers in lieu of surveillance by the individual.

What is being done along these lines in the year 1953?

On the Federal level, the United States Department of Agriculture conducts a two-phase voluntary program, involving inspection and sanitation. Approximately 15 to 20 per cent of our supply of processed poultry is covered by its provisions. The Food and Drug Administration of the Department of Health, Education, and Welfare helps to assure the wholesomeness of poultry which is shipped in interstate commerce. This is accomplished through the
inspection of the establishments where these products are processed and by
the examination and condemnation of lots of poultry which are known or
suspected to be adulterated or otherwise unfit for human consumption.

A large proportion of poultry is consumed in the same locality or State
in which it is originally processed. Probably less than 30 per cent of the
processed poultry in this country is supervised by programs of the United
States Department of Agriculture and the Food and Drug Administration.
Only rough estimates are available as to how much of the remaining 70 per
cent is supervised by State and local regulatory officials. Unfortunately, the
majority of this poultry receives, merely cursory, supervision.

In an effort to improve some of these situations various ordinances and
regulations have been adopted by States and communities. Some are adequate
and well formulated, while others are based primarily or partially on revenue
raising factors. Trade barriers flourish under this latter type whose strength
is dependent upon minor differences between it and the regulations that
exist elsewhere. Sincere and honest public officials take a dim view of any
measure which is in restraint of trade, and which may eventually affect the
health and nutrition of the people.

Forward-thinking health officials are alive to the need for a standard model
ordinance covering poultry inspection and sanitation, similar in scope to the
Public Health Service recommended ordinances and codes regulating milk
and eating and drinking establishments. On a number of occasions, the
Conference of the Surgeon General of the Public Health Service with the
State and Territorial Health Officers has indicated concern over the inability
of our present programs to protect adequately the consumer of poultry and
poultry products. At its meeting in Washington, D. C. last December, it
was recommended "that the States strengthen their State and local programs
for controlling the hazards associated with the processing of poultry, in-
cluding, but not limited to, such items as inspection for wholesomeness and
sanitation in storage, transportation, and retail sales; and that the Public
Health Service continue to apprise the State and Territorial enforcement
agencies concerning progressive codes for conducting effective poultry-in-
spection programs." Prior to the issuance of that resolution, your Associa-
tion, in October 1952, through its Committee on Meat and Milk Hygiene,
ruled: "Your Committee recommends the setting up of local administration
and enforcement of poultry sanitation and poultry inspection. Model ordi-
nances for both poultry sanitation and poultry inspection should be
formulated." Elsewhere in the report, it was emphasized that nothing can
be found in the methods or economics of the poultry industry that would
not adapt itself to the presently accepted methods for controlling milk
production. The report went on to say: "To assure widespread uniformity
and acceptance of the product, a system of public-health scoring by areas
should also be established."

Early in 1952, in anticipation of needs in this area of public health, the
Public Health Service formulated plans for the conduct of a poultry hygiene
program. Later that year, leaders of the poultry industry, realizing the apparent need for uniform standards, offered to assist the Service in developing the first part of a two-part model poultry ordinance. This portion, devoted to sanitation, will serve as the basis for relieving existing inadequacies in the processing and handling of poultry and poultry products. Shortly thereafter, a public-health-liaison committee was established to review the progress made in the development of the ordinance and to offer suggestions for its improvement. This portion, Part I—Sanitation, was released to health jurisdictions, to professional veterinary associations and to the industry, for review and comment. The final draft has now been prepared, including many of the comments received in response to our request. It is presently scheduled for publication early in 19X.

The detailed sanitation requirements contained in it are those which cannot be compromised from a public-health standpoint. They are essentials that can be complied with by large and small operators—without hardship to either group.

Buildings must be conducive to sanitary maintenance; rodents and insects must be built out. Products cannot be contaminated by improperly collected refuse, by equipment which is not constructed, located, operated, and maintained properly, or by employees who do not have proper facilities for washing their hands thoroughly at lavatories properly provided with soap and sanitary towels. The importance of prompt chilling and refrigerating facilities is emphasized. These are but a few of the provisions that will guide the plant operator to more effective operation.

The Public Health Service believes strongly that a poultry regulatory program is not complete without provision for ante-mortem and post-mortem inspection of poultry for wholesomeness by competent personnel. Therefore, Part II, entitled Ante-Mortem and Post-Mortem Inspection, is being prepared to complete the two-part document. This portion will be released after thorough review by experts in this field outside of the Public Health Service.

It is obvious that many questions remain unanswered with respect to the successful application of inspection procedures on the local or State level. This fact alone, however, should not prevent jurisdictions from embarking on programs of this type as soon as competent personnel and sufficient funds are available, for it is only through facing obstacles squarely, plus a little of the pioneering spirit, that progress will be made in this area. Among the obstacles currently recognized are: (1) the shortage of professional personnel; (2) the current unmet need for training facilities to be used for training lay inspectors, and (3) the generally inadequate salary scale for activities of this type.

Regulatory officials must not fail to recognize that improperly enforced food-control regulations provide a false sense of security to the consumers and, in general, foster lack of respect for the programs which they conduct. The industry might well heed the words of James Anthony Froude, an
English historian, who said, "Just laws are no restraint upon the freedom of the good, for the good man desires nothing which a just law will interfere with."

Because sanitation is a basic necessity in the processing and handling of perishable foods such as poultry, *Part I - Sanitation*, alone, may be adopted. Those jurisdictions which are able to provide the necessary funds and trained personnel to conduct ante-mortem and post-mortem inspections may adopt both Part I and Part II. However, the ordinance is so worded that Part II should never be adopted alone, but rather in conjunction with Part I. Each part is further divided into (1) an adoption-by-reference form, and (2) a complete form.

Since cost is a major factor, the adoption-by-reference form, being more convenient and less costly, is suggested for local adoption in areas where the adoption of ordinances by reference to published standards is considered legal.

On several occasions, I have been asked why Part I of the ordinance is to be released in advance of Part II. The reasons for this administrative action are twofold:

1. We have previously agreed that sanitation of poultry-processing plants is basic to a poultry-hygiene program and a prerequisite to effective poultry inspection. By offering Part I to regulatory officials at an advance date, we are providing them with an opportunity to solve an immediate and pressing problem.

2. The time interval between the issuance of the two parts will provide public-health and veterinary regulatory officials with an opportunity for studying some of the complexities associated with carrying out ante-mortem and post-mortem inspection in States and municipalities.

Perhaps, some of you are under the impression that the major portions of the industry are oblivious to certain deficiencies in operations about which we are speaking today. This is not so. Let me review briefly the action that has been taken by the industry for self-improvement in plant sanitation. Several sanitation schools for management have been sponsored by the Institute of American Poultry Industries. In addition, the Institute has prepared a sanitation manual which, I am sure, will be of assistance to progressive members of the industry.

Likewise, the Poultry Branch of the United States Department of Agriculture is to be commended for scheduling, on a sectional basis, many sanitation institutes throughout the United States during the past two years. Through their good work, there has been a renewed interest in improving and maintaining poultry-plant sanitation.

There has been in the past, and will continue to be in the future, much discussion regarding the most feasible method for conducting poultry inspection. In an address to the 1950 Convention of the American Veterinary Medical Association, Brigadier General W. O. Kester, Assistant for Veterinary Services, United States Air Force, states: (3)
"An inspection agency, to be acceptable, must comply with the four cardinal prerequisites for an adequate inspection service. First, the inspectors must be competent and qualified. Second, they must have tenure of office, so that no one may put pressure on them in connection with their duties. Third, the inspectors’ agency or supervisors must be responsible and accountable to the consumer. Fourth, the inspectors must have no financial interest or connection with anyone in the organization being inspected."

Generally speaking, these are the cardinal principles of inspection.

The qualifications for lay inspectors and their relationship to professional veterinary personnel have been discussed repeatedly during recent years. On this point, I should like to say that the proposed poultry ordinance does not attempt to set standards covering relative qualifications for employment. On matters such as this, the Public Health Service will be guided by the judgment of the organized associations of the veterinary profession and by outstanding public-health authorities. At the moment, the policy statement of the American Veterinary Medical Association relative to the use of lay inspectors is basically sound. As you may recall, it states that lay persons should be authorized to sort the abnormal from the normal; the latter to be passed without restriction; the former to be left to the judgment of the veterinary inspector. No particular educational level is required beyond common sense and good judgment. Well organized, on-the-job training will be encouraged.

This policy is consistent with the belief of most veterinary public-health authorities that many of the individual points of the inspection process can be undertaken by persons of limited training. To employ veterinarians on routine tasks, which can be performed ably by technical personnel of lesser qualifications, would be inconsistent with the concept that professional personnel should be utilized to the maximum. The work of inspection must be downgraded so it can be filled by less highly trained personnel, while supervisory work should be reserved for the special knowledge and training found in the veterinarian.

Through the adoption and enforcement of the proposed poultry ordinance by cities and States, health officers may assure themselves of an adequate level of sanitation in poultry-processing plants and safe, wholesome poultry and poultry products. Through its provisions they may authorize for sale in that community poultry and poultry products which are processed in other jurisdictions operating under this ordinance or its equivalent. The widespread adoption of this ordinance should provide a basis for the free interstate and intrastate movement of wholesome poultry and poultry products. It should provide standards of sanitation in poultry processing, storage and sales, and inspection to a level consistent with public-health requirements.

The veterinarian who is qualified in the field of food hygiene is in a strategic position to influence the quality, quantity, and safety of wholesome foods of animal origin.
The traditions of the United States Livestock Sanitary Association have been strong in this regard. We welcome your support, as a respected, allied public-health organization which has helped to chart the course to public-health improvement through legislation and education.

REFERENCES


THE EFFECT OF GRADE A MILK REQUIREMENTS ON THE NATIONAL BRUCELLOSIS ERADICATION PROGRAM

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The primary objective of the Public Health Service in the conduct of its milk-sanitation program is the prevention of milk-borne disease in man. Among its other major objectives of importance to the milk industry, as well as to public-health and agricultural regulatory agencies, are the standardization of milk-sanitation requirements and the uniform application of enforcement methods throughout the United States.

We feel justified in making the statement that these objectives, through the combined efforts of regulatory agencies and the milk industry, have been realized to a greater extent in this country than in most countries of the civilized world. Moreover, the high standards established have improved materially the economy of livestock production, and have made available a more abundant and wholesome food supply of animal origin. To illustrate:

It is well known that in the early 20's, dairy cattle owners in the Chicago milkshed rebelled against the heavy losses they were called upon to bear as a result of bovine tuberculosis. Tuberculin testing was practically discontinued for a time, as a result of refusal on the part of the owners of dairy cattle to permit the testing of their herds. Dr. Herman N. Bundesen, who was then, as now, the President of the Chicago Board of Health, promoted a City health ordinance which prohibited the sale on the Chicago market of milk produced from untested or tuberculous dairy herds. After much discussion and deliberation, the attitude of livestock producers was changed. The tuberculosis-eradication project was reinstated, and other cities and States adopted public-health milk ordinances containing tuberculosis eradication provisions, thus providing one of the most impelling forces for bovine tuberculosis eradication. The remarkable progress made in this project has excited the admiration of both public-health and livestock-disease-control agencies of the entire world.

We are all familiar with the many obstacles encountered in the brucellosis-eradication project, and of the "shot in the arm" of the brucellosis provisions of the Illinois State grade A milk law which becomes effective January 1, 1955. This law requires that grade A milk may be sold in the State of Illinois, after that date, only if produced from herds free from brucellosis. Therefore,

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all milk sold in Chicago will be required to be from brucellosis-free herds after January 1, 1955. This law has materially affected every State selling milk or milk products on the Chicago market, and has greatly stimulated efforts being made by all such States to control, and eventually to eradicate, brucellosis from domestic animals. Domestic animals are the only source of brucellosis in man.

It should be pointed out that similar standards to those set up by public-health authorities in connection with the marketing of milk have been adopted by livestock producers themselves, in the form of restrictions on interstate and other movements of livestock; these have been most helpful in the control and elimination of livestock diseases. This Association has recommended Federal regulations pertaining to brucellosis; however, only limited action has thus far been taken toward this end. We in the Public Health Service are pleased that all interested groups will be represented at a meeting to be held in Washington next week to study a proposed regulation in this connection.

The Milk Ordinance and Code—1953 Recommendations of the Public Health Service is a milk-sanitation standard designed for voluntary adoption by States and municipalities. It represents the combined judgment of individuals and groups concerned with milk sanitation from all parts of the country. Hundreds of proposals for changes in the new edition of this Milk Ordinance and Code have been received from State and local milk-sanitation enforcement agencies, professional public-health organizations, livestock sanitary groups, Federal agencies concerned, various agricultural and dairy-industry groups, and others. These proposals were carefully compiled and submitted for comment to State and local municipalities and to the dairy industry. The proposals were then submitted for review and comment to the Public Health Service Milk Sanitation Advisory Board—a group of recognized authorities on milk sanitation, some from industry, some from regulatory agencies. This background is mentioned to familiarize you with the procedures followed in the development of this Ordinance and Code.

A concerted effort was made, in the formulation of the animal-health provisions in this new edition, to bring about a closer relationship between States and local milk-sanitation programs and the animal-disease-control programs of the respective States livestock sanitary officials and of the local veterinary practitioners. The 1939 edition of the Public Health Service Milk Ordinance and Code required that all milk and milk products intended for raw consumption be from dairy herds which were free from brucellosis. It contained no provisions with respect to brucellosis control for milk which was produced for pasteurization. This has been recognized, for a number of years, as a shortcoming of the Ordinance, and has been corrected in the 1953 recommendations by the following requirement:
have taken place since the publication, in 1939, of the previous edition, and the relatively long period of time since it has been revised or amended.

In addition to use as State and local regulations, the 1953 edition of the *Ordinance and Code* has been adopted by the National Conference on Interstate Milk Shipments as the basic standard to be followed in evaluating or rating interstate milk supplies. It has been incorporated, also, into the Federal Specifications for milk and milk products under which sources of milk and milk products for Federal purchase are selected, including those for our military forces.

As an indication of the areas of the country in which the program of the National Conference on Interstate Milk Shipments is in effect, 26 of the States officially participated in four such conferences held in 1950, 1951, 1952, and 1953. During the past year, 30 States and the District of Columbia have engaged in this program to the extent that they have submitted ratings on interstate milk shippers located within their jurisdiction, for publication in the Public Health Service lists of compliance ratings for interstate milk shippers. It has not been determined, as yet, how many of the receiving States are also participating in this program by utilizing this list of compliance ratings as a means of locating good milk to supplement their milk supply. However, the mailing list of those who have specifically requested to receive copies of each list contains well over 1,000 names. Some of the major milk-shipping areas (as, for example, Wisconsin and Minnesota), have inaugurated extensive programs to take advantage of the over-all interstate milk shipment program. With respect to brucellosis, the 1953 Conference adopted a resolution that all dairy herds producing milk for interstate milk shipments under the interstate milk shipment certification program of the Conference be under either Plan A or Plan B.

The areas affected by Federal Specifications for milk are widely distributed throughout the entire country. The Armed Forces, for the most part, purchase Type II No. 1 milk, which is milk produced in accordance with the Public Health Service *Milk Ordinance and Code* or an equivalent standard. Other Federal agencies similarly specify in their contracts that milk of this quality be delivered to their installations.

It is obvious, therefore, that the new edition of the *Milk Ordinance and Code* will play a significant part in the eradication of brucellosis from dairy herds throughout most of the United States. Recognizing this in the development of its brucellosis provisions, we have attempted: (1) to analyze objectively the public-health hazards involved in the spread of brucellosis to rural as well as to urban populations; (2) to consider the practical application and economic implications of these provisions from the dairyman's point of view, as well as from that of the regulatory agencies, and (3) to arrive at an approach which is as uniform as possible with other brucellosis-control programs, and which will strengthen the over-all national brucellosis program.

There has been a reduction of almost 50 per cent in Federal personnel
3. Industry (in this case, the farmer), is under moral, as well as legal, obligation to offer for sale only food products which are safe and wholesome.

For the above reasons, to recognize a plan for the control of brucellosis which permits the unrestricted retention of brucellosis reactors in the dairy herd would place persons responsible for safeguarding market milk supplies in a rather difficult position. Why, then, is Plan B recognized at all in this model standard?

Since this is the first edition of the Ordinance and Code which will contain brucellosis requirements for dairy herds supplying milk for pasteurization, it was believed to be unfair to the dairy farmers to require suddenly that their herds be free of brucellosis. The fact was recognized that brucellosis cannot be eliminated over night in some dairy herds, without resulting in serious economic hardship to the dairyman. However, a start toward eliminating the public-health hazard of the transmission of this disease by means of milk supplies had to be made.

With the aid of the State livestock sanitary officials and the United States Department of Agriculture at their disposal, it is generally agreed that there is little reason why dairymen cannot, within a relatively short period of time, adopt either Plan A or Plan B to eliminate brucellosis from their dairy herds. To do so would not entail any expense to the dairymen whose herd is free of brucellosis reactors. If his herd should contain reactors, he will, under Plan A, be required to dispose of such reactors immediately; or, under Plan B, be permitted to retain the reactors in the herd for a temporary period of time. Remarkable progress already has been made in many areas of the country, and even in entire States, by dairymen, livestock-disease-control officials, public-health officials, and others, joining forces in a concerted effort to eradicate brucellosis from dairy herds. This effort should, and no doubt will, continue until the problem has been solved.

It is rather difficult to measure accurately what effect the brucellosis provisions in the new edition of the Public Health Service Milk Ordinance and Code will have on the control of brucellosis in dairy herds throughout the United States. We have rather accurate and current data, however, with regard to the extent of adoptions of the 1939 edition.

At the present time, it has been adopted by approximately 1,500 municipalities and 400 counties in 38 States and Alaska. Also, it is the basis of milk-sanitation laws or regulations in 32 States, Alaska, and Hawaii. Others not now operating under this Ordinance and Code are expected to adopt it, while still others, although not adopting it in its entirety, will, no doubt, adopt specific provisions, such as that for brucellosis.

Past experience with the issuance of new editions of the Ordinance and Code indicates that the majority of municipalities and States will, within a period of 5 years, revise their ordinances or regulations to conform with the new edition. We expect this period of time to be considerably shorter for this particular edition, because of the many technical developments that
will be revised to require all milk-producing herds to be under Plan A; therefore, a dairyman who has brucellosis reactors in his herd is urged to eliminate a sufficient number of such reactors each year so that all reactors will have been removed from the herd within a period of 3 years after his entry into Plan B. A longer period of time may be needed in isolated instances where the incidence of brucellosis in the herd is higher than 50 per cent."

As a result of close liaison with the Bureau of Animal Industry and others concerned with animal-disease-control work, these brucellosis provisions follow very closely the brucellosis program which was recommended by the United States Livestock Sanitary Association and approved by the United States Department of Agriculture. They also reflect a concerted effort to standardize and coordinate the animal-disease provisions of this *Ordinance and Code* with the animal-disease programs of the States.

As can be expected in developing any standard with broad application, these brucellosis provisions are not completely satisfactory to everyone concerned. They are considered too stringent by some, and too lenient by others. The fact that they provide the dairyman with a choice between two plans for the control of brucellosis in his dairy herd, and that under Plan "B" he is permitted to retain reactor animals in his herd for a temporary period of time, would seem to be reasonable from the dairyman's point of view. In view of the fact that brucellosis in dairy herds is very costly to the dairy farmer in terms of dollars and cents, and is a health hazard to himself and to the members of his family who consume the milk and handle the infected animals, it is obvious that he stands to profit by inaugurating a brucellosis-eradication program without delay. With the depressed prices of food of animal origin, it would seem that the time has come for the prompt elimination for slaughter of the remaining brucella-infected animals, particularly in those areas where a systematic brucellosis-eradication program has been in effect for some time.

Arguments that the brucellosis provisions of this new *Ordinance and Code* are too stringent do not appear to be valid from the point of view of the milk consumer, for the following reasons:

1. A public-health hazard is involved in permitting milk from diseased animals to be sold for human consumption, even when such milk is pasteurized. True, pasteurization is a very effective safeguard against the transmission of brucellosis from the cow to the milk consumer, but as a mechanical operation, pasteurization is subject to failure and, when manually operated, to human error.

2. Anyone who purchases grade A milk expects it to be of unquestionable quality; certainly, that it was produced from healthy cows. The definition for milk in this *Ordinance and Code* states that "milk is the lacteal secretion, practically free from colostrum, obtained by the complete milking of one or more healthy cows."
"Within 1 year after the adoption of this ordinance, all milk and milk products for pasteurization shall be from herds certified by the State Livestock Sanitary Authority as following either Plan A or Plan B approved by the Bureau of Animal Industry for the eradication of brucellosis. Evidence of this certification shall be filed as directed by the health officer. All additions to the herds shall be brucellosis-free. Tests and retests shall be made, and any reactors disposed of, in accordance with the latest requirements approved by the United States Bureau of Animal Industry, in effect at the time of the adoption of this ordinance. A certificate identifying each animal, signed by the veterinarian and the director of the laboratory making the test, and filed as directed by the health officer, shall be evidence of the above test."

The Code or interpretative portion of the Ordinance, reads as follows for this particular provision:

"Brucellosis.—Within the period specified in the second paragraph of this item, all herds producing milk which is to be pasteurized shall be certified as following either Plan A or Plan B approved by the United States Bureau of Animal Industry for the eradication of brucellosis, as given in Appendix A, or certified to be free of brucellosis by the State Veterinarian. All additions to the herd, except calves born into the herd, or vaccinated in accordance with the provisions for calf vaccination in the following paragraph, shall be free of brucellosis, as determined by a negative test made not more than 30 days prior to such addition. The certification to be furnished by the producer shall consist of a copy of the test or vaccination chart approved by the United States Bureau of Animal Industry and issued by the State livestock sanitary official. The recommendations of the United States Bureau of Animal Industry for the testing, retesting, and disposal of reactors for brucellosis, applicable to milk not for pasteurization as well as to milk for pasteurization are summarized in Appendix A, p. 148.

"This Ordinance does not prohibit the use of calf vaccination in herds required to be brucellosis-free. Calves which have been vaccinated at the age of 4 to 8 months with a vaccine approved by the United States Bureau of Animal Industry may be retained in the herd, if they carry a blood-serum agglutination titer no higher than incomplete in a 1-to-100 dilution; and prior to the time the animal becomes a milk producer, such titer is stabilized or receding, as determined by tests made at intervals of not less than 30 days or more than 60 days, and that there is no evidence of brucellosis infection in the herd.

"The health officer should follow the recommendations of the State and Federal livestock-disease-control officials, and assist them in developing brucellosis-free certified herds and areas. He should file his request for cooperative testing with the State Veterinarian. Ultimately, this Ordinance

11The number should be inserted when the ordinance is adopted, and the State Veterinarian should be consulted in this matter. It should not exceed 3 years if the community desires to be recognized as having adopted this ordinance."
engaged in the brucellosis-eradication project during the last 10 years. A marked increase in personnel will certainly be required to meet the additional workload anticipated as a result of wide adoption of the brucellosis provisions in the new Milk Ordinance and Code, as well as to maintain the momentum thus far achieved. It is important that we continue to be mindful of the fact that, in the past, disease eradication has paid huge dividends in a more abundant and wholesome food supply of animal origin.

Progress made thus far in brucellosis eradication justifies the conclusion that this serious disease of livestock and man will be eradicated from domestic animals, provided that basic recommendations first made by the United States Livestock Sanitary Association are adhered to, and that the livestock industry continues to support this project.

Among those fundamental procedures which are being questioned by some groups today is that of service to the owner, without cost to him except for the handling of his livestock. As pointed out above, the entire population benefits as a result of livestock-disease eradication. The consumers of food of animal origin do not object to participating in the expense of such a project when they are fully informed of the benefits to them. When the owner is required to pay for service, he may or may not cooperate in the disease-eradication program unless he is affected by an ordinance and regulation. There will always be enough of those who do not come under an ordinance or a regulation to maintain a reservoir of infection, and thereby to defeat the objective of eradication. The difference between success or failure in the brucellosis-eradication project is the difference between the owner paying for services or a well-organized program where all herds will be required to submit to one of the procedures for brucellosis eradication, without cost to him except for the handling of his livestock.
REPORT OF THE COMMITTEE ON PUBLIC HEALTH

Dr. W. L. Bendix, Richmond, Virginia, Chairman; Dr. A. G. Boyd, Sacramento, California; Dr. T. B. Clower, Atlanta, Georgia; Dr. A. R. Miller, Washington, D. C.; Dr. G. A. Rose, Ottawa, Canada; Dr. E. A. Willick, Regina, Saskatchewan; Dr. J. H. Steele, Atlanta, Georgia; Dr. Oscar Sussman, Trenton, New Jersey.

The 1953 report is the first of the Committee on Public Health of the United States Livestock Sanitary Association. This Committee, newly named, functioned in the years previous as the Committee on Meat and Milk Hygiene. It is believed that renaming this as a Committee on Public Health will in large measure improve the service of this organization to the Livestock Industry and to the nation.

As your Committee on Public Health, it will concern itself with diseases of animals that are transmissible to man and that are/or could become an important public health problem. The Committee will confine its activities to studying such diseases and such problems and making recommendations for their control and eradication. The Committee on Public Health will also include in its deliberations recommendations for methods, procedures, etc. involved in the handling of foods of animal and poultry origin intended for human consumption. The role of the veterinarian in matters directly concerned with public health is an ever increasing one. Public Health workers are more and more realizing the contribution such properly trained veterinarians can render to improving the health of the nation. It is the role of this Committee to serve as a liaison between veterinarians, livestock producers, food processors and handlers and those agencies and organizations directly concerned with safeguarding public health.

BRUCELLOSIS

The problem of Brucellosis in the milk supply of all the cities and towns in the United States is receiving an increasing amount of attention from public health workers having the responsibility of insuring a safe and healthful milk supply in their respective territories. To date there are ordinances either local, sectional or in a few instances statewide requiring some sort of attention to the Brucellosis problem in milk producing herds in 29 states. These ordinances vary widely in character and in areas covered. In one state all the milk sold is required to be from Brucellosis tested and negative animals. In some states all the major cities have Brucellosis ordinances of one kind or another while in some other states the ordinance simply forbids the sale of raw milk from other than Brucellosis tested and clean herds.

The Committee feels that the adoption of ordinances dealing with Brucellosis should be encouraged in all areas of the nation as rapidly as possible and to
this end the Committee wishes to recommend that this association go on record as urging the adoption of a Brucellosis ordinance comparable to the tuberculosis ordinance now in existence almost universally. In addition, the Committee recommends that this association endorse the United States Public Health Service standard milk ordinance which includes the provisions for assuring eventually Brucellosis free herds as the source of the fluid milk consumed in the United States.

POULTRY INSPECTION AND SANITATION

Something less than 15 per cent of all the poultry consumed in the United States is officially inspected for wholesomeness. Regulations prohibiting the interstate movement of uninspected poultry products do not presently exist and it is doubtful under existing circumstances whether such regulation would be feasible at this time. Your Committee feels that such regulation is desirable and should be eventually provided.

The problem is a dual one. First, an acceptable system of poultry inspection on the national level and second, a system of inspection on the local or state level.

The Production and Marketing Administration of the United States Department of Agriculture maintains a poultry inspection service chiefly used by the larger processors doing volume business over a large area. The inspection service provided by P.M.A. should be strengthened and enlarged. Because of its cost, and because any real expansion to take care of the very large volume of small processors who do a more or less local business would be exceedingly difficult of accomplishment if not impossible, some form of inspection at the local or State level is necessary.

Your Committee wishes to commend the Public Health Service Industry Group which has been working on the second phase of this problem. This group, made up of members of the poultry producers, poultry processors, public health and regulatory officials, has done serious and excellent work toward the preparation of a model ordinance covering the essential of both sanitation and inspection for wholesomeness. In the light of existing conditions, it is felt by your Committee that such an ordinance is most timely and it is a matter of extreme gratification to all concerned that such an ordinance can be presented for adoption.

Your Committee urges that this association encourage the adoption of both the ordinance for poultry sanitation and the ordinance for poultry inspection. Your Committee also recommends that the weight and prestige of the United States Livestock Sanitary Association be used to encourage the various States, or their political subdivisions, to require adequate facilities for processing poultry and adequate inspection for wholesomeness of the product so processed within the framework of the proposed United States Public Health recommendation. It is hoped that in addition to this type of service, Federal supervision or Public Health Service scoring of such
local services can be provided so wide distribution and acceptance of the product will be possible.

TRICHINOSIS

It is well known that most trichinae infections in swine in the United States could be prevented by the simple expedient of eliminating the feeding of raw garbage and eliminating excessive rat populations where swine are raised. It is presently the policy of the Bureau of Animal Industry in order to control Vesicular Exanthema to restrict the interstate movement of hogs that have been fed raw garbage on the presumption that such hog movements constitute a hazard and method of disease spread. Your Committee feels that this is equally true with regard to Trichinosis, a disease of humans spread by swine and contracted by them through the ingestion of uncooked garbage containing raw pork scraps. Your Committee feels that the Department of Agriculture should be commended for the attitude taken toward Vesicular Exanthema and raw garbage. Virtually all of the States have now passed laws forbidding the feeding of raw garbage to swine or contemplate doing so. The exceptions are Arkansas, California, New Jersey, New Mexico, North Dakota, Rhode Island and Vermont. Your Committee wishes to commend the States for this action and to strongly urge that enforcement be carried forward to rapid completion so that trichinosis in man will no longer be a problem.

ANTHRAX

During 1952, 1,644 outbreaks of Anthrax were reported in livestock in 32 states. 3,500 head of livestock died as the result of this disease and the 1952 epidemic was marked by the occurrence of the disease in many new areas.

Anthrax is a public health problem as it is frequently seen in man.

Your Committee wishes to recommend the following:

1. That all animal hair imported from foreign countries and intended for interstate shipment be sterilized either by auto-clave or formaldehyde solution at the port of entry into the United States.

2. That a thorough investigation of the existing condition in industrial plants where Anthrax is a health hazard be made by the United States Public Health Service. Human disease such at “Q” fever, Tetanus, Gas-Bacillus and others should be included in this study as they frequently accompany Anthrax in these industries.

3. That the United States Public Health Service undertake research regarding diagnostic and immunity tests for human Anthrax.

4. That an evaluation of chemicals and agents used to destroy Anthrax spores be made to determine the most practical and efficient ones to use when necessary to disinfect contaminated buildings and premises.

LEPTOSPIROSIS

The emergence of the leptospiroses as major livestock sanitary problems
in the United States has created new problems and areas of study in public health. All of the leptospira species or serotypes thus far shown to be present in animals, by bacteriological or serological methods, recovered in culture from domestic animals in the United States are *L. pomona* (6) and *L. canicola* (15) Serological evidence indicates that a member of the *L. hebdomadis* group (6,15,16) *L. grippotyphosa* (11,16) and possibly *L. autumnalis* (9) and *L. icterohaemorrhagiae* (9) are also involved in domestic animal leptospiroses.

Thus far most human cases of *L. pomona* infection in the United States have been diagnosed in retrospect or have been treated in situations which did not allow the investigators to recover leptospira from the patient (1 to 5, 8 to 10, 12, 13). Ample evidence has been accumulated abroad, however, to establish upon bacteriological, serological, and clinical evidence, the nature of *L. Pomona* infection or “swineherd’s disease,” and the population and occupational groups more likely to be exposed to this disease (7,14). The clinical syndromata of *L Pomona* infection are not pathognomonic, for they resemble brucellosis, influenza, or may occur as frank aseptic meningitis or iridocyclitis. A case described recently was characterized by arthritis and myocarditis (13).

*L. canicola* and *L. grippotyphosa* infections may resemble the syndromes cited above or may also be manifested by anemia, icterus and uremia.

The large number of human cases of domestic animal origin which have occurred in Europe, Israel, and Australia show that the following population or occupational groups are more likely to be exposed to leptospirosis (7,14): Agricultural workers, slaughterhouse workers, swimmers, veterinarians. This is reflected in the few outbreaks studied in the United States. The epidemic of *L. pomona* infection studied by Schaffer (10) involved people who swam in a creek which was subject to contamination by animal excreta. The cases cited by various authorities (1,2,3,5,8,12) involved slaughterhouse workers. Infections in veterinarians have been diagnosed in recent years (9).

An epidemic study made in Georgia (15) showed that *L. canicola* caused an epidemic of disease involving people, cattle, hogs, and dogs. This latter study and a recent serological retrospect study of a Wyoming epidemic (4,9) indicate that *L. canicola* infection can also be waterborne.

The gathering of factual evidence of the public health importance of animal leptospirosis in the United States has hardly begun. Extensive surveys have not been made in any one occupational group. Few epidemics or cases have been defined. Extension of our knowledge waits for increased awareness and interest in the practicing medical and veterinary groups and increased federal and state activity in field and laboratory investigations.

**BIBLIOGRAPHY**


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(9) Leptospora Unit, Rocky Mountain Laboratory, Hamilton, Montana 1953. Unpublished data.


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The purpose of this report is to review the information which has accumulated during the past few years concerning the properties and use of the chick embryo adapted Flury strain of rabies virus. Briefly, Rabies Vaccine Modified Virus Avianized® is produced in developing chick embryos from a strain of rabies isolated by Leach and Johnson (1) from the brain of a girl named Flury who died on March 29, 1939, after an illness of four days. She had been exposed to the tongue licks of a rabid dog some days before signs of illness were noted; the dog died five days before the girl took sick. Autopsy of the girl was performed by Dr Harald N. Johnson of The Rockefeller Foundation, who found street virus present in the central nervous tissues, as well as in the lachrymal and salivary glands, by injecting these tissues into white mice.

The Flury strain is unique in that, as far as I know, it is the only strain of rabies virus that has been maintained entirely in non-mammalian hosts since it was originally isolated from human tissues. Johnson inoculated infected brain tissue from this girl into the brains of one-day old baby chicks. Thirty days elapsed before the first inoculated baby chick showed signs of paralysis. Johnson continued to pass the strain from chick brain to chick brain for 136 passages. During the process, the virus showed a shortening of incubation period with a resulting increase in pathogenicity for the avian host, so that in the final passages the virus killed baby chicks in approximately six days’ time. In the course of this work, Johnson found that baby chick adapted virus showed a lessened pathogenicity for mammalian hosts, such as rabbits, mice, and dogs. He also observed that although rabies could be induced in dogs following intracerebral injection of the chick adapted virus, yet on autopsy no virus could be demonstrated in the salivary glands or saliva (2). This is an extremely important observation because it must be realized that if rabies virus is not present in the saliva of a rabid dog, then it is highly improbable that this dog could serve as a vector in transmitting the disease by bite to other animals.

Dr. Johnson very kindly made the Flury strain of virus available to our laboratory after he had passed it through 136 chick brain passages. The work described from now on deals primarily with studies that my associates, Dr. Hilary Koprowski and Mr. Jack Black, have carried on with this strain of virus. They succeeded in adapting the virus to grow in developing chick embryos. This is important because it allows for the production of the vaccine in large quantities, making it more accessible for widespread use.
embryos\(^{(3)}\), and it was noted that the strain was pantropic in its properties, virus being found in all embryonic tissues, including even the blood\(^{(4)}\). Furthermore, even at low chick embryo passage levels, the virus proved to be relatively innocuous for guinea pigs and rabbits tested by the parenteral route\(^{(3)}\).

Following encouraging results obtained in the vaccination of rabbits and guinea pigs with living chick embryo adapted Flury strain rabies virus, extensive laboratory tests were then carried out in dogs\(^{(5)}\). These may be summarized by stating that dogs which had been inoculated intramuscularly with a single injection of three ml. of a 33 1/3 per cent chick embryo suspension showed, as a rule, uniform resistance when inoculated bilaterally into the masseter muscles with rabies preparations derived from the salivary glands of dogs which had succumbed to street virus infection\(^{(5, 6)}\). The laboratory tests in turn were confirmed by extensive field trials carried out in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, and with the Departments of Health of the State of Georgia, the State of New York, and the City of New York. Data pertaining to this early work have been reported in the Proceedings of the 53rd Annual Meeting of the U. S. Livestock Sanitary Association Meetings, October 12, 1949, pages 264-272\(^{(6)}\). A special license was issued by the Bureau of Animal Industry, U. S. Department of Agriculture, in April, 1950, for the distribution and sale of the chick embryo Rabies Vaccine Modified Virus Avianized\(^{®}\). Following the successful use of the product, a general license was granted by the Bureau of Animal Industry in December, 1952.

The vaccine has had mass field trial during the past few years in Israel and Malaya, where it has been used for the vaccination of dogs in a rabies control program sponsored by the World Health Organization. In both countries rabies was controlled quite successfully, and full credit was given to the chick embryo vaccine as being the major factor in the good results obtained\(^{(7)}\).

At the present time the Flury strain Rabies Vaccine Modified Virus Avianized\(^{®}\) is licensed for use in the vaccination of dogs only, but there is good reason to believe that the product may be licensed fairly soon for the vaccination of other animals, particularly cats and cattle. During the past year, veterinarians in eastern Montana vaccinated approximately 5,248 cats, 7,826 dogs, one deer and one badger with the chick embryo propagated vaccine\(^{(8)}\). Reports of any ill effects following vaccination were nil. Cats were vaccinated with a one and one-half ml. dose, one-half the amount given to dogs. Likewise, in experiments carried out in Honduras, Costa Rica, and Guatemala, 6,087 cattle were vaccinated to determine the safety and effectiveness of various dosage schedules and routes of administration of the vaccine\(^{(8)}\). The incidence of vampire bat rabies has continued high in the nonvaccinated cattle in these areas, but no cases of rabies have been reported in the vaccinated cattle. In an experiment involving 168 head, four groups of cattle were inoculated either intramuscularly or subcutaneously with seven and one-half or 15 ml. each of 33 1/3 per cent Flury strain chick embryo rabies suspension. Upon
challenge five months later with rabies street virus of canine origin, NYC strain, it was found that the most satisfactory immune response was engendered by a 15 ml. dose of vaccine injected intramuscularly in the hind leg. The superiority of the intramuscular over the subcutaneous route of inoculation for inducing immunity in cattle supports the data that have been obtained consistently in the vaccination of dogs.

Rabies Vaccine Modified Virus Avianized® is prepared by growing the Flury strain of rabies virus in the developing chick embryo. The infected tissue suspension is frozen and dried. In order to insure good stability of the product under field conditions, stabilizers are added to preserve maximal virus viability. Each lot of the vaccine is tested in three ways: for adequate virus content by intracerebral injection of mice; for freedom from other pathogenic agents by inoculation into mice, guinea pigs and dogs; and for immunogenic potency by challenge of vaccinated guinea pigs with rabies virus derived from the salivary glands of dogs that have succumbed to street virus infection. The recommended dosage for vaccination of dogs is a single injection of three ml. of a 33 1/3 per cent chick embryo suspension given intramuscularly into the thigh muscles. It is important in order to secure a maximal immune response that the injection be given intramuscularly, and preferably into the muscles of the hind leg. More than a million dogs have already been vaccinated with Flury strain Rabies Vaccine Modified Virus Avianized®. In no instance has there been any indication that the modified virus has had a tendency to revert to its original state of virulence and transmissibility.

After prolonged serial passage of the Flury strain of virus in the chick embryo, a further profound change in its pathogenicity for laboratory animals was observed. Up to the 176th chick embryo passage level, suspensions of the Flury strain of virus rather consistently killed adult mice injected intracerebrally, with LD₅₀ titers ranging from 10⁻⁴.⁵ to 10⁻⁵.⁵ or occasionally 10⁻⁶.⁰. On the 176th passage, however, it was observed that the LD₅₀ titer of the Flury strain dropped to a level of 10⁻².⁵, and on the 178th egg passage, no virus at all could be demonstrated by injecting mice intracerebrally with supposedly infected chick embryo suspension(10). From the 178th to the 208th egg passage, it was not possible to detect any living rabies virus in the chick embryo suspensions by injecting these preparations intracerebrally into young adult mice 21 to 28 days old. It first appeared that the virus had been lost by continued chick embryo passage. However, when guinea pigs were vaccinated intramuscularly with the above-mentioned suspensions representing the higher chick embryo passage levels, the animals were found to be immune upon subsequent challenge with active street virus preparations. These results showed, of course, that the high chick embryo passage level virus, while apparently nonpathogenic for young adult mice injected intracerebrally, was still immunogenic and conferred good protection to vaccinated guinea pigs. Subsequent studies carried out by Dr. Koprowski and his associates have shown that while the high chick embryo passage level of the Flury virus had
lost its pathogenicity for young adult mice, it had retained its pathogenicity for suckling mice eight days old or younger when injected intracerebrally. A break in the susceptibility of mice to infection occurred between the ages of 8 and 14 days. Mice 14 days old or older were found to be completely resistant to intracerebral inoculation with high passage level Flury virus. The mortality titers obtained by injecting suckling mice with the high passage level virus were just about as high as those obtained by injecting young adult mice with the low passage level virus, namely LD₅₀ titers ranging from 10⁻⁴·⁵ to 10⁻⁵·⁸.

Furthermore, it was found that adult mice which showed no signs of illness following intracerebral inoculation with high passage level Flury strain of virus later proved to be fully immune when challenged by intracerebral inoculation of either virulent street virus or virulent fixed virus. The protective titers for adult mice were 10⁻⁴·⁵ to 10⁻⁵·⁸, approximately the same as the mortality titers at which the high passage level virus killed suckling mice. Another point worth noting is that while the high passage level virus apparently lost its pathogenicity for adult mice, rabbits, and dogs when injected intracerebrally, it appeared to retain in large measure its ability to kill Rhesus monkeys injected intracerebrally, giving LD₅₀ titers comparable to those found for suckling mice¹¹.

The results obtained following the further modification of the Flury strain of virus by continued passage in developing chick embryos are most interesting indeed, and once again show that most unusual changes in virulence and host pathogenicity can be brought about in a viral agent by continued passage in an ordinarily unnatural or foreign host. The fact that such a highly neurotropic virus as rabies can be so greatly modified in its tissue tropism and invasive properties is most thought-provoking.

I would also like to point out that much time-consuming labor and perseverance were required to bring about these changed characteristics of the Flury virus, for it must be realized that approximately ten days are needed for each passage from embryo to embryo. The greatly altered properties did not appear until 176 passages had been made. Only further work can tell whether the high passage level Flury strain of virus will retain its immunizing capacity, or whether this property in turn will be lost as a result of continued passage in chick embryos as occurred with the high passage 17 D strain of yellow fever virus¹²,¹³. We can be sure, however, that the Flury strain of rabies virus will never regain its original virulence for dogs, guinea pigs, hamsters, or other animals by following the procedure of continued passage in chick embryos. Our chief concern will be to prevent loss of immunogenic capacity for mammalian hosts. This is an eventuality that we are fully aware of, which we are able to be on guard against, and fortunately can forestall.

Table 1 shows the duration of immunity in dogs following vaccination with several types of rabies vaccine. Results obtained by Dr. Johnson of The Rockefeller Foundation in vaccinating dogs with phenolized, Semple
TABLE 1

Duration of Immunity in Dogs Following Vaccination with Several Types of Rabies Vaccine by Different Investigators

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>VACCINE</th>
<th>Months Between Vaccination and Challenge</th>
<th>MORTALITY RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vaccinates</td>
<td>CONTROLS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>0/25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12*</td>
<td>6/52</td>
</tr>
<tr>
<td>Johnson</td>
<td>Phenolized</td>
<td>12</td>
<td>3/22</td>
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<tr>
<td></td>
<td>(Lederle)</td>
<td>24</td>
<td>8/19</td>
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<tr>
<td>Kroprowski</td>
<td>Phenolized</td>
<td>12</td>
<td>0/25</td>
</tr>
<tr>
<td></td>
<td>(Lederle)</td>
<td>24</td>
<td>3/25</td>
</tr>
</tbody>
</table>

* 3 Injections

Type vaccine\(^{(14)}\) are compared with results obtained by Dr. Koprowski of our laboratory with both phenolized killed and avianized living virus vaccines. While both investigators obtained what would be considered to be satisfactory results with the phenolized killed vaccines, yet it is apparent that superior protection was afforded by the avianized living virus product.

TABLE 2

Results of 24 Months Immunity Test in Dogs Vaccinated with Different Types Rabies Vaccine

<table>
<thead>
<tr>
<th>AUTHORS</th>
<th>TYPE OF VACCINE</th>
<th>MORTALITY RATIO</th>
</tr>
</thead>
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<tr>
<td>U. S. Public Health Service in Cooperation with Lederle</td>
<td>Avianized (Flury) Lederle</td>
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<tr>
<td></td>
<td>Controls</td>
<td>18/33 54.5%</td>
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<tr>
<td></td>
<td>(Commercial)</td>
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<tr>
<td></td>
<td>Ultraviolet (Commercial)</td>
<td>0/31 0%</td>
</tr>
<tr>
<td></td>
<td>Benzene Extracted (Experimental)</td>
<td>0/30 0%</td>
</tr>
</tbody>
</table>

Table 2 shows results of challenge of dogs 24 months after vaccination with different types of rabies vaccine. I am particularly calling attention to these results, because I think it is necessary and timely to correct some misinformation that has been obtained by various interested persons concerning
the results of this test, which was conducted at Montgomery, Alabama, as a cooperative project of the Rabies Control Branch, United States Public Health Service Virus Laboratory and Lederle. I wish to point out that the procedure of challenging these dogs for immunity was not carried out properly, so that in reality it has not been possible to evaluate the protective capacity of one vaccine as compared to another. The test as a whole must be regarded simply as inconclusive, or no test. The dogs vaccinated with the avianized Flury strain of vaccine and the unvaccinated control dogs were all challenged with street virus in the morning before lunch. Unfortunately, the remaining groups of dogs, which had received phenolized, ultra-violet and benzene-extracted vaccines, were then challenged after lunch with the same street virus preparation, which had been stored in the liquid state in the cold room in the meantime. It is at once obvious that it is impossible to compare the relative state of protection of the three groups of dogs challenged in the afternoon with that of the two groups of dogs challenged in the morning, since no control, nonvaccinated dogs were included in the afternoon challenge tests. Without having such controls challenged at the same time as the three latter groups of vaccinated dogs, it is impossible to state with certainty whether the seeming protection resulted from the effectiveness of the vaccines used, or whether the challenge material had lost its invasiveness and its power to induce rabies infection.

From experiments carried out in our laboratory at Pearl River, there is good reason to believe that the street rabies virus suspension used as challenge material had in reality, during the noon hour period of storage in the cold room, lost the power to induce infection by the intramuscular route. We have, for instance, found that rabies street virus preparations, held in the frozen state for fairly long periods of time, retain their intramuscular invasiveness and pathogenicity quite well at -70°C. However, duplicate samples, held at -40°C, show a marked loss in these properties. Intracerebral invasiveness of the virus, on the other hand, is apparently maintained equally well by storage at either -70°C or -40°C. These data serve to emphasize that the intramuscular invasiveness of rabies street virus is apparently a much more labile constituent than the intracerebral invasiveness, and must be so reckoned with in challenge experiments.

Thus, I wish to emphasize once again that the results of challenge 24 months following vaccination can be considered significant only in that portion of the experiment involving the Flury-vaccinated dogs and the nonvaccinated control dogs. As seen in Table 2, none of the 33 Flury-vaccinated dogs died as a result of challenge, whereas 18 out of 33 nonvaccinated controls died.

The experiment in which vaccinated dogs were challenged at the end of 39 months was, I believe, properly carried out and the results can be considered as highly significant (Table 3). A dog from each group was challenged in sequence, so that every first dog had received phenolized vaccine, every second dog had received ultra-violet vaccine, every third dog had
TABLE 3

Results of 39 Months Immunity Test in Dogs Vaccinated with Different Types Rabies Vaccine

<table>
<thead>
<tr>
<th>AUTHORS</th>
<th>TYPE OF VACCINE</th>
<th>MORTALITY RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. S. Public Health Service in Cooperation with Lederle</td>
<td>Phenolized (Commercial)</td>
<td>8/34 23.5%</td>
</tr>
<tr>
<td></td>
<td>Ultraviolet (Commercial)</td>
<td>7/30 23.3%</td>
</tr>
<tr>
<td></td>
<td>Avianized (Flury)</td>
<td>0/30 0%</td>
</tr>
<tr>
<td></td>
<td>Lederle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Controls (Non-Vaccinated)</td>
<td>31/36 86.1%</td>
</tr>
</tbody>
</table>

received avianized Flury vaccine, and every fourth dog was a nonvaccinated control animal. The challenge was very rigorous, as shown by the fact that 31 out of 36, or 86 per cent, of the control dogs died of rabies infection. All of the Flury-vaccinated dogs lived, whereas approximately 23 per cent of both the phenolized and ultra-violet vaccinated dogs died.

It is noteworthy that such good protection was afforded after such a long interval by the killed products as represented by the phenolized and ultra-violet vaccines. As a matter of fact, these results were better than had been anticipated; but again it is apparent that the living virus vaccine, as exemplified by the Flury strain avianized product, gave the best results. The Rabies Vaccine Modified Virus Avianized® appears to confer a solid degree of protection to vaccinated dogs for at least a three-year period against quite a potent challenge dose of virus.

TABLE 4

Immunization of Dogs with High Passage Level Flury Strain Rabies Virus

<table>
<thead>
<tr>
<th>No. of Chick Embryo Passages</th>
<th>Mortality Ratio of Dogs Challenged With Street Virus*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flury Strain</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>3/10 30%</td>
</tr>
<tr>
<td>187</td>
<td>0/25 0%</td>
</tr>
<tr>
<td>None</td>
<td>15/19 78.9%</td>
</tr>
</tbody>
</table>

*Challenged 30 days after vaccination by intramasseter inoculation of NYC strain street virus.

Table 4 shows results obtained in the laboratory by challenging dogs that were immunized with the high passage level of the Flury strain rabies virus.
AVIANIZED RABIES VACCINE

These results are comparable with those found in the past, using low passage level chick embryo Flury strain virus as immunizing agent, and would indicate that the high passage level Flury strain can be used equally well as an effective vaccine. It has the added feature of having a greater margin of safety for certain hosts, particularly cattle.

TABLE 5
Correlation between Resistance and Serological Evidence of Immunity Induced in Cattle by the 185th Egg Passage of Flury Strain

<table>
<thead>
<tr>
<th>Log of Dilution of Challenge Virus</th>
<th>Ratio of Calves (A) Showing Serum Neutralizing antibodies and (B) Surviving Challenge with Street Virus, After Immunization with Different Amounts (ml.) of Flury Strain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 ml.</td>
</tr>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1.50</td>
<td>3/3</td>
</tr>
<tr>
<td>1.95</td>
<td>3/3</td>
</tr>
<tr>
<td>2.40</td>
<td>2/2</td>
</tr>
<tr>
<td>Total</td>
<td>8/8</td>
</tr>
</tbody>
</table>

A = Neutralizing Antibody
B = Challenge

Table 5 shows the correlation between host resistance and serological indications of immunity induced in cattle by vaccination with the 185th egg passage level of the Flury strain of virus. With a single exception, cattle which showed serum neutralizing antibodies following vaccination survived the challenge test with street virus, indicating that the presence of such antibodies gives a rather reliable index of the degree of protection afforded cattle by the vaccination procedure.

In additional studies to be reported (15), Dr. Koprowski has shown that hyperimmune serum may be used in conjunction with Flury strain vaccine as an immunization procedure, and that serum does not interfere with or inhibit the immunizing capacity of the living virus agent. Dr. Koprowski's work gives increasing evidence to show that the combined use of Flury strain living virus vaccine with immune serum is the method of choice to employ when attempting to protect animals that have had severe exposure to rabies virus, as a result of either laboratory induced or natural infection.

Further work is also being carried out using the Flury strain of virus as an immunizing agent in man. The results thus far indicate that the product is safe for human administration. However, additional experiments need to be made, and are now in progress, to determine the optimal dosage and time factors involved in order to induce the best immunizing response.
From the progress that has been made in adapting and developing the modified Flury strain of rabies virus, we feel quite confident that a similar approach will prove to be successful in our studies on poliomyelitis viruses. As a matter of fact, comparable results have been obtained already with the MEFl strain Lansing type virus adapted to the developing chick embryo (16, 17, 18), and we believe that it is only a matter of time until we are able to report equal success in adapting and modifying the Brunhilde and Leon types of poliomyelitis by chick embryo cultivation. We are firmly of the opinion that living modified viruses still offer the best possibilities for producing effective and safe immunizing agents, not only for domestic animals, but also for man.

REFERENCES

2. **JOHNSON, H. N.**: Personal communication.
7. **KOPROWSKI, H.**: Personal communication.
REPORT OF THE COMMITTEE ON RABIES


Rabies and its contagious nature, as well as the danger connected with the bites of rabid dogs, have been well known since the time of Aristotle. However, there are numerous problems in connection with the suppression and control of this disease that remain unsolved, and only research and the pooling of resources and efforts of all organizations interested in the control of this disease will make it possible to supply these answers.

Although rabies is primarily a disease of animals and is spread through vectors to numerous species of livestock, it causes considerable economic concern in many states and even of greater importance is the fact that human life is in danger and is of great concern to the Medical Profession and Public Health Service.

The co-ordination of agencies such as the Federal Bureau of Animal Industry, Public Health Service, Fish and Wild Life Service, and the various state organizations will be extremely difficult due to the difference in the manner of approach to the problems of rabies control by the various states.

Statistics covering compulsory vaccination of dogs has shown that it has been highly successful in certain areas. However, there are states in which compulsory vaccination against rabies is frowned upon and would only be used in a case of extreme emergency.

It is believed that laws in connection with disease control and eradication

INFORMATION COLLECTED BY THE U.S. BUREAU OF ANIMAL INDUSTRY SINCE 1938 ON INCIDENCE OF RABIES IN THE UNITED STATES

<table>
<thead>
<tr>
<th>Year</th>
<th>Dogs</th>
<th>Cattle</th>
<th>Horses</th>
<th>Sheep</th>
<th>Swine</th>
<th>Cats</th>
<th>Goats</th>
<th>Misc.</th>
<th>Man</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td>413</td>
<td>32</td>
<td>164</td>
<td>42</td>
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<td>44</td>
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<td>17</td>
<td>38</td>
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<td>30</td>
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<td>53</td>
<td>71</td>
<td>260</td>
<td>4</td>
<td>277</td>
<td>28</td>
<td>7,238</td>
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<td>60</td>
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<td>19</td>
<td>310</td>
<td>41</td>
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<td>419</td>
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<td>373</td>
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<td>14</td>
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<td>378</td>
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<td>819</td>
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<td>22</td>
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<td>413</td>
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<td>7,597</td>
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<td>948</td>
<td>33</td>
<td>48</td>
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<td>428</td>
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<td>7,910</td>
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<td>34</td>
<td>35</td>
<td>53</td>
<td>480</td>
<td>4</td>
<td>1,387</td>
<td>14</td>
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<tr>
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<td>916</td>
<td>38</td>
<td>19</td>
<td>31</td>
<td>466</td>
<td>7</td>
<td>1,674</td>
<td>21</td>
<td>8,453</td>
</tr>
<tr>
<td>Totals</td>
<td>103,713</td>
<td>8,851</td>
<td>507</td>
<td>614</td>
<td>776</td>
<td>5,514</td>
<td>137</td>
<td>9,990</td>
<td>407</td>
<td>130,507</td>
</tr>
</tbody>
</table>
are adequate in a majority of our states so that a regulation could be adopted to permit compulsory vaccination, if and when needed.

In analyzing the statistics on the number of cases of rabies in the United States from 1938 to 1952 inclusive, as submitted by the Bureau of Animal Industry of the United States Department of Agriculture, it is noted that the total cases of rabies in the United States has remained rather consistent during this period with a difference of 3,707 cases from the high level in 1946 to the low level in 1942.

These tables also disclose the fact that from 1942 to 1952 inclusive, there has been an increase of 1,514 cases of rabies listed as miscellaneous which includes rabies in vectors such as, foxes, skunks, raccoons, wolves etc.

In view of the above facts, your Committee on Rabies recommends:

1. That studies be undertaken to determine whether virus strains exist which are of greater pathogenicity to some animal species than to others.
2. A continued and increased effort by the United States Wild Life Service in studying the possible reservoirs of rabies in vectors and the improvement of methods to combat same.
3. Increased efforts on the part of pharmaceutical houses manufacturing rabies vaccine so that there is a uniformity in the dosage to be used, especially in cattle.
4. Whenever possible states should take advantage of sending a representative to attend the refresher courses in laboratory diagnoses made available by the Communicable Disease Center, United States Public Health Service.
5. Intensified educational program to the public recommending vaccination of canines.
6. Increased efforts on the part of Dog Law Enforcement Agents in eliminating the stray dog.
7. When an outbreak of rabies of serious proportions occurs in any state, full cooperation should be solicited from all agencies interested in the control of rabies.

INCIDENCE OF RABIES IN THE UNITED STATES
CALENDAR YEAR 1952*

Statistics on the number of cases of rabies in the United States in the calendar year 1952 have been collected by the Bureau of Animal Industry of the United States Department of Agriculture.

There were 8,453 cases reported. There were 5,261 cases in dogs, 916 in cattle, 38 in horses, 19 in sheep, 31 in swine, 486 in cats, 7 in goats, 1,674 miscellaneous, and 21 in man.

This material was compiled from a questionnaire sent by the Bureau to

*Data received from Alaska, Hawaii, and Puerto Rico are given on page 000.
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 318 shows the distribution of the cases by States.

**TABLE 1**

Rabies in the United States by States during the year 1952

<table>
<thead>
<tr>
<th>STATE</th>
<th>DOGS</th>
<th>CATTLE</th>
<th>HORSES</th>
<th>SHEEP</th>
<th>SWINE</th>
<th>CATS</th>
<th>GOATS</th>
<th>MISCELLANEOUS</th>
<th>MAN</th>
<th>TOTAL</th>
</tr>
</thead>
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<tr>
<td>Alabama</td>
<td>400</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
<td>19</td>
<td>1</td>
<td>Fox</td>
<td></td>
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</tr>
<tr>
<td>Arizona</td>
<td>11</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td>12</td>
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<td>176</td>
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<td></td>
<td></td>
<td></td>
<td>4</td>
<td>1</td>
<td>Fox</td>
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<td>224</td>
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<tr>
<td>California</td>
<td>103</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td>Various Species* 16</td>
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<td>142</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Connecticut</td>
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<td></td>
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<td></td>
<td>Fox</td>
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<td></td>
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<td>Florida</td>
<td>12</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td>25</td>
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<td>8</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>7</td>
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<td>Fox</td>
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**TABLE 1—Continued**

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<th>CATTLE</th>
<th>HORSES</th>
<th>SHEEP</th>
<th>SWINE</th>
<th>CATS</th>
<th>GOATS</th>
<th>MISCELLANEOUS</th>
<th>MAN</th>
<th>TOTAL</th>
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*Includes skunks, raccoons, oxen, muskrat, gophers, rats, mice, beaver, weasels, wildcats, foxes, groundhogs, mink, badgers, opossums, wolves, civet cats, woodchucks, rabbits, deer.

Alaska — no report available.

Hawaii reports that rabies has never occurred in the Territory.

Puerto Rico reports 8 dogs, 10 cattle, 4 horses, 2 swine, 1 cat, 1 goat, and 40 mongooses.
REPORT OF COMMITTEE ON RABIES

CAGES OF RABIES REPORTED IN VARIOUS STATES IN 1952

TOTAL CASES REPORTED 8,453

U.S. DEPARTMENT OF AGRICULTURE
### Distribution of Rabies by States for the Period 1945-1952, Inclusive

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**Totals:** 9,963 | 10,872 | 8,946 | 8,508 | 7,597 | 7,910 | 8,022 | 8,453 | 70,271
VESICULAR STOMATITIS IN SWINE

T. B. CLOWER, D. V. M. AND C. J. MIKEI, D. V. M.

Atlanta, Georgia

Beginning in May, 1952, and continuing through May, June, July and August of 1952 and 1953, repeated outbreaks of vesicular stomatitis occurred in swine in Georgia. Positive diagnosis were made on three premises in 1952 involving over 1,000 head of swine and on ten premises in 1953 involving approximately 700 swine. These outbreaks have occurred in six counties located in southeast Georgia in an oval-shaped area measuring approximately 140 miles by 50 miles. This area is drained by the Altamaha River and three smaller rivers which form and flow into it and by the Satilla River which has no connection with the Altamaha or its tributaries. Excepting for cultivated land, the country involved is heavily wooded and much of those parts lying adjacent to the creeks and rivers is swampy. Open range conditions prevail so that livestock intermingle, regardless of ownership. And even though there were cattle and mules on eight of the thirteen premises where vesicular stomatitis was diagnosed, it was observed to affect cattle in only one instance.

The application of quarantines and the containment necessary in order to insure against further spread have occasioned some difficulty. In one occurrence, swine with lesions were found in a Federally-inspected meat packing plant and were traced to a livestock auction barn 150 miles distant. This barn, located in the described area which contained 879 swine and 45 cattle accumulated for sale, was quarantined. The transfer of this infection to test cattle and hogs by scarification and inoculation on tongues of the cows and snouts of the swine was readily accomplished but a "take" in the test horses used was not obtained. It is believed that the circumstances involved in a situation of this sort, where clear-cut test results do not derive, is readily appreciated. In this instance the operator incurred extensive loss through cost of feeding and holding the animals and by not being able to conduct sales during the quarantined period. Another expense, not to be discounted, which was a part of this outbreak was the cost to the meat packing plant of cleaning, disinfecting and of holding animals and meat associated with the outbreak so as to be able to continue operation while a diagnosis was being made.

The symptoms and lesions of swine affected with vesicular stomatitis are not distinguishable from those affected with vesicular exanthema or foot-and-mouth disease. Snout and foot lesions are identical with those of vesicular exanthema with the exception that possibly on the average they are less severe. Temperatures go as high as 107. Ordinarily from 10% to 50% of a herd are affected. In none of the outbreaks so far have we observed marked
VESICULAR STOMATITIS IN GEORGIA

systemic effects. In comparison, the illness produced seems to be less severe than that produced by the more virulent manifestations of vesicular exanthema.

In test animals the infection is easily transmitted to the same species and has in practically all instances been easy to transmit to the tongue of a bovine by scarification and inoculation. On some occasions difficulty has been encountered in transmitting the infection to test horses. This has not been explained by immunity determined by serological tests as might be supposed. In this connection considerable care has been exercised in the selection of tests animals as relates to the possibility of immunity through living in an area where the disease occurs.

Many primary investigations have been required to handle reported suspicious disease in the area involved. Information obtained from veterinarians, livestock owners, game wardens and others having familiarity over a period of time with the area, rather conclusively shows that vesicular stomatitis has occurred in swine and other animals in this area for at least 15 years and likely longer. Accounts are given of deer being affected in addition to swine and cattle. The horse population in this area is now limited and for the most part is comprised of mules which are few in number. We do not have any report of horses and mules being affected even though it seems likely that they are.

Serological tests run at Beltsville by the Bureau of Animal Industry indicate in every instance where they have been conducted that the New Jersey type of vesicular stomatitis is responsible for the outbreaks.

The occurrence of vesicular stomatitis in swine in Georgia is summarized as follows:

1. It has affected swine and not cattle in all instances but one in the outbreaks occurring in 1952 and 1953.

2. These outbreaks have occurred in the months of May, June, July and August.

3. They have been confined to six counties which are located within an oval-shaped area approximately 140 miles by 50 miles in size which, excepting for cleared land, is heavily wooded and in which the river bottoms in many instances are swampy.

4. Open range circumstances prevail.

5. The New Jersey type of vesicular stomatitis has been shown to be the causative agent in each case where serological tests have been conducted.
Approximately one year ago in Chicago, Illinois, a long overdue conference, the First National Conference on Trichinosis, was held. This conference was sponsored by The American Medical Association and The American Veterinary Medical Association among other interested, participating, scientific groups. One of the main topics discussed was garbage-borne diseases in swine and problems in their control. The relationship of raw garbage feeding and trichinosis in swine has long been recognized; in the past year, however, the outbreak of vesicular exanthema which spread throughout the United States within the period of a year or less further highlighted the serious effects and potentials of the feeding of raw garbage to swine. In addition to trichinosis and vesicular exanthema, raw garbage may act as the vector for the spread of diseases such as hog cholera, foot and mouth disease, erysipelas, brucellosis, anthrax, salmonellosis, and some parasitic diseases.

Hog cholera is one of the most important porcine disease in the United States. Udall states that in the East probably 85 per cent to 90 per cent of new outbreaks of hog cholera can be traced to virus present in pork scraps fed in raw garbage. The history of foot and mouth disease in the United States indicates that the feeding of raw garbage is one of the weakest links in our defense against biological diseases that may be spread as a means of warfare. At the last annual meeting of this organization Shope et. al. pointed out that, “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.”

Salmonellosis is a disease that is found in garbage fed lots and is due to a combination of raw garbage and poor sanitation normally maintained at such premises. Movement of hogs to clean pens and elimination of raw garbage as feed reduces the incidence of this particular disease. Evidence is available which indicates that where garbage is fed to swine, human health hazards multiply due to improper waste disposal, fly breeding, and the presence of large populations of lazy, well fed disease vector rodents.

Studies in the late 1930’s by Dr. Maurice Hall, of the National Institutes of Health, indicated a significant infection of the human population with the parasitic worm, *Trichinella spiralis*. Dr. Willard Wright and Dr. Benjamin Schwartz have further corroborated these studies and the present indi-
cations are that one of every six Americans is infected at sometime with trichinae. Medical experts such as Dr. Vernon Link,\(^1\) of the United States Public Health Service, indicate that trichinosis can occur in humans without specific clinical symptoms ever being identified with the disease. Trichinosis, a reportable disease in forty-four of the states, is seldom diagnosed clinically except for those infections which occur in epidemic form. Dr. Wright\(^{14}\) summed up the situation in 1939 as follows:

"1. It appears evident that the United States has the greatest problem in trichinosis of any country in the world since about one in every six persons is infected with the parasite.

2. There has been no decline in the incidence of trichinae in man and swine during the past 50 years, and it is thus apparent that control measures now operative are of little value in retarding the dissemination of the parasite.

3. Human trichinosis is based almost entirely on porcine trichinosis and the latter on the all too common practice of feeding uncooked garbage to swine. Consequently, the most rational procedure for the control of the disease involves the elimination of garbage feeding or the proper cooking of garbage prior to its consumption by swine."

This month, approximately fifteen years after Dr. Wright's summary, an editorial\(^{15}\) entitled "Trichinosis—A National Disgrace" appears in the American Journal of Public Health pointing out that the problem is still with us.

Since Wright Schwartz and other leading scientific and medical minds all agree that the practice of raw garbage feeding is bad and should be discontinued for the good of the pork consuming public and the entire livestock industry, why then do we still have this problem confronting us? In the words of Dr. Brock Chisholm,\(^{16}\) former Director General of World Health Organization, "...there is a sacred cow in this country and its name is business..." Raw garbage feeders, despite high disease losses, have found their business to be highly profitable. Cheap feed, readily available in the form of raw garbage has given them such an edge, that even, normally marginal type producers can raise hogs and bring them to market at a profit. Telling such businessmen that a greater amount of money can be made by cooking their feed, falls on deaf ears. The cost of handling, heating and labor incident to such operations and the production of a less firm fatted hog that may bring a lower market price is, in their opinion, not warranted. They are hard headed successful businessmen and only by the feel of economic as well as social pressures will they agree to the production of a safe food product and the elimination of possible animal disease spread from their farms to others. Economic pressure means pressure that will cause the selling price of raw garbage fed hogs to drop sufficiently below that of the safer cooked garbage or grain produced animal, in order to eliminate the unwarranted margin of
profit that now exists, unwarranted because of disease producing potentials. *What Is Currently Being Done to Eliminate Raw Garbage Feeding?*

All states, except the main garbage fed hog producer states, have passed either regulations or statutes which prohibit the feeding of raw garbage to swine. Although most of the states now have regulations, relatively few of them have actively commenced enforcement of same.

In 1941, an interstate quarantine regulation of the United States Public Health Service (Section 72.23, 1947, Revised) was issued requiring that any garbage shipped or transported across state lines must be heated to 212°F for 30 minutes before being fed to swine. The United States Public Health Service has to date not actually enforced this regulation in any of the major areas of interstate transportation of raw garbage. There are still federal institutions which sell garbage across state lines in contravention of this regulation. The Service has failed to take action against garbage feeders known to have transported raw garbage across state lines. They have attempted by education and persuasion to induce garbage feeders and the individual states to institute and enforce local regulations but have not enforced their own regulation to this date.

The United States Department of Agriculture, Bureau of Animal Industry, Federal Meat Inspection Service has had and enforced regulations covering the treatment of all federally inspected pork products customarily eaten without cooking.

The United States Department of Agriculture, Bureau of Animal Industry, Interstate Inspection and Quarantine Division issued regulations effective July 1, 1953, which prohibit the interstate movement of raw garbage-fed hogs or pork unless specially processed.

It is apparent that a good deal can be done with the federal and state regulations that do exist. In fact, if all the regulations were presently enforced by those having them, the movement of raw garbage-fed hogs and pork across state lines would cease. States allowing the production of raw garbage-fed hogs and pork would be required to eat all such pork within their own boundaries. The cases of human Trichinosis and garbage-borne diseases of livestock would then be the responsibility of those state officials and farm organizations who blocked the passage and enforcement of suitable legislation.

The Federal Meat Inspection Service could be of tremendous help to other units within the Bureau of Animal Industry by requiring certification from all sellers, to the effect that to the best of their knowledge, the hogs to be federally inspected, were not fed raw garbage. This would unite the animal and human health activities of the Bureau of Animal Industry at this time.

In conclusion, the taxpayers should not be forced to continue to pay millions of dollars of administrative and indemnity expenses that past garbage-borne disease outbreaks, such as vesicular exanthema and foot and mouth disease, have caused; nor should one in every six American citizens be
subjected to a worm infestation in order that a few hog producers might continue to feed raw garbage. The solution to the problem for the raw garbage feeder, is not cruel, it is not heart rending, in fact it is rather simple—cook garbage, dispose of wastes properly, and control flies and rodents.

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PROGRESS REPORT ON THE ERADICATION OF VESICULAR EXANTHEMA

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Washington, D. C.

Vesicular Exanthema has now been out of the confines of California as far as we know for fifteen months. A great deal has been learned on this supposedly insignificant disease that one day grew up to sweep across our country to produce interruption of trade channels, scare markets and bring fear of foot-and-mouth disease in forty-two of our forty-eight states. However, it is fully realized that there is a great deal more to learn about this disease.

Those of us who were present at the last meeting will remember the lengthy discussion that took place. The problems were many, and we all realized that the task of control and eradication would be a great one.

The thorough discussion of the problem was responsible for a united front to get rid of the disease. Those officials in States that had not had the disease were able to get first-hand information from those that had it, especially from a control and eradication standpoint.

Within a short time following the meeting the State disease control officials, the Bureau of Animal Industry and the various segments of the swine industry all were in firm agreement that we could not afford to live with the disease. The unity of the different groups produced some amazing results. The States set up programs of eradication in which the Federal Government co-operated. The purpose of the programs was to find the infection and stamp it out.

As you recall, the disease was first officially diagnosed outside of California on June 17, 1952. At the meeting of this Association last year the spread of the disease was discussed along with the progress on the control and eradication of it. In glancing at the chart we can see that at the time of the Louisville meeting not too much new infection was being found. It appeared that ground was being gained on the virus and possibly the disease could be controlled if we could find all of it and stamp it out.

It was not known how much infection was in the country or how much infected meat was hanging on rails in plants. It was realized that there was a possibility that the chief means of contaminating garbage with infected pork scraps was coming from swine that were slaughtered during the early stages of incubation when they did not show any evidence of the disease. There was an important unknown factor—how much pork had been slaughtered while in this stage and was still in refrigeration? Watching the scale of infection in the country, it was thought that we were in a favorable
position as the majority of known infected swine were being disposed of rapidly.

The disease was not reported farther north than New York along the eastern seaboard, but during the latter part of October it was found in Massachusetts and during the next ninety days it spread with great rapidity throughout the New England States. At the same time it was spreading in other States throughout the country. In a one-week period over thirty carloads of swine were found infected at the time of unloading in the State of Massachusetts. These shipments originated in the midwest. When trying to trace the source, the trail usually led to grain feeding premises. Thousands of these premises were inspected, but no infection was found. Possible sources of this infection will be discussed later in this report.

You will notice that the number of swine found infected gradually decreased during the months of March, April, May and June. However, during these months new infection was found as a result of shipments in the States of Arizona, Maryland, Massachusetts, New Jersey, Pennsylvania, Illinois, etc. At the same time the disease was appearing mostly on garbage feeding premises in Connecticut, Florida, Georgia, Indiana, Massachusetts, Michigan, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Carolina, Ohio, Rhode Island, Tennessee, Texas, Virginia, Washington, West Virginia.

Since July 1 there has been a slight increase of infection due chiefly to new local infection found in Florida, Ohio and Texas, and in swine arriving infected at New Jersey, Pennsylvania and Maryland in shipments from the Eastern part of the hog belt region.

The disease has now appeared in 42 States and the District of Columbia. It has varied from a very mild to a very virulent. The mild cases were often difficult to diagnose, while in virulent cases there was 100 percent infection. It is hard, even for those who have seen a great deal of this infection, to realize that the same virus can produce either very mild or very virulent forms of the disease.

Infection still shows up on raw garbage feeding premises, but our most disturbing factor is the continuing infection in the Eastern States as a result of shipments from the Eastern part of the hog belt region where infection cannot be found. It appears only upon arrival and is not picked up locally. Also, another dangerous situation has arisen because of infection found in a number of auction sales and other concentration points in Texas, Florida and Ohio. This infection apparently comes from hogs shipped intra-state because in several instances infection was traced to movements of swine through one of these concentration points. In some cases we were able to trace the infection to raw garbage fed swine that were shipped into the yards, and inspection at the home premises within the State revealed the infection. In other cases we did not find the source, and this is of greater concern. Frequent periodic inspections may have prevented the spread into these yards.
There is some convincing evidence that the disease is present on some, as yet unknown, premises. Every 30 days during the past five or six months some shipments from the hog belt have been arriving at the eastern markets "infected upon arrival." The swine have been shipped in properly cleaned and disinfected cars. Yet, when the source of the swine is checked no evidence of the disease is found. The best assumption seems to be that locally slaughtered garbage-fed swine are contaminating the yards. Grain-fed swine, held in the contaminated pens before shipment to the eastern markets, are then found infected upon arrival. When the source of the shipment is checked, the infection is not found because the garbage-fed swine already are slaughtered.

It is easily understood how one would arrive at the conclusion that the disease in a shipment of swine did not come from his State when all the premises where the swine originated were inspected and no evidence of the disease was found. However, it must be admitted that some of these States are not inspecting all their swine on garbage-feeding premises frequently enough to know that the disease is not present. It is logical to assume that these swine are the culprits contaminating the pens that later indirectly infect grain-fed swine that pass through such pens for interstate shipment to the East. This raises the question as to whether the only infection in the country exists in the counties that are under Federal quarantine at this time.

Now that we have seen the spread of the disease and the apparent reduction of the incidence during the past six months, let us look at the action that has been taken to combat the disease.

After the disease appeared in New England and at the same time became widespread throughout the rest of the country during the first part of the year, it was realized that nothing could be done unless the infection was found and stamped out. It would be necessary also to control the movement of garbage-fed swine until such time that all garbage fed to swine is cooked prior to feeding it.

Meetings were held with State control disease officials and representatives of the different agencies of the swine industry. A program was approved that emphasized three major points:

1. Find infection and stamp it out.
2. Control movement of garbage-fed swine.
3. Require that garbage be cooked prior to feeding.

The States enacted laws and regulations to this effect and the Federal Government put on similar restrictions and co-operated with the States in their programs.

Two basic steps of disease control and eradication as far as vesicular exanthema is concerned have to be placed into effect before we can say that we are on the road to eliminate the disease.
REPORT ON THE ERADICATION OF VESICULAR EXANTHEMA

1. Inspection (Frequent, Periodic, at least semi-monthly)
2. Control the movement of raw garbage fed swine

The inspection is important since

A. It will uncover the disease at the source. Then it will enable us to quarantine it and stamp it out.
B. It will enable us to know what is the true extent of the infection.
C. Inspectors can pass along proper advice and help that the garbage feeders need.
D. These men can explain our programs. Remember, it will be far easier to achieve the end results of garbage cooking, if the feeders realize themselves that it is necessary.

Why is semi-monthly inspection so important? During the past year when vesicular exanthema was found, the affected hogs were held under quarantine until slaughtered. Yet the disease continued to appear in new places. Taking the nation as a whole, inspection has been inadequate. Only that portion of infection has been found where inspection was established or when the disease appeared in public markets, packers’ pens or at destination points.

It is understood that many months will pass before all garbage is cooked prior to feeding it to swine throughout the United States. It is granted that this matter is beyond our immediate control. However, since we cannot get this satisfactory requirement now, we should protect ourselves by setting up a system of inspection that would locate the infection at the source and, therefore, prevent it from spreading to other farms within your State or to adjacent States. To me, our insurance for the control of this disease rests with proper inspection. It is our only protection in the interim between now and when the feeder properly cooks his garbage prior to feeding it. Much progress is being made along these lines, and we know that we have proper inspection set up in 23 States*. Many other States at this time are on the brink of initiating semi-monthly inspection of all the garbage feeding premises within their States. Many States have a good percentage of those feeding garbage, properly cooking it so that the program is moving on and we are making progress as each day goes by.

If we make the same progress this year that we have made during the past 12 months, we should be in a very favorable position by the time this Association meets again.

Controlling the movements of garbage-fed swine is important because it will help prevent the contamination of stockyards, auction markets, sales barns, other concentration points, and means of transportation. Restrictions must be placed on these swine when they are moved and steps taken to prevent contact with other type swine.

It was suggested at the last meeting that, until satisfactory inspection and

*Alabama, Arizona, Arkansas, California, Connecticut, Idaho, Iowa, Louisiana, Maine, Maryland, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, Ohio, Oregon, Rhode Island, South Dakota, Utah, Wisconsin, Wyoming.
control was obtained over the marketing of all garbage-fed swine, no State
could feel assured that it would not get the disease. Some States, which
took drastic measures to prevent the entry of the disease, found the infection
within their border, either in stockyards, auction markets, other concentra-
tion points, or on garbage feeding premises.

Something had to be done to require that garbage be cooked prior to
feeding it to swine. This was a State problem. With the cooperation of the
different interested groups of the swine industry and the disease control
officials, forty-one States have passed such laws or regulations. At the time
of the last meeting Nebraska was the only State that had passed such a law.
These results are gratifying and beyond anyone's expectation. At the present
time we do not have laws or regulations requiring the cooking of garbage
in Arkansas, California, New Mexico, North Dakota, Vermont, New Jersey
and Rhode Island. However, in some of these States action is being taken
by the State officials that will bring the desired restriction on garbage cooking.

What is happening in the major garbage feeding States such as New
Jersey, Massachusetts and California? In New Jersey a program is being
developed which gives promise of the control and eradication of the disease.
Although a garbage cooking law has not been passed, it is believed that
feeders will be cooking in the near future. New Jersey officials soon hope
to have all garbage feeders inspected semi-monthly. They also have
attempted to find how much infection they had on their farms and have
tried to control the marketing of all garbage fed swine in their State. The
Federal Government has recently made a survey of movements of swine
from the State. Strengthening the enforcement of interstate movements will
aid the program materially within the State.

Massachusetts has passed a garbage cooking bill to become effective
January 1, 1954. In the interim they are holding exhibitions of garbage
cooking and using educational means to convince the raisers to cook the
garbage. It is hoped that in the next thirty days semi-monthly inspections
of the garbage feeding premises within the State will be initiated.

In California the market for garbage-fed swine has been reduced because
of the Federal quarantine which permits only pork that originated from
swine slaughtered outside the State of California or processed in normal
plant procedure to a temperature high enough to kill the vesicular exanthema
virus to be moved interstate from there. Some California officials are opti-
mistic over the possibility of a program being developed there in the
near future.

Many problems are encountered in trying to carry out the present
garbage cooking laws. One of the chief obstacles is the lack of satisfactory
equipment. It is true that there is a lack of this equipment, but we have
much more of it now than we had 12 months ago, and we will continue
to have more as each month passes. We have also learned that some
individuals have purchased equipment that is not satisfactory.

It has often been heard, "How will we cook household garbage?", and
yet we do know that with the cooperation of the city officials, garbage can be sorted and used for hog feed when cooked properly.

The Bureau is conducting a continuous survey of garbage cooking throughout the United States. This survey represents only a small fraction of the 14,000 premises so it isn’t too indicative. However, a trend can be noted that those who begin cooking are not satisfied at first but later change their minds.

They find that the increased cost of cooking is somewhat compensated by the decrease in disease losses and that they are able to start younger pigs on the cooked garbage in comparison to raw garbage. They are beginning to realize, too, that they are not being sold a new method of feeding, but that our livestock industry cannot afford to live with a type feeding that is responsible for spreading animal and human disease.

Getting swine raisers to cook garbage is largely a selling proposition. There is a consolation in that as they are convinced, the majority will eventually appreciate the change just as dairy producers appreciated the need for the pasteurization of milk. The results in obtaining proper cooking and feeding will be just as good as the time and effort we are willing to put on it.

The Bureau has employed a physicist who has been surveying garbage cooking establishments in the Washington, D. C. vicinity. He has found apparently good cooking units with cold spots in them. The owners welcomed the changes and assistance that he has given them. This is a type of important help that these swine raisers need.

This can also be taken as a word of caution. In other words, if infection is found on a premise that is cooking garbage, do not look at other possibilities for other sources of infection until you have checked the temperature of the garbage that is being cooked.

Because of a number of defects found in equipment, the State official may find the services of a State engineer or physicist helpful in the early stages of the program.

The Bureau plans to publish the findings of its survey within the near future. Some results are already obvious. For example, the form of cooking that places prongs down into garbage does not do a very thorough job of cooking as the steam doesn’t penetrate the garbage but comes right up along the outside of the pipe. Pipes that have been installed on the bottom of trucks should be as close to the bottom as possible as garbage below such pipes will not be cooked properly. The proper spacing of the holes in such pipes is vitally important for uniform cooking and so far the closed system or steam returning to the boiler apparently does not do the job. These are just a few items found in the study.

At the present time there are approximately 14,000 premises throughout the country that are feeding garbage. Of this number about 31% are reported to be cooking the garbage prior to feeding it to swine. How many of this 31% are cooking properly is not known.
How much infection actually exists in the United States? This map (see attachments) shows in what counties throughout the country the disease was reported in as of September 21 but how close it is to the true extent of infection is not known, but there is no doubt that more infection exists. Out of the 14,000 premises only 37% are being inspected semi-monthly. Quite a number of these 14,000 premises have not been inspected for the first time, and some of them have been inspected only once or twice during the past year.

Program aims for the coming year first will be the semi-monthly inspection of all garbage feeders throughout the United States. When this is established, a better estimate of infection can be made. As each State initiates such inspections, the information that can be forwarded to you will be more reliable.

The only weakness that can defeat the program is complacency—complacency by those who have not had any infection reported within their States for the past 6 or 8 months or those States in which the disease has not appeared as yet. Possibly you may feel that the disease is eradicated in your State, but talk first to officials of Texas and Florida, who have recently experienced a flare-up of this disease, or officials of the Eastern States who have received shipments of infected swine. They will assure you that the infection has not gone.

There is a major problem facing many of you since funds are not available to set up satisfactory means of enforcement of your garbage cooking bills. However, this is not the first time that you gentlemen have battled such obstacles. You will find a solution to this problem provided that we are agreed that such inspection, control over the marketing of garbage-fed swine, and the cooking of garbage is necessary to rid your State and the country of vesicular exanthema.

CONCLUSIONS:

1. Vesicular exanthema is still a threat to the livestock industry of the United States.
2. There is still a good possibility that the disease may sweep across the country again unless measures are taken to prevent it.
3. A chief weakness in the control and eradication program is that only about 31% of 14,000 premises that feed garbage to swine are cooking the garbage prior to feeding it. 37% of the 14,000 premises are being inspected semi-monthly—others have been inspected only once or twice during the past year.
4. Semi-monthly inspection is essential to know the number of garbage feeding premises, to find infection, and quarantine it on premises until it can be stamped out. Inspect frequently enough so that cases that develop soon after one inspection would still show some evidence of the disease at next inspection. Explain program, assist feeder in setting up
equipment—check cooking operations and see that sanitary conditions are adequate in feeding swine.

5. Limit movement of swine fed raw garbage so that they are handled in such a way to prevent them from contacting other swine either directly or indirectly.

6. Require the cleaning and disinfecting of conveyances and facilities that are used by swine that are moved intra-state and inter-state.

7. Garbage feeders will need a great deal of assistance to be convinced of the need for cooking the garbage. They will also need a great deal of help to set up equipment and to cook the garbage properly.

8. The program for the coming year should consist of semi-monthly inspections, slaughter and special processing infected and exposed swine, cleaning and disinfecting, control movement of garbage-fed swine both intrastate as well as interstate and require that all garbage fed to swine be properly heat-treated.
EXPERIMENTAL INFECTIONS WITH VESICULAR EXANTHEMA
PART I. DIRECT AND INDIRECT CONTACT EXPOSURE

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Vesicular exanthema is a vesicular viral disease primarily of swine and clinically indistinguishable from foot-and-mouth disease and vesicular stomatitis in this animal. Traum (1934) recognized that a vesicular outbreak in swine in California during April 1932 and thought to be foot-and-mouth disease did not react in test animals in a typical manner. When a second outbreak occurred in 1933 cross-immunity tests against vesicular stomatitis (New Jersey and Indiana types) and foot-and-mouth disease (A, O and C types) showed the California virus to be immunologically different (1, 2). Traum suggested the name vesicular exanthema for this new disease. Periodically this disease has been recognized and identified in California since that time. However, in June 1952 the disease suddenly spread across the United States and has now been diagnosed in at least forty States. Because of the urgency of making a prompt differential diagnosis in a vesicular outbreak, and since much information is needed with regards to the control and eradication of vesicular diseases, a project was established October 1952 at the Animal Disease Station, Beltsville, Maryland, by the Bureau of Animal Industry. The purpose of this project is to conduct immunological and infectivity studies on the virus of vesicular exanthema. The first part of this paper deals with studies concerning the spread of this disease by contact, both by direct contact with infected pigs and by pen exposure. Included also are studies on the duration of infectivity.

REVIEW OF LITERATURE

The majority of material written about vesicular exanthema is concerned with the historical background and symptomatic picture of this disease. Crawford in 1933-34 conducted a group of experiments with vesicular exanthema (3). While he found that this condition was communicable as a result of direct infection, experimental results with indirect infections were inconsistent. In one experiment susceptible pigs housed in the same barn with infected pigs and using no special quarantine procedures to prevent spread did not become infected. In similar experiments, animals did become infected by indirect exposures. Crawford concluded that vesicular exanthema was not very communicable by indirect infection. Also, vesicular exanthema has a closer relationship to vesicular stomatitis than foot-and-
mouth disease as indirect infection plays only a minor role in the spread of vesicular stomatitis and vesicular exanthema, while foot-and-mouth disease is readily spread by indirect infection.

**MATERIALS AND METHODS**

These experiments were conducted in barns and laboratories designed and maintained to insure strict quarantine. All personnel entered the barns through a dressing room in which all street clothing was removed and proceeded into the barn through a shower stall. In the barn personnel dressed in coveralls, rubber hats, boots, coats and gloves which remained in the barn and workers were required to shower when they left. Where it was necessary to maintain isolation between pens, the rubber clothing was washed with 2% lye solution and rinsed with water. The pens are separated by ceiling to floor concrete walls and each pen is separated from the connecting corridor by a small room which serves as a buffer area and decontamination chamber. Each entrance is closed by double steel doors. The floor area in the buffer zone between the doors was kept clean with 2% lye solution and feed for the individual pens was also kept in this area. Sewage from several barns was steam sterilized. The sewage was held at 180°F. for approximately one hour (at 25 lbs. pressure). In other barns the sewage was treated with one percent (final conc.) lye for twenty four hours in chemical sterilization tanks. All expendable materials as straw, manure, carcasses, etc., were incinerated. Rubber watering hose and rope were provided for each pen. Swine temperatures were routinely taken twice a day, except at the beginning of experiments when more frequent temperatures were taken. The pen floors were not washed during contact experiments.

All animals used on these experiments were a Chester White-Landrace cross secured from the Nutrition Section of the Animal Husbandry Division, Bureau of Animal Industry, Beltsville, Maryland. The pigs were uniform in size averaging about 175 pounds and were either females or castrated males with no prior immunization inoculations.

Virus used throughout these experiments was a seventh passage of an original harvest made on June 17, 1952, from a field outbreak in swine at a Nebraska biological plant and designated Nebraska No. 1 vesicular exanthema virus. It was found to be of B 51\(^1\) type when typed serologically and immunologically by Dr. R. A. Bankowski at University of California. The virus used for these experiments came from different pools of frozen virus stored at—70° C. in a dry ice chest. Many of the virus harvests used for these early experiments were not titrated for infectivity. The infectivity titer averaged about 1x10\(^{-5.3}\) I.D.\(_{50}\)\(^2\) for repeated titrations on two large lots.

\(^1\) It has been decided by the Bureau of Animal Industry and cooperating officials in California that the nomenclature of the present existing types will be: type A48, previously known as "F" isolated in 1948; type B51, previously "B" and isolated in 1951; and type C 52, isolated in 1952.

\(^2\) 50% infecting dose.
of 20 per cent stock virus-saline suspensions before and after a month's storage at—70°C. Vesicular coverings were ground in a mortar and pestal with phosphate buffered saline pH 7.6 used as a diluent. Sterile ground glass about the coarseness of sea sand was used as an abrasive and 10 to 15 mgm/cc of streptomycin sulphate in buffered saline was added for intravenous inoculations. Vesicular fluid was of high virus content and could be used with, or in place of vesicular coverings. The final concentration of vesicular material was 5% which was centrifuged for ten minutes at 2000 R.P.M. and the supernatant used as inoculum.

The animals were snubbed to a wall ring by a 1/4 inch manila rope and were bled from the anterior vena cava using a 16 gauge 4 1/2 inch needle and a 50 cc syringe. The syringe was then carefully removed leaving the needle in place and 5 cc of 5% inoculum injected with a second syringe.

For the titration, virus was ground as above with the exception that 10% vesicular material was the final concentration. One-hundred fold dilutions were inoculated intradermally on the snout using a 20 gauge needle and a 3 cc dose. Four swine were inoculated with each dilution. Seventy-two hour final readings were used with the 50% infectivity dose averaging $10^{-6}$.

DIRECT CONTACT EXPERIMENT "A"

The contact experiments were designed to find out how long and when swine infected with vesicular exanthema are active disseminators of the virus. In this first part 14 swine were inoculated I.V. with 5 cc of 5% inoculum. On the fourth day after inoculation two infected pigs were placed in a pen with two normal swine, one of which was scarified on the snout and pads of the front feet. This procedure was repeated on the 6th, 8th, 10th and 12th days. Temperatures were taken twice a day on each pig and the animals were examined each day for vesicles.

DIRECT CONTACT EXPERIMENT "B"

The second experiment was set up because no contact swine in the first experiment developed vesicles. It was carried out in an identical manner except that inoculated swine were added to normal swine at 12, 24, 36, 48, 72, 96 and 144 hours after inoculation.

DIRECT CONTACT EXPERIMENT "C"

The third phase of the contact experiments was designed to determine as closely as possible when infected swine actively disseminate virus. Two swine were inoculated I.V. as above. The site of inoculation was then bathed with 5% formalin and the swine and pen washed with water. The two swine were then placed in contact with two normal swine in a clean pen for 12 hours. At that time the inoculated swine were withdrawn and placed in a pen with two other normal swine. This process was repeated at 24, 36, 72, 96, 144 and 192 hours. In each pen one of the normal swine was scarified on the
snout and feet before the infected swine were introduced. In all experiments strict quarantine was maintained between pens.

**INDIRECT CONTACT EXPERIMENT “D”**

This experiment was designed to determine the spread of virus by placing normal swine into infected pens after the infected pigs had been removed. Eight pens were used with three pigs being inoculated in each pen. At 72 hours 23 pigs had ruptured vesicles on snout and feet and were removed from the pens, one of the inoculated pigs failing to develop lesions. During the time in the pens no manure was removed nor any cleaning done. Two contact pigs (one scarified) were added immediately to the first pen. Each day thereafter two contact pigs were added to the next pen, etc. Thus contacts were added 0, 24, 48, 72, 96, 120, 144 and 168 hours after removal of infected pigs from pens. All negative pigs were challenged at three weeks.

**INDIRECT CONTACT EXPERIMENT “E”**

In this pen exposure experiment infected pigs were removed from their pens as above, but not until six days after inoculations. Contact groups were added at 0, 48 and 96 hours after removal of infected pigs.

**EXPERIMENTAL RESULTS:**

*Experiment “A” (Direct contact exposure)*

Fourteen pigs were inoculated intravenously with 5 cc of 5% Nebraska No. 1 vesicular exanthema virus. All the pigs showed lesions at 48 hours, 12 showing lesions on four feet, one on three feet, and one on two feet. Two of these inoculated pigs were placed in a clean pen in contact with two normals at four days after inoculation. This was repeated at 6, 8, 10 and 12 days. None of the contact pigs developed lesions. Those placed in contact at four days showed temperature elevations of 103.8 and 104.0°F. On challenge at three weeks all pigs were positive except the four day group which was negative indicating that this group contracted infection without evidence of lesions and developed immunity.

*Experiment “B” (Direct contact exposure)*

This was a similar experiment to the “A” experiment but with contact pigs being added at 12, 24, 36, 48, 72, 96 and 144 hours. Here both contact pigs developed lesions at 12, 24, 36, 48 and 72 hours. In the 96 hour group one pig developed lesions, the other pig while showing no lesions did have a temperature elevation of 104.6°F. The 144 hour pigs were negative showing neither lesions nor temperature elevations. All three negative pigs were negative to challenge at three weeks indicating inapparent infection followed by the development of immunity. In this experiment the 12 and 24 hour groups were placed in contact before the development of lesions on the inoculated pigs. It is known from other experimental work that the length of the incubation period is directly correlated with the method and
amount of virus exposure. The long incubation period of the 12 and 24 hour groups in this instance may have been due to the delayed exposure from the inoculated swine or to light exposure from the inoculated swine before lesions developed.

Three of the eleven contact pigs which developed lesions failed to show temperature elevations. In this experiment any temperature over 103.4°F. was considered an elevation. Temperature elevations on the contact pigs ranged from 103.4°F. to 105.8°F.

In the inoculated group of 14 pigs used to infect the contact swine, the average time for the development of a temperature elevation was 34.8 hours and for the development of the first lesion 46.8 hours. Thus, the average time between the first temperature rise and the first lesion was 12.0 hours. This period between temperature rise and development of first lesions compares favorably with other experiments.

![Figure No. 1](attachment:figure1.png)
### TABLE No. 2

**Experiment "B"**

<table>
<thead>
<tr>
<th>Group No.</th>
<th>No. of Pigs</th>
<th>Pen Contacts Added (Hours after inoculation)</th>
<th>1st Temp. Elev. of Contact (Hours after addition of infected pigs)</th>
<th>1st Lesion of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>12 hours</td>
<td>60</td>
<td>84*</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>24 &quot;</td>
<td>—</td>
<td>96**</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>36 &quot;</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>48 &quot;</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>72 &quot;</td>
<td>72</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>96 &quot;</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>144 &quot;</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* Lesions in contacts developed 60 hours after initial lesions in inoculated pigs.
** Lesions in contacts developed 84 hours after initial lesions in inoculated pigs.


### TABLE No. 3

**Experiment "C"**

<table>
<thead>
<tr>
<th>Group No.</th>
<th>No. of Pigs</th>
<th>Hours in Pen Contact (after Inoculation)</th>
<th>Hours of Contact</th>
<th>1st Temp.Elev. of Contact (Hours after addition of infected pigs)</th>
<th>1st Lesion of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>0-12</td>
<td>12</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>12-24</td>
<td>12</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>24-36</td>
<td>12</td>
<td>96 hours</td>
<td>144 hours</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>36-48</td>
<td>12</td>
<td>84 &quot;</td>
<td>108 &quot;</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>48-72</td>
<td>24</td>
<td>24 &quot;</td>
<td>96 &quot;</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>72-96</td>
<td>24</td>
<td>24 &quot;</td>
<td>72 &quot;</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>96-144</td>
<td>48</td>
<td>48 &quot;</td>
<td>48 &quot;</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>144-192</td>
<td>48</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>192-240</td>
<td>48</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

RESEARCH RESULTS WITH VESICULAR EXANTHEMA

EXPERIMENT "B" (Direct Contact)

Percent Positive vs Time

FIGURE NO. 2

TABLE 2

<table>
<thead>
<tr>
<th>Group No.</th>
<th>No. of Pigs</th>
<th>Added (Hours After Inoculation)</th>
<th>1st Temp. Elev. of Contact</th>
<th>1st Lesion of Contact (Hours after addition of infected pigs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>12 hours</td>
<td>60</td>
<td>84*</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>24 &quot;</td>
<td>—</td>
<td>96**</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>36 &quot;</td>
<td>36</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>48 &quot;</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>72 &quot;</td>
<td>72</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>96 &quot;</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>144 &quot;</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

* Lesions in contacts developed 60 hours after initial lesions in inoculated pigs.

** Lesions in contact developed 84 hours after initial lesions in inoculated pigs.
TABLE NO. 1
EXPERIMENT "C"

TEMPERATURE REACTIONS AND LESIONS OF DONOR PIGS ONLY
SHADEd AREA INDICATES PERIOD IN WHICH CONTACT'S DEVELOPED LESIONS

<table>
<thead>
<tr>
<th>ANIMAL NUMBER</th>
<th>TREATMENT</th>
<th>HOURS FOLLOWING INOCULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>1251</td>
<td>INOCULATED</td>
<td>5 cc - 5% I.V.</td>
</tr>
<tr>
<td></td>
<td>INOC</td>
<td></td>
</tr>
<tr>
<td>1265</td>
<td>=</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>INOC</td>
<td></td>
</tr>
</tbody>
</table>

*At 36 hours feet were hot, tender, and blanching, but no vesicles were formed.

CODE:
- Right Front Foot - Right Rear Foot
- Snout - 0
- Left Front Foot - Left Rear Foot

0 = No visible lesion
+ = Visible lesion
Experiment "C" - (Direct Contact Exposure)

In this experiment only two pigs were inoculated intravenously with 5 cc of 5% inoculum, and these were moved from one clean pen in contact with two normal pigs to another clean pen. The two infected pigs were suspicious at 36 hours with blanched, hot, swollen feet, which were sensitive to pressure. Both animals had ruptured foot vesicles at 48 hours after inoculation. The hours in contact started at 0 to 12 hours, the last group being in contact 192 to 240 hours. The two contact groups of 0-2 hours and 12-24 hours were negative. One contact animal in the 24-36 hour group was positive. The 36-48, 48-72, 72-96 and 96-144 hour groups were positive. Both the 144-192 and 192-240 hour groups were negative. Challenges of negative animals at three weeks resulted in the 0-12, 12-24, 144-192 and 192-240 hour groups being positive, indicating that none of these pigs had developed immunity. One negative animal from the 24-36 hour group was negative on challenge showing that this pig had developed an immunity. Of particular interest is the 24-36 hour group where one contact pig developed lesions although the donor pigs were not showing lesions during the period of contact.

The inoculated pigs developed their first lesions 48 hours after inoculation, and the period of virus elimination to normal swine occurs during a maximum of 120 hours between the 24th and 144th hours after inoculation.

Experiment "D" (Indirect exposure)

In this pen exposure experiment two normal contact pigs were placed in an infected pen, 0, 24, 48, 72, 96, 120, 144 and 168 hours after removal of infected pigs—a separate pen being used for each group of contacts. Of the pigs used to infect the pens, three pigs in each of eight pens were inoculated intravenously, showing temperature elevations at an average of
RESEARCH RESULTS WITH VESICULAR EXANTHEMA

33.4 hours after inoculation. Eighteen pigs showed lesions at 48 hours and 23 had ruptured and unruptured vesicles at 72 hours at the time they were destroyed, one pig failing to develop lesions.

Only one of the pigs placed in the infected pens developed lesions. This was in the 72 hour group. Both pigs in this group showed temperature elevations.

On challenge at three weeks one pig in the group added immediately after removal of infected pigs was immune and both pigs in the 72 hour group were immune. All remaining animals were positive, including those in the 24 and 48 hour groups, which would indicate that none had developed immunity.

Experiment "E" (Indirect Exposure)

In this experiment two normal contact pigs were placed in an infected pen at 0, 48 and 96 hours after removal of infected pigs. One of the pigs added immediately was positive, both pigs in the other groups were negative. All negative pigs were positive on challenge at three weeks.

DISCUSSION

The spread of this virus seems to be controlled without difficulty when routine safety precautions are taken to prevent spread. Our system of disinfection with 2% lye solution, the incineration of all animals and expendable material, and the showering of personnel with change of clothing on leaving an infected premise has restricted any spread. We have had no evidence of breaks within the barns nor indications of spread as by aerosol.

In the first of a series of experiments designed to determine the period at which swine infected with vesicular exanthema are active disseminators of the virus, no lesions were found in the contact pigs added to I.V. exposed swine four days after inoculation. However, this group of pigs did develop an immunity. The 6, 8, 10 and 12 day groups were all negative and developed no immunity.

In a similar experiment ("B") all contact pigs developed lesions up to four days. The four-day group had 50% reactions, but 100% developed immunity. In experiment "C" it was shown that no virus was shed by I.V. exposed swine during the first 24 hours after inoculation. However, virus was eliminated for approximately 12 hours before the first appearance of lesions. Contact pigs developed lesions up to the 6-8 day group which was negative and did not develop an immunity.

The initial period of virus elimination from the I.V. exposed swine appears to coincide very closely with the development of the first vesicular lesions. Since the I.V. exposed donors developed their first lesions at 36-48 hours and the 24 to 36 hour group of swine was the first group to become infected or develop immunity, it appears that virus is shed in some manner prior to vesiculation. Other experiments in the second part of this paper add additional evidence to show that swine do not necessarily have to be vesiculated to be
shedding virus. The long incubation period of this first contact to become infected, 96 hours first temperature elevation and 144 hours first lesion, after addition of infected pigs, as compared with shorter incubation periods of 108, 96, 72 and 48 hours to first lesions respectively for each of the successive groups, definitely points towards a graduated increase of virus elimination from a brief period prior to vesiculation until shortly before the period of complete non-infectivity.

From these three experiments it appears that swine begin to shed virus within 12 hours before they become vesiculated and continue to shed virus for 84 to 108 hours after vesiculation. At either end of the viral elimination period some contact pigs fail to show lesions but develop an immunity. The upper limit seems to be about 100 hours after the development of vesicles that the infected animal no longer sheds virus. We have never had a contact pig develop lesions when contacts have been added over 100 hours following the appearance of vesicles. During this period of approximately 4½ days when pigs in direct contact with infected pigs develop lesions we see a variation in the incubation period before lesions are seen in the contacts.

One group of 14 inoculated pigs had as an average time for the first temperature rise 34.8 hours and an average time for the appearance of the first lesion of 46.8 hours. This gave 12.0 hours as the average time between the first rise in temperature and the development of lesions.

Figures one and three show that the average temperature of reacting contact pigs is lower than that of inoculated animals. Because of the increase in the period of incubation the peak temperature reaction of contact animals is 24 to 48 hours after the peak reaction of inoculated animals. This increase in incubation period of contacts is associated with a decrease in the percentage of positive contacts as compared with inoculated animals, requiring three to four days longer to reach 100% positive animals.

From other experiments there appears a direct correlation between dosage and degree of reaction of an animal. Thus, in contact animals where the amount of virus shed by donor pigs varies, we see different temperature curves and incubation periods in the contact animals. This can be seen on Table No. 1 where the incubation period decreased as the donor pigs developed lesions and hence were shedding increased amounts of virus. Correspondingly, reacting pigs showed higher temperature elevations.

Table No. 4 shows that temperature elevations while significant in a majority of cases are either absent or missed in a surprising number of contact animals. Twenty-one percent of the contact animals developed lesions or became immune without showing temperature elevations. Of inoculated animals 100% had temperature elevations and all developed lesions. Of interest is the fact that all animals which have shown temperature rises following exposures have gone on to develop lesions or an immunity without lesions.

Table 5 summarizes the direct contact experiments with all groups having
any reaction in shaded blocks. Animals listed as negative developed neither lesions nor immunity. As shown, several groups failed to develop lesions, but were immune when challenged at three weeks. Since pigs inoculated intravenously show lesions at an average of 48 hours, subtracting 48 hours from the hours after inoculation at the top of the chart will give the number of hours which the virus is shed. In experiments “B” and “C” this would be about 100 hours.

In the pen exposure experiments it was quite difficult to infect pigs by indirect exposure. Actually only two contact pigs developed lesions and no pigs in groups over three days following the removal of infected pigs developed immunity.

In all experiments one pig in each group was scarified so that actual skin breaks were on the snout and feet of contact animals. No significant difference could be seen between the speed or degree of reactions in contact animals between those scarified and non-scarified pigs. This raises the question of whether the virus is primarily spread by contact with susceptible epithelial
tissues of the snout and feet where primary lesions are observed or by another mode of spread.

SUMMARY

1. The virus of vesicular exanthema can be spread by direct contact quite easily, but only for about 120 hours.
2. In one instance a contact pig developed lesions although the donor had not developed vesicles at the time of contact.
3. Once vesicles have formed virus is shed for about 84—108 hours.
4. An average time of 12.0 hours elapsed between the first temperature rise of inoculated pigs and the first lesions developed.
5. It is quite difficult to spread virus by indirect contact.
<table>
<thead>
<tr>
<th>Lesions</th>
<th>Contact Swine</th>
<th>Inoculated Swine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Per Cent</td>
</tr>
<tr>
<td>With Temperature Elevation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesions</td>
<td>16</td>
<td>66.5</td>
</tr>
<tr>
<td>Without Temperature Elevation</td>
<td>4</td>
<td>16.5</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>83.0</td>
</tr>
<tr>
<td>Immunity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without Lesions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Temperature Elevation</td>
<td>2</td>
<td>8.5</td>
</tr>
<tr>
<td>Without Temperature Elevation</td>
<td>1</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>13.0</td>
</tr>
<tr>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without Lesions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With Temperature Elevation</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Without Temperature Elevation</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevation with lesions or immunity</td>
<td>13</td>
<td>75.00</td>
</tr>
<tr>
<td>Temperature Elevation Without Lesions or Immunity</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

* Included in Total of Contact Swine Are Only Those Pigs From Positive Pens—Where One Or More Animals in the Pen Developed Lesions or Were Immune to Virus Challenge.
**TABLE No. 5**

*Summary of Direct Contact Experiments*

<table>
<thead>
<tr>
<th>Hours after I. V. inoculations of donor pigs</th>
<th>0-24</th>
<th>24-48</th>
<th>48-72</th>
<th>72-96</th>
<th>96-120</th>
<th>120-144</th>
<th>144-168</th>
<th>168-192</th>
<th>192-216</th>
<th>216-240</th>
<th>240-264</th>
<th>12 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment “A” (Donor pigs allowed to remain in pen with contacts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No les</td>
<td>No les</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
</tr>
<tr>
<td>Experiment “B” (Donor pigs allowed to remain in pen with contacts)</td>
<td>*Les</td>
<td>*Les</td>
<td>Les</td>
<td>Les</td>
<td>Les</td>
<td>Les</td>
<td>No Les</td>
<td>Imm</td>
<td>***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment “C” (Donor pigs moved about pen with contacts)</td>
<td>Neg</td>
<td>**Les</td>
<td>Les</td>
<td>Les</td>
<td>Les</td>
<td>Les</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
<td>Neg</td>
</tr>
</tbody>
</table>

* 12-24 and 24-36 hour contacts were positive since donor pigs remained in pen and thus infected contacts after development of lesions.

** Only one pig in this group was positive—one animal remaining negative.

*** End-point was not reached since no additional contact groups were added beyond 192 hours.

Les — Lesions; Neg — Negative; Imm — Immune.
6. Reactions always occurred when temperature elevations were present. However, in the direct contact experiments 16.5% of the animals developed lesions and another 4.5% developed immunity without lesions while failing to show temperature elevations.

PART II.

FEEDING OF VIRAL SUSPENSIONS AND INFECTED TISSUES

The first part of this paper dealt with the spread of vesicular exanthema by direct and indirect contact. This part reports the transmissibility of vesicular exanthema by feeding of infected tissues, the storage of infected meat and subsequent feeding, and the variations in virus titrations by feeding as compared with other routes of inoculations.

Vesicular exanthema appears to be a disease primarily of garbage fed swine. During the first twelve years of vesicular exanthema in California less than 7 percent or only thirty-five outbreaks out of 517 herd infections were other than garbage fed herds. In most of the thirty-five outbreaks definite contact could be established between the infected herd in question and an infected garbage feeding establishment. Our investigations were designed to determine the ease of spread by feeding infected meat, the duration of infectivity in meat which has been stored, and the various swine tissues which will spread infection.

REVIEW OF LITERATURE

A review of literature on vesicular exanthema reveals only one instance where an experiment was conducted with meat scraps. Duckworth in 1935 reported on feeding of meat scraps from infected pigs. Meat scraps from two infected swine with temperatures of 108°F and 107°F. were fed to six pens of about sixty pigs per pen. None of these pigs developed lesions. A pen of sixty pigs inoculated with blood from the meat scrap pigs had two pigs develop lesions. No definite conclusions were made as to the ease with which vesicular exanthema can be spread by feeding.

MATERIALS AND METHODS

Since our general procedures have been discussed in the first part of this paper, only procedures relating directly to the feeding experiments will be discussed here.

Feeding Experiment "A."—The first phase of the feeding experiments was conducted to determine if virus in high enough concentrations to infect other swine was contained in three general areas of the carcasses of inoculated animals. Also, similar tissues from inoculated animals were stored for later feedings to determine the duration of infectivity. The three groups of meat pooled were: (1) snout, feet, and skin; (2) viscera, including lymph glands, heart, spleen, kidney, liver, lungs and sections of intestines;
VESICULAR EXANTHEMA FEEDING EXPERIMENTS

(3) chopped meat and crushed bone. A group of nine swine were inoculated I. V. with 5 cc. of five per cent Nebraska No. 1 vesicular exanthema virus. This was the seventh passage of an original harvest made in June 17, 1952 from a field outbreak at a Nebraska biological plant. This virus is B51 type with an infectivity titer of $1 \times 10^{-5.332}$ I. D. 50. Eight of these pigs were destroyed 72 hours after inoculation, all showing ruptured or unruptured vesicles on the feet and temperature elevations ranging from 104.0°F. to 106.2°F. During the slaughter of these swine care was taken so that parts of one area of a carcass did not come in contact with parts of any other area. Thus, the feet did not come in contact with the meat, etc. The feet and snout were removed first and placed in polyethylene plastic bags for storage or used for immediate feeding. The remainder of the swine were distributed in bags in like manner. Approximately ten pounds of meat scraps were placed in each bag, special care being made to have samples from each of the different pigs in each bag. These bags were labeled and placed in ten gallon cans with lids and stored for future use. In addition to the group of samples to be fed fresh, three sets were refrigerated at 7.0°C. and one set frozen at $-70^\circ$C.

The susceptible swine to be fed the meat scraps were fasted for 48 hours prior to feeding. Swine were divided into three groups to correspond with the three sections of meat scraps. Each group of two or three pigs was fed ten pounds of carcass material per pig. The pigs were examined daily and their temperatures taken twice a day. In all, five different feedings were made using (1) fresh material, (2) after one week's refrigeration at 7.0°C., (3) after two week's refrigeration at 7.0°C., (4) after four week's refrigeration at 7.0°C., and (5) after being frozen at $-70^\circ$C. for eighteen weeks. Uneaten meat scraps were allowed to remain in the pens for 48 hours and then removed. All negative pigs were challenged at three weeks to see if they had developed an immunity.

Feeding Experiment "B."—In this experiment swine were slaughtered at peak temperature reactions but prior to the formation of vesicles in an effort to determine if meat scraps from pre-vesicular swine will spread vesicular exanthema. Also, the carcasses were divided into additional groupings so as to determine more specifically which tissues were infective. The procedure was basically the same as Experiment "A" with some exceptions. Fourteen pigs were inoculated intravenously and watched closely and were slaughtered when they developed temperature elevations of 104.0°F to 107.2°F. At the time of slaughter none of the animals had developed vesicles. Eight of the fourteen pigs were used as a source of infected tissues. A control group of fourteen pigs similarly inoculated in another barn were allowed to develop vesicles so that it could be assumed that the slaughtered pigs would have likewise developed vesicles in approximately the same period of time.

The following materials were collected for immediate feeding: (1) Feces collected from the infected pigs just prior to slaughter; (2) whole blood;
VESICULAR EXANTHEMA FEEDING EXPERIMENTS

(3) feet and snouts; (4) lymph glands; (5) spleens; (6) crushed bone; (7) viscera (heart, liver, kidney, lungs and washed intestines); (8) meat (no bone, skin nor lymph glands attached); and (9) urine. The urine samples differed from the other eight samples in that it was collected after vesicles developed from infected swine other than those slaughtered for the first eight samples. Eighteen pigs were divided into nine groups with one pig in each group being scarified on the snout. Each group of two pigs was fed one of the above materials within three hours after slaughter. Twenty pounds of material were fed to each group of two pigs, except in spleen and lymph gland group where smaller amounts were collected. Two liter volumes of blood, feces, and urine were mixed with equal volumes of feed prior to feeding. As in the previous experiment, susceptibles were fasted for forty-eight hours prior to feeding. Again, all negative pigs were challenged at three weeks.

Feeding Experiment "C" and "D".—These experiments were conducted to determine the 50% infecting dose of vesicular exanthema by feeding, and a comparison of a feeding titration with intradermal and intravenous methods. In all titrations four pigs per dilution were used. In Experiment "C" hundred-fold dilutions were made of a fresh pool of virus. The virus pool had been made from the vesicular coverings of fresh ruptured and unruptured vesicles from snout and feet of a group of swine inoculated for virus production. This material was ground in mortars, using sterile ground glass as abrasive. A 20% suspension was made, using phosphate buffered saline pH 7.6 as a diluent. Fifteen mgm/cc of streptomycin was added. This pool was centrifuged for 44 minutes at 1800 R.P.M. Comparative titrations were run on the fresh suspension and in later experiments on the stored frozen pool which was frozen at -70°C in sealed bottles. Three cc. intradermal doses on each snout were used with the dilutions being 10⁻¹, 10⁻³, 10⁻⁴, and 10⁻⁷. At the same time groups of pigs, fasted for 48 hours, were fed 10 cc. each of 10⁻¹, 10⁻², 10⁻³ and 10⁻⁴ dilutions. These 10 cc. doses were incorporated in a ball of moistened feed, placed on a piece of paper within a feeding trough. Each pig was fed separately and all feed consumed.

In experiment "D" standard doses of 2 cc. were used for feeding, intravenous inoculations, and intradermal inoculations. Also, hundred-fold dilutions were made in all three methods. The inoculum for this series of titrations was the same as the first series, but used after the virus pool had been frozen at -70°C for one month.

Incorporated in other experiments was the feeding of various amounts of blood from inoculated pigs. The results will be reported in these papers.

Experiment "E."—Sixteen swine were inoculated I. V. with 5 cc. of 5 per cent vesicular exanthema virus. Six of these pigs showing temperature elevations of 105.8°F.—106.2°F. and no vesicles were bled out at 28 hours. Defibrinated blood from these six pigs was pooled. Varying amounts were mixed with equal volumes of feed and fed to groups of two pigs each. These susceptible pigs were fasted for 48 hours prior to feeding. One group
received 1000 cc. of blood per pig, another group 500 cc. per pig and a
third group received 100 cc. per pig.

Experiment "F."—Twelve swine were similarly inoculated. Six of these
pigs showing temperature elevations of 105.0°F.—106.8°F. and no vesicles
were bled out at 26 hours. One group of pigs was fed 1000 cc. per pig of
defibrinated blood and another group fed 100 cc. per pig.

**EXPERIMENTAL RESULTS**

Experiment "A."—When pigs were fed fresh meat scraps all susceptibles in
the group receiving snout, feet, and skin were positive. All three receiving
viscera were positive. None of the swine receiving chopped meat and crushed
bone was positive. Those animals receiving meat after one week's refrigera-
tion had positive reactions in the snout, feet and skin group. Only one pig
was positive in the viscera group and none in the meat and crushed bone
group. On challenge at three weeks all negative pigs were immune.

After two weeks of refrigeration all pigs in snout, feet and skin group
and in the viscera group were positive. Those in the meat group were
negative, but were immune on challenge at three weeks. After one month's
refrigeration the snout, feet and skin group and meat group were positive
and the viscera group negative. These negative pigs were immune when
challenged at three weeks.

In the tissues which were frozen at —70°C. and fed at eighteen weeks, the
snout, feet and skin group was positive as was one of the pigs in the viscera
group. The meat and crushed bone group was again negative. All negative
pigs were immune when challenged (Table 6).

Experiment "B."—Eight pigs were slaughtered approximately six hours
prior to the development of vesicles, but after they had developed temperature
reactions. The average initial temperature elevation occurred 25.7 hours fol-
lowing intravenous inoculation and the pigs were slaughtered at the thirtieth
hour. In a control group of pigs, inoculated at the same time, all developed
vesicles having an average of 26.5 hours for the first temperature elevation
and 36.0 hours for the formation of vesicles.

Groups of two pigs each, one scarified on snout and front feet, were fed
different lots of meat from the infected pigs. All groups fed body tissues
were positive. Only the groups fed feces and urine were negative. However,
those pigs fed feces were negative on challenge at three weeks. The urine
group was positive on challenge (Table No. 7). The first group to develop
lesions was the feet and snout group at forty hours post feeding. The blood
and lymph gland groups were positive at 96 hours. Viscera and meat groups
were positive at six days. All groups had both pigs positive except in the
meat group where only one animal developed lesions. The negative animal
was negative on challenge indicating the development of immunity.

Of interest is the fact that four of the 13 pigs developing lesions in this
experiment failed to show temperature elevations. The highest recorded
**VESICULAR EXANTHEMA FEEDING EXPERIMENTS**

<table>
<thead>
<tr>
<th>Tissue Group</th>
<th>Feed</th>
<th>Chal.</th>
<th>Feed</th>
<th>Chal.</th>
<th>Feed</th>
<th>Chal.</th>
<th>Feed</th>
<th>Chal.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Week</td>
<td></td>
<td>2 Week</td>
<td></td>
<td>4 Week</td>
<td></td>
<td>18 Week</td>
<td></td>
</tr>
<tr>
<td>Meat - Bone</td>
<td>0/3</td>
<td>0/3</td>
<td>0/3</td>
<td>0/3</td>
<td>0/3</td>
<td>0/3</td>
<td>0/3</td>
<td>0/3</td>
</tr>
</tbody>
</table>

* Donor pigs had vesicles at time of slaughter.

** This group of pigs was not challenged.

1, 2, 4 week groups stored at +17°C, 18 week group stored at -70°C.

Numerator indicates number of positive pigs and Denominator indicates number of pigs in group.

Dash indicates no challenge was made because all pigs had developed lesions and were known immune.

All challenges made at three weeks.
## TABLE No. 7

*Feeding Experiment "B"*

<table>
<thead>
<tr>
<th>Tissue</th>
<th>On Feeding</th>
<th>On Challenge</th>
<th>Time for Lesion Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feet — Snout</td>
<td>2/2</td>
<td>—</td>
<td>40 Hrs.</td>
</tr>
<tr>
<td>Spleen</td>
<td>2/2</td>
<td>—</td>
<td>72 Hrs.</td>
</tr>
<tr>
<td>Crushed Bone</td>
<td>2/2</td>
<td>—</td>
<td>72 Hrs.</td>
</tr>
<tr>
<td>Whole Blood</td>
<td>2/2</td>
<td>—</td>
<td>96 Hrs.</td>
</tr>
<tr>
<td>Lymph Glands</td>
<td>2/2</td>
<td>—</td>
<td>96 Hrs.</td>
</tr>
<tr>
<td>Viscera</td>
<td>2/2</td>
<td>—</td>
<td>6 Days</td>
</tr>
<tr>
<td>Meat</td>
<td>1/2</td>
<td>0/1</td>
<td>6 Days</td>
</tr>
<tr>
<td>Feces</td>
<td>0/2</td>
<td>0/2</td>
<td>—</td>
</tr>
<tr>
<td>Urine</td>
<td>0/2</td>
<td>2/2</td>
<td>—</td>
</tr>
</tbody>
</table>

* Donor pigs had temperature elevations, but no lesions at time of slaughter.

Numerator indicates the number of pigs with positive lesions — Denominator indicates total number of pigs exposed.

Dash indicates no challenge was made since all pigs had developed lesions and were known immunes.

temperature was 105.4°F. which is lower than the temperatures were in the inoculated pigs. The first temperature elevation was 22 hours after feeding; the greatest time between feeding and temperature elevation being 88 hours.

Experiment “C.”—Pigs were fed varying dilutions of a freshly ground virus suspension. This suspension was simultaneously titrated intradermally on the snouts of groups of 4 pigs, the I.D. 50 being \(1 \times 10^{-5.47}\). The pigs were fed 10 cc. amounts per pig and all groups were positive, eg. \(10^{-1}, 10^{-2}, 10^{-3}\) and \(10^{-4}\), so that no endpoint was reached. In the next experiment “D” the same virus pool was used after being frozen for four weeks at \(-70^\circ\)C. Here the intradermal titration was \(1 \times 10^{-5.032}\). The intravenous I. D. 50 was \(1 \times 10^{-4.032}\). In order that doses might be standardized 2 cc. amounts were fed, the same dose as that given intradermally, but only one-fifth the volume previously fed. On feeding the I. D. 50 was \(1 \times 10^{-3.384}\).

Experiment “E.”—Groups of two pigs were fed defibrinated blood from infected swine. The first group received 1000 cc. of blood per pig mixed with an equal volume of mash. Both of these animals developed vesicles. Two pigs fed 500 cc. of defibrinated blood each were negative as were a group fed 100 cc. each. Those fed 100 cc. were positive on challenge at three weeks. One of the pigs in the 500 cc. group was positive and one remained negative. This indicated that one of the 500 cc. pigs while failing to develop vesicles did develop an immunity.
VESICULAR EXANTHEMA FEEDING EXPERIMENTS

Similar groups of pigs were injected subcutaneously, intravenously and intradermally with smaller volumes of the same defibrinated blood pool to determine the comparative minimum infecting dose by different exposure methods. Subcutaneously inoculated pigs receiving 50 cc. of blood developed vesicles and one of two pigs receiving 10 cc. of blood was immune to a later virus challenge. Intravenously inoculated pigs receiving 10 cc. of blood developed vesicles and intradermal snout inoculated pigs receiving 1.0 cc. of blood developed vesicles (Table 8).

Experiment “F.”—In the next experiment another pool of defibrinated blood was similarly made and two pigs fed 1000 cc. each and two fed 100 cc. were all negative. On challenge at 3 weeks all four animals were positive showing that none had developed immunity.

The inoculation of similar groups of swine with the same defibrinated blood pool by subcutaneous, intravenous and intradermal snout exposure routes demonstrated the presence of virus in the blood. One of two pigs receiving 50 cc. subcutaneously developed vesicles and two pigs receiving 10 cc. intravenously developed vesicles. The intradermal snout inoculated pigs failed to develop vesicles, but one out of four pigs receiving 1.0 cc. of blood was immune and two pigs receiving 5.0 cc. of blood were immune to a 3 week post exposure challenge (Table 9).

DISCUSSION

Susceptible swine can be infected quite easily with vesicular exanthema when fed swine tissues from infected animals during the acute stages of the disease. Nearly all body tissues from intravenously exposed donor swine obtained before clinical lesions were evident, as well as after the appearance of vesicles, transmitted the disease to susceptible swine by feeding. Vesicular exanthema was transmitted from pigs with temperature elevations approximately 10 to 12 hours prior to the time of vesiculation and at 36 hours after the initial appearance of vesicles. Other investigations have shown a direct correlation between the size of the infective virus exposure dose and the length of the incubation period. The application of this information towards the incubation periods obtained from feeding different swine tissues indicate the greatest virus concentration was contained in the snouts, skin and feet (both before and after vesicles developed), since the group fed this material showed a 40 hour incubation period as compared with 72 hours for spleens and crushed bones, 96 hours for whole blood and lymph glands and 6 days for meat and viscera. Along with the above incubation period observations, it has been shown that some susceptible animals may become infected without clinical manifestations of lesions, as they develop an immunity to a later challenge with concentrated virus. Our experimental investigations have shown these cases may be produced with small sub-clinical virus dosages, old weak virus samples or attenuated virus suspensions. The feces fed group in this experiment developed immunity without lesions, whereas the urine fed group was susceptible to virus challenge. These
TABLE No. 8  
*Experiment “E”*  
*(Comparison of Feeding Infective Blood with other Methods of Exposure)*

<table>
<thead>
<tr>
<th>Dose</th>
<th>Feeding Feed</th>
<th>Subcuaneous Inoc.</th>
<th>Chal.</th>
<th>Intravenous Inoc.</th>
<th>Chal.</th>
<th>Intradermal Inoc.</th>
<th>Chal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 cc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2/2</td>
<td>—</td>
</tr>
<tr>
<td>5.0 cc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0/2</td>
<td>0/2</td>
</tr>
<tr>
<td>10.0 cc.</td>
<td>0/2</td>
<td>1/2</td>
<td></td>
<td>2/2</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50.0 cc.</td>
<td>2/2</td>
<td></td>
<td>1/2</td>
<td></td>
<td>0/1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100.0 cc.</td>
<td>0/2</td>
<td>2/2</td>
<td>1/2</td>
<td>0/1</td>
<td></td>
<td>2/2</td>
<td>—</td>
</tr>
<tr>
<td>500.0 cc.</td>
<td>0/2</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000.0 cc.</td>
<td>2/2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Indicates challenge made at three weeks post exposure.
### TABLE No. 9

**Experiment “F”**

*(Comparison of Feeding Infective Blood with other Methods of Exposure)*

<table>
<thead>
<tr>
<th>Dose</th>
<th>Feeding</th>
<th>Subcutaneous</th>
<th>Intravenous</th>
<th>Intradermal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feed</td>
<td>Inoc.</td>
<td>Chal.*</td>
<td>Inoc.</td>
</tr>
<tr>
<td>0.1 cc.</td>
<td></td>
<td>0/2</td>
<td>1/2</td>
<td>2/2</td>
</tr>
<tr>
<td>0.5 cc.</td>
<td></td>
<td>0/4</td>
<td>4/4</td>
<td>0/4</td>
</tr>
<tr>
<td>1.0 cc.</td>
<td></td>
<td>0/4</td>
<td>3/4</td>
<td>0/4</td>
</tr>
<tr>
<td>5.0 cc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0 cc.</td>
<td></td>
<td>0/2</td>
<td>1/2</td>
<td>2/2</td>
</tr>
<tr>
<td>50.0 cc.</td>
<td></td>
<td>1/2</td>
<td>0/1</td>
<td>0/2</td>
</tr>
<tr>
<td>100.0 cc.</td>
<td></td>
<td>0/2</td>
<td>2/2</td>
<td>2/2</td>
</tr>
<tr>
<td>1000.0 cc.</td>
<td></td>
<td>0/2</td>
<td>2/2</td>
<td>—</td>
</tr>
</tbody>
</table>

* Indicates challenge made at three weeks post exposure.
results would indicate some virus was being eliminated in the feces before the development of vesicles in the donor animals.

Vesicular exanthema virus seems to remain viable for long periods when infective swine tissues are stored at ordinary refrigeration (7°C.), since all swine tissues remained infective after one month storage. These tissues showed marked decomposition after two weeks storage and gross putrefactive changes after one month’s storage. These results indicate that decomposition changes of meat scraps in garbage would not have an unfavorable effect on the virus. Swine tissue refrigerated at —70°C. were infective after 18 weeks storage. These results show the potential danger of new disease outbreaks in clean areas or where the disease had been eradicated, when garbage containing infected pork held in cold storage for months after a previous outbreak is fed.

About thirty per cent of the animals fed infected swine tissues developed lesions while failing to show temperatures. Also, temperatures were lower than those of inoculated animals. No differentiation could be made between the temperatures, nor time and quantity of lesion development, between those pigs which were scarified (to simulate abrasions as received by broken glass, etc. in garbage) and those pigs which were not scarified. Titrations of virus suspensions ran much lower when the titration was made by feeding than by intradermal inoculations. In one titration pigs fed 10 cc. of a 1:10,000 dilution of virus developed vesicles.

Comparative infectivity titrations of virus of both epithelial suspensions and blood by different exposure methods on susceptible swine showed a wide variation in the amount of virus needed for a 50 percent minimum infecting dose (M.I.D.). Tables No. 8 and 9 show the results of two experiments (“E” and “F”) where infective blood was inoculated into swine by various methods. All pigs in each of the experiments received the same blood pool—the only differences being the method of inoculation and the dosage given. A comparison of the two experiments shows that the blood pool used in experiment “E” had the higher infective titer—two pigs positive in the 1.0 cc. I. D. group as against none positive, but one out of four being immune, in Experiment “F,” etc. Of significance in these experiments is the fact that several doses in the intradermal and subcutaneous groups developed immunity while failing to show any clinical symptoms. The intradermal snout (I.D.S.) method of titration requires the smallest amount of virus. Preliminary calculations from these experiments and other work indicates that it requires 10 to 100 I.D.S. minimum infective doses above (M.I.D’s) of virus to produce one intravenous or subcutaneous M.I.D.; whereas, it takes 100 to 1000 I.D.S.M.I.D.’s to produce one feeding M.I.D. These findings have considerable practical value in determining the presence of virus in tissues containing a very small amount of infective material. For example, in another experiment, spleen tissues containing approximately two M. I. D.’s per gram of tissue when titrated I.D.S. gave negative results,
because 2 to 3 cc. of spleen saline suspension is about the largest quantity which can be successfully injected intradermally in the pig snout, while 500 grams per pig of the same spleen tissue produced lesions after feeding.

Defibrinated blood from swine infected with vesicular exanthema, when fed to susceptible pigs will produce lesions, but only if fed large amounts, because the virus titer of blood is comparatively low. About 1000 cc. of blood produced lesions, 500 cc. and lesser quantities failed to produce lesions but sometimes immunized, and 100 cc. dosages failed to produce lesions or immunize.

**Summary**

1. Vesicular exanthema can be transmitted quite easily by feeding meat scraps from swine inoculated with this virus.
2. All groups of tissues fed from intravenously inoculated swine, after slaughter were infective which included snouts, skin and feet, spleen, crushed bone, lymph glands, blood, viscera and muscle.
3. Feces collected before vesicles developed when fed to susceptible swine, failed to produce lesions but contained sufficient virus to immunize pigs against a 3 week post-feeding virus challenge. Urine failed to produce lesions or immunity.
4. Tissues collected from intravenously inoculated swine without lesions, slaughtered 6 hours before vesicles would have developed; and from similarly inoculated swine, slaughtered 36 hours after primary vesication, produced lesions by feeding.
5. Virus infectivity tests made one week, two weeks and four weeks following storage of all vesicular exanthema infected swine tissues at 7°C. produced lesions or immunity in all pigs by feeding, even though there was marked decomposition changes in the two week and four week storage samples.
6. Infected swine tissues stored 18 weeks at — 70°C. produced lesions by feeding.
7. Comparative virus titrations by different methods of exposure with vesicular exanthema virus epithelium suspensions or infected defibrinated blood indicates that it takes 10 to 100 intradermal-snout M.I.D.’s to make one intravenous or subcutaneous M.I.D. and 100 to 1000 intradermal snout M.I.D.’s to make one feeding M.I.D.
8. The feeding incubation period varied from 40 hours to 8 days. The length of the incubation period is directly correlated with virus dosage—the largest virus dosages producing the shortest incubation periods.
9. Tissues containing small quantities of virus when fed or inoculated into susceptible swine frequently fail to produce clinical lesions, but produce an inapparent infection with immunity.
REFERENCES


REPORT OF THE COMMITTEE ON VESICULAR DISEASES


This Committee, identified for several years as the Committee on Foot-and-Mouth Disease (FMD) has been appropriately designated as the Committee on Vesicular Diseases. From the standpoint of diagnosis, especially, the FMD problem is inseparable from the other viral vesicular disease problems — vesicular stomatitis (VS), and vesicular exanthema (VE). Moreover, the latter are capable of causing infections in individual herds of susceptible animals that are at times as seriously damaging as FMD. There is little if any essential difference in the clinical picture or the consequences of VE, VS and FMD in swine, except possibly the greater infectiousness of the latter. Both VE and FMD, and presumably VS, may readily be spread through the feeding of unprocessed garbage containing infected meat scraps.

Early diagnosis is of great urgency regardless of the nature of the infection in order that appropriate action may be taken. There can be no question as to the proper course if the diagnosis should be FMD, nor should there be any laxity if the diagnosis be VE, for the eradication of which Bureau and State officials are striving. The question arises whether similar offensive action should not be taken against VS in swine. Hogs were first proved experimentally susceptible to VS in 1918, but it was not until 1943 that the infection was recognized in other than intentionally inoculated swine. VS has since been repeatedly diagnosed in Georgia hogs, first in 1952 and on later occasions in 1953. One outbreak in swine was diagnosed in June 1953 in North Carolina.

Doctor Hendershott has kindly found time on the program for the timely report by Doctors Clower and Mikel covering the occurrences of the disease in Georgia's swine. VS also appeared in cattle in the State of Georgia. In addition, diagnosis of the disease has been made in cattle and/or horses in New Jersey, Oklahoma, and Virginia.

The outbreaks have been generally sporadic and self-limiting with relatively low rates of morbidity in affected herds, although covering quite wide areas in some states. While a specific diagnosis was not accomplished, there were quite clear epizootiological evidences of the disease in Arkansas adjoining the infected area in Oklahoma. All diagnoses of VS in the past ten years have involved the New Jersey type of the virus. The last recorded diagnosis of infection with the Indiana type of the virus was made in the case of an outbreak in Colorado in 1943. Whether VS exists elsewhere in swine
has not been determined but it is certain that the existence of either VE or VS seriously complicates diagnosis, particularly when the disease is known to have persisted for some time, and there is a natural tendency to assume that any vesicular condition is attributable to those infections rather than FMD.

It is recommended that a committee be established by the United States Bureau of Animal Industry for carrying out a field survey of VS in swine in Georgia and North Carolina. The committee might be comprised of no more than one Bureau representative and no less than two representatives of states having experience with VS. After a thorough epizootiological study of the disease, the committee should submit recommendations relative to appropriate means of dealing with the problem.

The Bureau of Animal Industry now has 46 trained field diagnosticians strategically located in various parts of the United States. In addition, several State agencies have veterinarians proficient in diagnosis. It is our collective responsibility to see that any suspicious vesicular disease is reported immediately to the State official or the Bureau Inspector in charge. In turn, their joint responsibility is to investigate immediately such reports and call in one of the designated diagnosticians when required.

The differential diagnostic procedures are preferably carried out on the affected premises by inoculation of test animals. Supplementary laboratory tests such as the complement-fixation test may be conducted if considered desirable by the Bureau and State officials. Usually these procedures provide a definite answer in a reasonable time, provided that suitable inoculum and appropriate susceptible animals are available. Unfortunately, these requisites are sometimes lacking, and the whole problem may be further complicated by lack of cooperation from the owner or indifferent assumption that the disease is inconsequential and diagnosis unimportant. Such instances may be rare, but even one failure to diagnose FMD could be disastrous. One failure to diagnose VE might have lasting damaging effects upon eradication efforts. If what appears to be VS is not specifically diagnosed in each outbreak unjustifiable chances are being taken.

The events of the last several years in Mexico have received special consideration by this Committee, and the Association may well be proud of its understanding and support of the international undertaking so vital to this country. What new developments the recent reappearance of FMD in that country may bring is problematical at this time. The current situation has been reviewed by Dr. Simms.

Last year's proceedings include a report on the beginning and the end of the outbreak of FMD in Canada. Canada was declared to be infected February 25, 1952, by its Minister of Agriculture and declared by him to be free of this disease August 19, 1952. The U. S. Department of Agriculture removed Canada from the list of FMD infected countries March 1, 1953. Last year's proceedings also contained papers by Doctors Childs and Wells which covered significant phases of the diagnosis and the eradication of this disease in
Canada. We are pleased to report that Canada has remained free of the disease.

The papers presented at this session on the VE status and the experimental studies of the disease at the Animal Disease Station at Beltsville, Maryland, and the status of Vesicular Stomatitis in Georgia need no further comments from your Committee.

**FOOT AND MOUTH DISEASE IN EUROPE**

The severe outbreak of FMD in Central and Western Europe that appeared in 1949 and again in 1951 had substantially decreased in force by the end of 1952 and has since remained generally at a low ebb. In the 1951 outbreak, a variant of Type A virus known as A5 added complications and made prevention and control extremely difficult. This variant first appeared in Schleswig-Holstein, Germany, and spread southward to Holland where it moved to Belgium, Luxemburg, France, Italy, Denmark, Sweden, and Great Britain and also infected 4 farms in Norway. Then an invasion, again from Germany, of Type C virus attacked the animals in several of these countries. Thus, the European situation which had already been involved with A and O types of virus was further complicated with variant A5 and Type C virus, presenting a problem with three serologically and immunologically different types of virus plus an A variant which differed considerably from the A type which was current in Europe at the time of its first appearance. According to several observers the vaccine made at some of the laboratories with the then present Type A virus would not satisfactorily protect against A5 infections.

In some European countries trivalent vaccines have been used, and such vaccines have been used considerably in South America. The efficacy of the trivalent vaccine has been questioned by some of the leading European and South American workers. The product has been receiving study in some of the laboratories in these countries.

Regarding the European FMD situation, your attention is further called to the following: Finland which had been free from FMD from 1941 to 1952 reported Type A5 infection in December 1952, when several thousand animals were affected. The disease was reportedly brought under control in January 1953, and no outbreaks have been reported since April 13, 1953. In France during the period of July to December 1952, over 3,000,000 cases were reported, involving 429,000 farms, constituting the worst epizootic in France during this century. The disease continued to decrease in 1953 with 261 newly reported infected farms in the first half of April 1953 and the report for the first half of July of this year showed only 36 newly infected farms. The disease in Germany also decreased in incidence; in the last report which covers the last half of June, only 10 farms were reported infected. Great Britain had its first outbreak of the present series in November 1951. It has been considered as the worst in that country in many years; 116 outbreaks occurred in 1951, 495 in 1952, and 27 through August 6 in 1953. The extent
of the outbreak caused an inquiry to be made by a Committee of The British Parliament into the advisability of continuing the eradication by slaughter, which has been the British policy.

A report from Hungary simply states that FMD occurs extensively in that country. The last report from Italy in January 1953 showed nearly 1500 premises infected. In the Netherlands, A and O types of virus spread rapidly from late 1951, and in December of that year these were followed by Type C. The epizootic subsided during the early part of 1952, again increased somewhat in January 1953, but no new cases have been reported since April 1953. There has been no report of FMD in Norway in 1953, the few cases which occurred in late 1951 and early 1952 having been eliminated by the slaughter method. In Switzerland, no FMD outbreaks have been reported since June 1953. Severe outbreaks were experienced, however, in 1951 and in 1952, when 2,600 outbreaks were reported. FMD was reported for the first time in modern history on the Isle of Jersey in 1952 in which Type A was involved and again in December 1952 when Type O was present. Procedures similar to those employed in the U. S. and Canada were used to eradicate the disease.

RECENT RESEARCH DEVELOPMENTS

Your Committee's reports in former years contained statements of new developments and findings from various foreign research institutes. Among these advances were the cultivation of FMD virus in the laboratory, using minced bovine tongue epithelium, and the propagation of A and O types of virus in embryonated chicken eggs. The bovine tongue epithelium culture first reported and developed in Holland is now used routinely there and in other countries to a considerable extent for the production of vaccine.

Observations made during the last three years at the Research Institute (Animal Virus Diseases) at Pirbright, England, show that unweaned white mice are very satisfactory in studies of FMD viruses and the application of these findings should find a large field of usefulness. FMD virus can be propagated readily in unweaned white mice, producing infections with a typical course. This has been done with the six recognized types of virus and also with virus obtained directly from infected animals in the field. The virus is found in high titer in the tissues of the infected mice, especially the skeletal muscle. The suckling mice can be used in titrating virus, frequently giving as high a titer as obtained by the use of cattle. They have been found more satisfactory than guinea pigs in testing the neutralizing power of convalescent bovine or other sera. Such tests can be done on a large scale at low cost. This has many practical applications. One example is demonstration of neutralizing antibodies in the serum of convalescent cattle from which virus for typing may be unobtainable or unsuitable for complement-fixation. The British workers were able to detect neutralizing antibodies of specific type in the serum of cattle by the use of unweaned mice as early as four days after appearance of the first lesions. When inoculated with virus, each infected mouse yields an average of one gram of tissue virus; in other words, 35 to
50 such mice may produce as much virus for vaccine or other use as one inoculated susceptible cow, and vaccine produced from mouse tissue virus has in limited trials been found to produce acceptable immunity. The British workers are now studying the utility of white rats between birth and 36 hours of age. Other studies along similar lines are in progress in other countries.

PLUM ISLAND LABORATORY

Although some unexpected delays have been encountered in development of final plans for the Plum Island Animal Disease Laboratory, chiefly because of estimated high costs of island construction and other circumstances, the plans are progressing with expectation that construction will be under way late this year or early in 1954. While it is probable that construction of all facilities will not be accomplished before late 1955, it is expected that a limited program of related research may be initiated in advance of that time. It is the considered opinion of this Committee that the Nation cannot be judged as properly prepared for protection against FMD and other dangerous exotic diseases of livestock until this laboratory, properly staffed and equipped and adequately financed, is in full operation.
DISCUSSION OF PAPERS ON VESICULAR DISEASES

PRESIDENT CHILDs: We will allow ten minutes for a discussion of vesicular exanthema. I am sure Dr. Mulhern, Dr. Mott and Dr. Shahan will help answer any questions.

DR. PETER GERMANIO (Westville Grove, New Jersey): I would like to have a couple of minutes to tell the members of the Association why the garbage feeders of New Jersey do not want to cook their garbage.

In the first place, the disease came in 100 per cent through grain-fed pigs. Therefore, it was spread through community sales, livestock sales, railroad cars, and in many other ways, not only through garbage. The fellows are well aware of that fact.

Also, they are aware of the fact that western pigs come into New Jersey to be slaughtered, and most of the carloads show VE. They are grain-fed pigs, not garbage-fed pigs.

Also, western feeders coming in by carloads do not break down with vesicular exanthema here in New Jersey. That means they had the infection where they came from, on the farms.

The men here have many reasons for not wanting to cook garbage, because they don't see that it is going to do any good. If they are going to cook garbage for infected pigs, why go to all that expense? I think if they are going to be forced to cook the garbage, the government should guarantee them eradication and pay for it if the pigs break down. I think they will stick with them.

A man two seats to my right feeds 10,000 pigs per year. His losses are less than one per cent. He takes care of his pigs, and he sees that I look at them. I am not in favor of vesicular exanthema, believe me. Cooking garbage is not going to reduce his losses. He is not going to be compensated for cooking garbage, as Dr. F. J. Mulhern indicated, because he looks after his pigs and does not have any trouble.

There are a lot of angles to consider concerning VE, and I think there is as much VE now in the United States as there ever has been. Immunity has increased in pigs, and they are not showing VE. Grain-fed pigs are polluted, not only garbage-fed pigs. I am speaking for my friends who feed 10,000 garbage-fed pigs every year. They put out 100,000 garbage-fed pigs, and they will keep on putting them out. They don't worry about diseases. They will do anything for the betterment of the industry, but they want some reassurance. They don't want to be penalized 5 to 7 cents a pound every time they turn around because they are feeding garbage. That is what I tell my clientele.

MR. L. B. HAINES (Westville Grove, New Jersey): I am a garbage feeder and a dairyman. I have in my herd on the dairy farm about 200 head of
dairy cattle. I think this VE is as near to bang's disease as it can get. It is
in a corner, and nobody knows when it is going to break out.

All I have heard since I left Iowa on the 4th of July last year has been
that garbage spreads this disease. If you put 200,000 horses, cows and sheep
in a small area you will have a lot of trouble with them, and you will
find disease. If you put that many hogs in that area you will have the same
trouble. When you put 200,000 hogs on 100,000 acres you won't find disease.
In some of our states they can't find this disease. It is not easy to find it
there.

Concerning bang's disease, lot of the dairymen said, "I hope my cows
won't break out with bang's disease." So we killed them off until we got a
needle. We got the needle, and now we go to bed and forget about bang's
disease.

Gentlemen, if we don't have a needle I believe that you are going to have
this disease even if you cook garbage until it is black. When you talk about
putting pipes in the bottom of a garbage truck and cooking ten tons of
garbage at once—well, you won't cook all of that garbage, and you know it.
You will have to change your method of cooking it.

If this disease is so dreadful to the animal population in the United States,
we had better do away with all garbage feeding, and pass a bill banning the
feeding of any garbage. Why kid the garbage farmer? If he goes to work
and puts in a plan to cook garbage, it will cost him $10,000 to cook garbage
for 2,000 hogs. It will cost him $100 a week to cook it, the way I would
set it up.

There is no use going off half shot on this. If we would stop to think that
we have had serum plants closed up, nobody hears about that. A garbage
hog went past a serum house, that way. A garbage hog went here and there.
Don't you realize that California and New Jersey take the hogs out of the
Midwest? Sure!

As one of our speakers said today, we can't do without the Midwest, and
the Midwest can't do without us. But if you had whooping cough and you
hauled all the children with whooping cough out of the Midwest and sent
them to the East and West Coasts, they wouldn't have any whooping cough
in the Midwest. (Laughter)

MR. NORMAN LICHTMAN (Westville Grove, New Jersey): We feed about
10,000 to 12,000 hogs a year, and we have two boilers cooking every day.
One is cooking right now. We were one of the first ones in South Jersey
to have vesicular exanthema. How it got there, I don't know, but we were
cooking garbage. We are cooking it because we have raw garbage. We get
our garbage from the Campbell Soup Company. There is no meat in it. Hogs
come in from the West by railroads. I heard one gentleman, in charge of
stockyards transportation, say something about that this morning. It costs
$9 to clean and disinfect a railroad car, he said. I know you can't do it for
$9. I never saw a railroad car really cleaned or disinfected for $9.
DISCUSSION OF VESICULAR EXANTHEMA

Somebody should be behind the railroads, because we don’t hear too much about the railroads. I think the railroads today are the biggest carriers.

DR. JACOB TRAUM: I should not enter this discussion because I have been familiar with this work for twenty years. I come from California. We have had VE in California for twenty years.

Whenever we brought up the question of cooking garbage, nothing happened. We killed the animals with VE for two years, as you know, treating the disease as foot and mouth disease. We decided finally to live with the disease.

After we decided to live with it, gentlemen like these men came up to us and said that they were making money on the garbage feeding business irrespective of anything. They said they were beginning to lose too much money on VE. About a year and a half ago they appeared at the University of California and asked that something be done—that they get the needle, as this fellow said. “Give us a needle, because we are losing money on this garbage feeding.”

The garbage feeders gave us an itemized list showing how they were losing at least 20 per cent because of VE. They made money in spite of the fact that they were losing 20 per cent, because the commodity is cheap, the handling of it is cheap—in fact, everything about it is cheap. They still claimed that if they didn’t have VE they would have made 20 per cent more money. They also wanted a needle.

With due respect to these gentlemen—and I have never met any of them—if they were really serious and conscientious about what they honestly believe, and if they study this matter, I am sure they would come to the conclusion that VE has been a problem that they are willing to live with. They are making money despite the disease and irrespective of what it does to everybody else. If they actually analyzed the matter and the condition, I am sure they would come to that conclusion. They couldn’t come to any other conclusion.

This question of vaccine has worried us, and we have thought about it for years. We would like to have a vaccine, too. These gentlemen should know that making a vaccine for VE is out of the question right now. You would have to infect an animal with VE. Dr. L. O. Mott said it took 850 pigs to do his experiments. Why? Because they had to get virus to do it with. You can’t make vaccine without virus. You have to inoculate one pig for every immunizing dose.

The report of the Committee on Foot and Mouth Disease talked about the type of variance in virus with foot and mouth disease. They make a virus for one type and then a variant for another type. You haven’t even started a vaccine for VE, gentlemen. We would be glad to give you the needle if we knew how to do it. It isn’t ready yet—it isn’t even ready to be started on in the near future.

I wish you fellows would be honest with yourselves. You are making
money despite the fact that you are losing hogs. You are making money despite the fact that you have no immunization against all these things. You are still making money.

You presented a story about hogs coming from the West with VE. When this outbreak occurred in 1951 the hog men in California offered me $20,000 a year if I would take a job with them. I decided not to because I was rich enough and didn't need more money. (Laughter) I have a feeling for these fellows in some respects.

Irrespective of VE, it didn't matter so much to them whether VE started outbreaks elsewhere. They didn't care about that at all, because, as I said, they were getting along very nicely. It is simple for you fellows to say, "Give us the needle."

MR. LICHTMAN: I would like to ask Dr. Traum a question. I have 10,000 hogs. I send them to be processed. I disinfect the farm and put in fresh hogs. Suppose they break out with VE after thirty days?

DR. J. TRAUM: If we have universal cooking I will assure you we won't have that trouble. We don't want to take up the rest of the afternoon quibbling back and forth. We will be glad to have a meeting with you men any time you wish, outside this meeting. I will be glad to spend evenings with you fellows, and if you don't go home convinced that you should cook your garbage I'll quit this business. (Laughter and Applause)
REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

J. D. Ray, White Hall, Illinois, Chairman; Frank Breed, Lincoln, Nebraska; Joseph W. Green, Indianapolis, Indiana; James R. Hay, Columbus, Ohio; T. Lloyd Jones, Toronto, Ontario, Canada; R. Fenstermacher, St. Paul, Minnesota; A. H. Quin, Kansas City, Missouri; C. E. Wicktor, Los Angeles, California.

Your committee has attempted to obtain a comprehensive picture of the transmissible disease problem in swine for the United States and Canada. Livestock Sanitary officials of the 48 States and Canadian Department of Agriculture were communicated with and a response was received from 32 States and Canada. These reports are submitted in summary.

HOG CHOLERA

The incidence of hog cholera was reported as unchanged or decreased in 25 States during the year. Five states reported an increased incidence and two of these were major swine producing states. Two of the major hog growing States were in the group with decreased incidence. Canada reported the worst outbreak in a number of years. It started in Ontario and was confined to that Province. The disease spread from sales barns and 2,947 swine died or were slaughtered before the disease was eliminated. That country is free of the disease at this time.

Your attention is directed to a few facts that pertain to hog cholera control in the United States. Your Secretary, Dr. R. A. Hendershot, compiled this information and we feel it deserves careful study. It pertains to the health requirements relative to interstate movement of swine. The most universal requirement which is listed by 39 states is that serum and virus must not be used less than 30 days before shipment, and another 5 states make the same requirement but for 21 days. Shipments may be made into 26 states, provided serum alone has been used not more than 21 days before movement. Two states allow shipments if serum used not over 30 days previously and the other extreme is 5 days before shipment. Numerous variations are found where hog cholera vaccines are concerned and four states will permit entry of swine subject to vaccination at destination. The particular problem that we direct your attention to is the utter disregard of requirements to keep recently vaccinated swine under quarantine where they will not spread hog cholera to susceptible herds. The outbreak of vesicular exanthema that occurred last year would not have been nearly so extensive if quarantines had been lived up to.

SWINE ERYsipELAS

Little change occurred in the swine erysipelas situation during the year. Four states reported an increased incidence of the disease and one of these
was in the major swine producing territory. However, two of the major swine growing states experienced a decreased incidence. Swine erysipelas is fairly prevalent in part of Canada, but usually occurs in the chronic form. The simultaneous use of swine erysipelas anti-serum and *erysipelothrix rhusiopathiae* vaccine is permitted in 26 states. This committee recommends that this association actively support the continuation of controlled distribution of *erysipelothrix rhusiopathiae* vaccine through veterinarians.

**ATROPHIC RHINITIS**

Atrophic rhinitis continued to spread as evidenced by increased incidence in 14 states and four of these were major hog raising states. Only one state, which is in the midwest, reported a decrease of this disease. In Canada this disease is common but does not appear to have as high an incidence as it did a few years ago. Research projects are underway, both in that country and the United States, and much basic information has been learned about the problem, but, much more is needed.

**RESPIRATORY DISEASES**

The incidence of respiratory diseases has not changed much the past year. Only two states reported an increase and one of these was in the middle west. Three states reported decreases and two of these were in the middle west.

**TRANSMISSIBLE GASTROENTERITIS**

Transmissible gastroenteritis appears to have leveled off in incidence. At least, it did not increase in any state. Apparently the disease has not been recognized in Canada up to this time.

**ENTERITIS COMPLEX**

The incidence of the enteritis complex has been largely unchanged. Three states reported an increased incidence but none were in the major hog raising territory. Two major swine raising states experienced a decrease in these troubles. The extensive use of feeds containing antibiotics or other agents to control intestinal infections no doubt has favorably influenced the incidence of the enteric troubles. Where *vibrio colon* prevails, the problem of relapses continues to be a factor following whatever treatment is used. Also, this infection does not seem to be controlled as easily as some others by use of the reinforced feeds.

**POST VACCINATION PROBLEMS**

Evidence of increased trouble following vaccination against hog cholera is reported. Five states report such evidence and two were major swine raising states. Specific mention was made of increasing trouble following use of the various types of modified live virus hog cholera vaccines. The adverse effect on pigs in utero when sows are vaccinated with these vaccines, about breeding time and while pregnant, is called to your attention especially.
GENERAL REMARKS

It has not been the intention of this committee to ignore such an important disease as vesicular exanthema in swine, but discussion of this problem has been left to the committee on vesicular diseases. This malady was listed by 21 of the reporting states as a problem during the year. Likewise, brucellosis has been left for the committee on brucellosis, however, we want to emphasize the importance of this disease and the need for concerted effort in swine brucellosis control. Edema disease of swine continues to be a problem of note in some areas and deserves attention. We need more information about the cause of this trouble.

Vesicular stomatitis was reported by one state as a problem that had to be differentiated from vesicular exanthema during the year.

Numerous research projects are in progress pertaining to some phase of transmissible diseases of swine, and the committee expresses its interest in their continuance. However, we feel that more work should be done as rapidly as possible to try to solve some of the many baffling questions confronting the swine industry.
REPORT OF THE NATIONAL COMMITTEE ON THE ERADICATION
OF HOG CHOLERA


The National Committee on the Eradication of Hog Cholera makes the following report:

1. We wish to reaffirm the recommendations made in the comprehensive report of this committee presented to this body in 1951 at Kansas City. We further recommend that the United States Livestock Sanitary Association and all State Livestock Sanitary Officials promote legislation and activation in conformity with the 1951 report.

2. Conforming with our own recommendations concerning public relations, a sub-committee of this committee has arrived at the final stage in drafting a popular document to be entitled “What Is Known About Hog Cholera.” This manuscript is to be published by the United States Livestock Sanitary Association and it is hoped the booklet will be as helpful as the similar one entitled “What Is Known About Brucellosis.” The sub-committee responsible for this work, which has taken nearly a year to complete, is: Claude Gifford, A. H. Quinn, J. D. Ray, S. H. McNutt and L. M. Hutchings, with R. A. Hendershott, your Executive Secretary, as an ardent critic.

3. In the past year by correspondence and again last night, in both open and executive session, this committee has reviewed the current situation pertaining to hog cholera and its control, with the idea in mind that as soon as agreement can be reached we will endeavor to initiate a test area and program for cholera control and eradication. To this end, and with many fine suggestions plus some caustic debate still ringing in their ears, the following sub-committee has been appointed to draw up the methods of procedure, financial arrangements, selection of area or areas and other factors necessary to activate pilot test areas: A. H. Quinn, J. A. Baker, F. C. Smith, C. L. Campbell, H. W. Schoening. This sub-committee is to report its recommendations in six months. In turn, the United States Department of Agriculture, Bureau of Animal Industry, will then be contacted and if necessary, fund raising machinery will be set up to actually activate this phase of our original report.
PRESENTATION OF KEY TO PRESIDENT T. CHILDS

R. A. HENDERSHOTT.

SECRETARY HENDERSHOTT: Dr. Childs, it has fallen to my very pleasant lot during the last few years to present to the outgoing Presidents some memento of their term in office. I was a little bit taken aback this year. I hardly knew what to do about it. You have already received one beautiful golden key from the city of Atlantic City; that is something that hasn't been customary in the past. I suspect that you will proudly display that key when you go back above the border, and wear it on your fallen chest. (Laughter)

On behalf of the Association I do want to say that, like the Presidents of this Association before you, you have carried on in the same high manner and with the same integrity and with the same interest as have your predecessors. We in this Association have been very, very fortunate in the selection of officers to guide this Association during the years, and as we view them from the Secretary's office—and, I am quite sure, as the men in this audience view them—this year we have had a splendid meeting on the eastern seaboard—they have all watched you during this meeting, and we all know that you have measured up to the best of the Presidents who have preceded you.

It is a very great pleasure for me, sir, to present to you this very small token of our appreciation of your service as President of this Association. I hope it will remain untarnished, as will our memory of your geniality and service; if it doesn't, send it back and we will have it replated for you. (Laughter and Applause)

PRESIDENT CHILDS: Thank you very much, Dr. Hendershott. It has indeed been a great pleasure to be associated with Dr. Hendershott and the members of this Association. I shall certainly keep this key and, with your permission, the other one also, and put them among my other gatherings over a fairly lengthy period of life.

When I look at this it will remind me of the pleasant associations I have had with you gentlemen, which I hope will be continued. They will be continued as far as I am concerned. I will always enjoy coming to your meetings, in whatever capacity I may come.

I have gotten a great deal of benefit from these meetings, moreso than almost any others I have attended, and I have attended quite a considerable number in my lifetime. I think this meeting has been tops.

As the outgoing President of the United States Livestock Sanitary Association I shall now try to convey to all members, whether present here or absent, my sincere and deep appreciation for the privilege of holding membership in this superb organization, and more particularly in being honored as I
PRESENTATION OF KEY TO PRESIDENT T. CHILDS

have been. These are honors I shall always cherish, together with this Past President’s key.

Since assuming my present duties at Ottawa I have made many visits of an official nature and otherwise to the United States, and have always felt very much at ease and at home in your land. My associations with your people, whether official or otherwise, have invariably been pleasant and satisfactory. I say that from the part of my anatomy that Dr. Hendershott referred to as my “fallen chest.” (Laughter) I don’t like that at all. My chest is still bigger than my waist, believe it or not. (Laughter)

During my numerous official visits to Washington, D. C. I have always found Dr. B. T. Simms and his officers most courteous, understanding and helpful in adjusting problems arising in connection with the livestock trade as between our two countries. Our official relations with the various state officials concerned with the livestock trade have also been very pleasant.

I recall quite clearly the prompt action taken by Doctor Simms at the beginning of our foot and mouth disease outbreak in Saskatchewan. Within a day or so after my apprising him of the situation and inviting him to send a specialist up to look over the situation, Doctor Shahan arrived. His advice and assistance were invaluable. Later on Doctor Mulhern arrived and took an active part in the campaign. We were very glad to have the advice and assistance of these officers. I would be very glad if there were some way we could repay that good neighbor act.

This Association has been of incalculable value to the livestock industry. I believe that by keeping your ranks closed against the common enemy called animal diseases, and giving full support to those whose responsibility it is to keep your country free of really destructive exotic diseases, a still greater service can be rendered in the future.

Thank you, gentlemen, for your forebearance. I leave this office with very pleasant memories indeed. (Applause)

(Dr. T. C. Green assumed the Presidency.)

PRESIDENT GREEN: Dr. Childs, before you leave the platform, it has been observed that you have two keys. Since we will look forward to your coming back, and knowing that Dr. Orlan Hall travels with you, you might lend him one of those keys so that both you and he can get through the border.

(Laughter)

DR. WEST: Mr. President, it should be announced to the General Assembly that the Executive Committee re-elected our very good Secretary-Treasurer for the ensuing year.

PRESIDENT GREEN: I am sure the members heard what Dr. West has just called to your attention, that our good Secretary-Treasurer for these many years passed has been reelected for the ensuing year. I am sure that makes all of us very happy.

If there is no further business claiming the attention of this convention, I declare this meeting adjourned.

(The meeting adjourned sine die at 1:15 p.m.)
NOMINATION, ELECTION AND INDUCTION OF OFFICERS FOR 1954

PRESIDENT CHILDS: This completes the formal part of our program. We will go now to unfinished business.

SECRETARY HENDERSHOTT: There is no unfinished business that I know of Mr. President.

PRESIDENT CHILDS: Is there any new business?
SECRETARY HENDERSHOTT: None that I know of, sir.

PRESIDENT CHILDS: We will call now for the report of the Nominating Committee. Dr. West, Chairman.

DR. WEST: Mr. President and Members of the Association: Your Nominating Committee met yesterday, and the following report is unanimously agreed upon and is signed by all members of the Committee, namely Drs. H. A. Milo; F. L. Schneider; H. F. Wilkins and Mr. H. W. Norton Jr.

The Nominating Committee is pleased to place in nomination the following men for the elective offices of this Association:

President - Dr. T. C. Green, West Virginia.
First Vice President - I. G. Howe, New York.
Second Vice President - H. F. Wilkins, Montana.
Third Vice President - A. L. Brueckner, Maryland.

PRESIDENT CHILDS: Thank you, Dr. West. Are there any nominations from the floor?

VOICE: Mr. President, I move that nominations be closed.

(The motion was severally seconded, was put to a vote, and was carried unanimously.)

DR. WEST: Mr. President, I move that the Secretary of the Association cast the unanimous ballot for the nominees.

(The motion was severally seconded, was put to a vote, and was carried unanimously.)

SECRETARY HENDERSHOTT: Mr. President and members of the Association, as directed by you I hereby declare the election of Dr. T. C. Green of West Virginia as President of this Association; Dr. I. G. Howe of New York for President, and Dr. A. L. Brueckner of Maryland as Third Vice President First Vice President; Dr. H. F. Wilkins of Montana for Second Vice of this Association, for the year 1954. (Applause)

PRESIDENT CHILDS: Dr. West, will you escort Dr. Green to the platform? Dr. F. W. B. Smith, will you please escort Dr. Howe to the platform? Dr. Stuart of Ottawa, will you escort Dr. Wilkins to the platform? Dr. Stewart, will you escort Dr. Brueckner to the platform? (Applause)

Gentlemen, it is my privilege and pleasure to present to you your new President for the coming year, Dr. Green, whom you all know very well. My heartiest congratulations to you, Dr. Green. (Applause)
Gentlemen, it is my pleasure to present Dr. Howe, of New York, as your First Vice President for the coming year. My congratulations, Dr. Howe. (Applause)

Dr. Green, perhaps you would like to say a few words to the meeting.

Dr. Green: Mr. President and Members of the United States Livestock Sanitary Association: I am deeply grateful for this unexpected honor which you have bestowed not only upon me but upon my State, West Virginia. In accepting this high honor I realize the great responsibility that goes with it in times like these. With your help, which I feel sure I will receive, I shall execute those responsibilities to the best of my ability.

Thank you. (Applause)

President Childs: Dr. Howe, will you say a few words?

Dr. I. G. Howe: Members of the Association, there is very little that I can say at this time except that I wish to express my appreciation for the honor you have given me, and also to tell Dr. Green that he may consider me as his first lieutenant, and that I will contribute all the help I can during the year. (Applause)

President Childs: Now it is my pleasure and privilege to present Dr. Wilkins, your Second Vice President for the coming year. Dr. Wilkins' shoulders are broad. Will you say a few words, sir? My congratulations to you.

Dr. Wilkins: Thank you, I do want to thank you folks for having made me a second lieutenant. I assure you that I will do the best I can in that capacity to forward the good work of this Association, and to be as helpful as I can be to our new President and First Vice President. (Applause)

President Childs: Permit me to present Dr. Brueckner, your Third Vice President for the coming year. Dr. Brueckner, will you say a few words and accept my congratulations? (Applause)

Dr. Brueckner: Thank you, Dr. Childs. I simply want to say that I appreciate very much the honor that been conferred upon me. I will do all I can in the office of Third Vice President to uphold the traditions of the United States Livestock Sanitary Association. Thank you. (Applause)
CONSTITUTION AND BY-LAWS
OF THE
UNITED STATES LIVESTOCK SANITARY ASSOCIATION

ARTICLE I — NAME

The name of this Association shall be “The United States Livestock Sanitary Association.”

ARTICLE II — PURPOSE

The purpose of this Association shall be the study of livestock sanitary science, milk and meat hygiene, and the dissemination of information relating thereto, the unification so far as possible of the laws, regulations, policies and methods pertaining to milk and meat hygiene, and to the prevention, control and eradication of transmissible livestock diseases; to maintain co-ordination among the various livestock regulatory organizations, and to serve as livestock sanitary science clearing house between this Association and the following:

- The livestock owner, the livestock sanitarian, the milk and meat hygienist, the veterinary practitioner, the transportation and stock yard companies, the milk and meat producing and distributing companies, and various other interested agencies. The word “livestock” as herein used shall be understood to include poultry.

ARTICLE III — MEMBERSHIP

There shall be two kinds of members—Official and Individual.

- The livestock sanitary departments of each State also the United States, and the Canadian, Cuban and Mexican governments, The Territories, Puerto Rico and the Virgin Islands shall be eligible to official membership in this Association and be represented on the Executive Committee by the livestock sanitary executive official.
- Any person engaged in livestock sanitary work for federal, provincial, state, territory, county or municipal governments and any other person interested in livestock sanitation or milk and meat hygiene may be elected to individual membership.

ARTICLE IV — MEETINGS

The meetings of this Association shall be annual and special.

ARTICLE V — OFFICERS

The officers of this Association shall be: President, First Vice-President, Second Vice-President, Third Vice-President, Secretary-Treasurer, and an Executive Committee.

The officers of this Association shall hold office for one year or until their successors have been duly elected and qualified.
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 Association and shall determine its activities and policies.

All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee.

The First Vice-President shall be ex-officio chairman of the Executive Committee.

The Executive Committee shall elect yearly a Secretary-Treasurer for the Association. The Secretary-Treasurer shall receive such salary and allowance as may be fixed by the Executive Committee.

The Executive Committee shall cause to be audited annually or oftener if deemed necessary, the receipts and disbursements of the Secretary-Treasurer, and shall have authority to hear and determine all complaints filed before it in writing relative to the conduct of any member; and shall have authority to accept or reject applications for individual membership properly placed before them. Three negative votes shall disqualify for such membership.

The President, the Chairman of the Executive Committee and the Secretary-Treasurer and the Chairman of the respective committees shall constitute the Program Committee. It shall be the duty of the officers of the Program Committee to make the necessary arrangements and provide the program for the annual and special meetings.

1. President: It shall be the duty of the president to preside at all meetings of this Association; to appoint all committees except 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 Executive Committee. In the absence of the president, he shall preside at the meetings of the Association. In the event of the absence, disability or resignation of the president he shall perform all duties of the president. He shall be an ex-officio member of the Executive and Program Committees.
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 Committee 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

113 Registration.
114 Call to Order.
115 Report of Secretary-Treasurer.
116 President's Address.
117 Reading of Papers.
118 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 business.

ARTICLE II — APPLICATION 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.
ROSTER OF MEMBERS BY STATES, PROVINCES
AND COUNTRIES

ALABAMA

Official Membership
Representative
Dr. John Milligan,
State Veterinarian
408 Magnolia Avenue
Auburn, Alabama

Individual Members
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.

Individual Members

CALIFORNIA

Official Membership
Representative
Dr. J. E. Stuart, Chief
Division Animal Industry
Department Agriculture,
Sacramento 14, California

Individual Members
Bouton, Jay H.
Boynton, Wm. H.
Bunker, V. C.
California Cattlemens’ Ass’n
Cameron, Hugh S.
Casselberry, N. H.
Christopherson, Elmer M.
Dunlap, Mary K.
Evisle, T. B.
Fisher, V. E.
Fulmor, James N.
Hage, Theodore J.
Haims, Phil
Hart, George H.
Hurt, L. M.
Jasper, Donald E.
Kelly, Arthur L.
Lash, Elmer
Ludwig, H. T.
McKay, Kenneth G.
Murphy, George H.
Pellissier, Frank L.
Quortrup, E. R.
Railsback, Guy A.
Rich, Sigmund T.
Rosenwald, A. S.
Schaaf, Kermit
Schalm, O. W.
Schermherhorn, R. J.
Schmidt, H. J.
Schroeder, C. R.
Sheffield, E. F.
ACTIVE MEMBERS, 1954

Sheldon, F. W.
Wood, F. W.

Los Angeles County
California

Official Membership
Representative

Dr. C. E. Wicktor,*
County Livestock Inspector
203 Administration Bldg.,
Union Stock Yards,
Los Angeles, California

Individual Members
Hurt, Ross H.
Young, W. A.

COLORADO

Official Membership
Representative

Dr. M. N. Riemenschneider
Colorado Dept. Agriculture
3130 Zuni Street,
Denver 11, Colorado

Individual Members
Clark, W. A., Jr.
Colorado Serum Co.
Davis, C. L.
Frank, Nathan
Gow, R. M.
Henry, C. W.
Mydland, H. T.
Riemenschneider, M. N.

CONNECTICUT

Official Membership
Representative

Dr. Jean V. Smith,
State Veterinarian
Hartford, Connecticut

Individual Members
Beck, John W.
Ferrigno, Frank
Jungherr, Erwin
Lipman, Bernard
Smith, Jean V.

DELWARE

Official Membership
Representative

Dr. Harry McDaniel, Jr., Director
Livestock Sanitation
Dover, Delaware

Individual Members
Kakavas, James C.
Reed, William E.
Seeger, Karl C.
White, Howard J.
Woodhouse, Clarence A.

DISTRICT OF COLUMBIA

Official Membership
Representative

Dr. B. T. Simms, Chief
Bureau of Animal Industry
Washington 25, D. C.

Individual Members
Anderson, Robert J.
Brandly, Paul J.
Giltner, L. T.
Gooding, C. L.
Herl, O. E.
Hourrigan, James L.
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
Shalkop, Wm T.
Simms, B. T.
Spindler, Lloyd A.
Tellejohn, A. L.
Wight, A. E.
Williams, James E.

FLORIDA

Official Membership
Representative

Dr. Clarence L. Campbell
State Veterinarian,
326 Caldwell Bldg.,
Tallahassee, Florida

Individual Members
Acree, J. A.
Du Puis, John G., Jr.
Fish, James G.
Habecker, I. N.
Johnson, V. C.
Scatterday, J. E.
Swanson, Leonard E.

GEORGIA
Official Membership
Representative
Dr. T. B. Clower
State Capitol
Atlanta, Georgia

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Andrews, John S.
Bahnsen, Peter F.
Bateman, Osgood M.
Clower, T. B.
Cooperrider, Donald E.
Jones, T. J.
Kleckner, Albert K.
Langer, Peter H.
Menges, Robert W.
Mikel, C. J.
Mosher, L. A.
Robinson, Virgil B.
Sippel, Wm. L.
Smith, Fred H.
Starr, L. E.
Steele, James H.
Sutton, J. M.
Tierkel, Ernest S.

HAWAII
Official Membership
Representative
Dr. Ernest H. Willers,
Box 3319
Honolulu, T. H.

IDAHO
Official Membership
Representative
Dr. A. P. Schneider
State Veterinarian
Room 206, State House
Boise, Idaho.

Individual Members
Blain, O. I.
Schneider, A. P.
Wallentine, Van Ness D.

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Official Membership
Representative
Dr. A. K. Merriman, Supt.
Division of Livestock Industry

Women's Building
State Fair Grounds,
Springfield, Illinois

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Alberts, J. O.
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Bartlett, David E.
Beamer, P. D.
Byle, C. E.
Boley, L. E.
Bott, A. E.
Brewer, N. R.
Bryan, H. S.
Caldwell, Harry
Campbell, C. L.
Case, J. P.
Cunkelman, J. W.
Curtis, Homer C.
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Davison, A. H.
Delmore, John L.
Dunk, Milton R.
Dykstra, L. A.
Fidler, C. E.
Fredrickson, Luther E.
Ganey, David R.
Grace, Oliver D.
Graham, Robert
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Hensley, A. P.
The Holmes Serum Co.
Hostetler, Clarence B.
Huggins, M. J.
Inst. of American Poultry Ind.
Jaffray, D. S.
Jensen, G. W.
Kamm, R. C.
Kennedy, Earl R.
Kingman, H. E., Jr.
Koonz, Carl H.
Lake, B. L.
Legner, A. A.
Levine, Norman D.
Mau, Fred C.
Merrick, A. C.
Merriman, A. K.
Michels, Charles B.
Mid-West Order Buyers
Misener, A. G.
Morland, Duke
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Mueller, George L., Jr.
Lacroix, J. V.
Novotny, Gilbert
Nowlen, James C.
Orum, A. M.
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Pickard, J. R.
Potts, W. S.
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Ray, J. D.
Rinehart, Herman C.
St. Louis Livestock Exchange
Schooley, Maurice A.
Schwab, William
Seher, O. W.
Sheaffer, Jos. G.
Sparks, H. L. & Co.
Spesard, W. R.
Stone, Alex B.
Swaim, J. E.
Thomson, A. C.
Thompson, Roy A.
Watkins & Potts
Watkins, M. H.
Webb, L. M.
Weaton, Olin G.
White, C. B.
Wilson, Harold E.
Woods, George T.

INDIANA
Official Membership
Representative
Dr. J. W. Green
State Veterinarian
Room 477 Board of Health Bldg.,
1330 West Michigan Street
Indianapolis 7, Indiana

Individual Members
Axby, J. L.
Brose, Cyrus P.
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Burch, George R.
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Conner Prairie Farm
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Gillie, George W.
Gochenour, W. S.
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Grove, Thorpe J.
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Jones, T. K.
Klussendorf, R. C.
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Ralph, D. T.
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Tucker, F. C.
Waltz, R. H.
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Official Membership
Representative
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Division of Animal Industry
Des Moines 19, Iowa

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Davis & Mannasmith
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Hanson, Dick
Hendricks, Stanley L.
Hubbard, Earl D.
Huff, T. B.
Iowa Farm Serum Co.
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Jones, Lloyd D.
Killinger, Arden H.
Lee, C. D.
Molgard, P. C.
Munce, Thomas W.
Munger, Grant B.
Nicol, H. Stanley
Salsbury, John G.
Salsbury, Joseph E.
Schwarte, L. H.
Torrney, J. P.

KANSAS
Official Membership
Representative
Mr. A. G. Pickett,
Livestock Sanitary Comm.
909 Harrison St.,
Topeka, Kansas

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Curtis, L. M.
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Fagan, Raymond
Foltz, Vernon D.
Gough, W. James
Harwood, N. D.
Kushner, A.
Leasure, E. E.
Meeks, R. B.
Pellette, Dudley B.
Roderick, Lee M.
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Scott, Joseph P.
Twiehaus, Marvin J.
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Official Membership
Representative
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State Veterinarian
Frankfort, Kentucky

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Forsee, W. T.
Glockner, William C.
Guard, Samuel R.
Hull, F. E.
Lackey, Otho M.
Montgomery, Geo. A.
Stearns, T. J.

LOUISIANA
Official Membership
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Dr. F. B. Wheeler
State Veterinarian
Livestock Sanitary Board
State Capitol Building
Baton Rouge, Louisiana

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Oglesby, W. T.
Saulmon, E. E.
Wheeler, F. B.

MAINE
Official Membership
Representative
Mr. Francis G. Buzzell, Chief
Division of Animal Industry
State House
Augusta, Maine

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Merrill, Stanford D.
Shaw, Harold J.
Witter, J. F.

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Official Membership
Representative
Dr. A. L. Brueckner, Director
Livestock Sanitary Service,
College Park, Maryland

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Barker, H. C.
Brueckner, A. L.
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Cotton, Cornelia
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Grey, Charles G.
Habermann, Robert T.
Hastings, J. Walter, Sr.
Heemstra, Louis C.
Hinshaw, W. R.
Hummon, O. J.
Johnson, Howard W.
Lowe, L. Robert
Manthei, Chester A.
Mingle, C. K.
Mulhern, Francis J.
Peck, Arthur H.
Poelma, L. J.
Remsberg, J. Homer
Scruggs, J. H.
Smith, Claude A.
Snyder, Rudolph
Thorp, W. T. S.
Zwickey, R. E.
MASSACHUSETTS

Official Membership Representative
Dr. W. S. Shannon, Dir.
Livestock Disease Control
41 Tremont Street
Boston 8, Massachusetts

Individual Members
Aldrich, E. M.
Moore, Stevenson, Jr.
Peck, Donald
Thibeault, Cornelius
Van Roekel, Henry

MICHIGAN

Official Membership Representative
Dr. Lee Davisson,
State Veterinarian
721 State Office Bldg.,
Lansing 13, Michigan

Individual Members
Barner, Ralph D.
Clark, C. F.
Cunningham, Charles H.
Davisson, Lee
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Eads, F. E.
Higgins, W. A.
Lohman, Andrew G.
Newman, John P.
Reed, Glen W.
Schildman, A. S.
Smith, C. B.
Stafseth, H. J.
Van Tilborg, E. J.

MINNESOTA

Official Membership Representative
Dr. Ralph L. West
Secretary & Executive Officer
Livestock Sanitary Board
Saint Paul, Minnesota

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Beebe, W. L.
Braunworth, Elmer H.
Butler, Homer C.
Campbell, John N.
Driver, Fred C.

Fenstermacher, R.
Finson, James J.
Fitch, James A.
Gale, Charles
Griffiths, Henry J.
Hines, L. B.
Kernkamp, Howard C. H.
Mather, George W.
Morgan, O. B.
Pomeroy, B. S.
Railsback, Lee T.
Roepke, Martin H.
Sautter, Jay H.
Spurrell, Francis A.
West, Ralph L.

MISSISSIPPI

Official Membership Representative
Dr. Vernon D. Chadwick
State Veterinarian
Jackson, Mississippi

Individual Members
Chadwick, Vernon D.
Simms, B. T., Jr.

MISSOURI

Official Membership Representative
Dr. L. A. Rosner
State Veterinarian
P. O. Box 630
Jefferson City, Mo.

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American Hereford Association
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Beckman, C. Herman
Brown, John William
Cahill, E. A., Jr.
Campbell, C. L.
Case, Arthur A.
Cheroweth, 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
Evans, J. H. Jr.
Frank, George A.
Gentry, F. D.
Graham, Guy G.
Groth, A. H.
Hopkins, L. T.
Kilgore, R. L.
Lockhart, Ashe
Lubbehusen, R. E.
McDougle, H. C.
Murdock, F. M.
Omhundro, R. E.
Price, Edmund R.
Quin, A. H.
Ragsdale, A. C.
Rosner, L. A.
Schilling, S. J.
Schofield, William C.
Simpson, John B.
Vezeey, Stanley A.
Wank, Carl A.
Wells, J. L.
Whiting, J. A.
Wilke, T. E.

MONTANA
Official Membership
Representative

Dr. H. F. Wilkins
State Veterinarian
Helena, Montana

Individual Members

Cronen, G. W.
Fisher, B. O.
Hadlow, W. J.
Itcaina, Pete
Jasmin, A. M.
Joneschild, E. M.
Kilpatrick, J. W.
Marsh, Hadleigh
McNamara, Clifford J.
Miser, R. Robert J.
Myczkowski, Myroslaw
Oreutt, Bruce
Roenisch, Harold W.
Safford, John W.
Sanders, C. T.
Stineburg, C. E.
Timmons, R. C.
Tunnicliif, E. A.
Wilbur, John L., Jr.
Wilkins, H. F.
Wipf, J. D. Conrad

NEBRASKA
Official Membership
Representative

Dr. J. L. George,
Bureau of Animal Industry,
Lincoln, Nebraska

Individual Members

Alford, Simon W.
Bachman, Wilbur
Baldwin, E. M.
Bjornson, C. B.
Boulier, L. J.
Breed, Frank
Corn States Serum Co.
Drach, Amor C.
Emrich, C. O.
Gesellchen, V. W.
Gross, H.
Hasselbalch, Neal
Hoerlein, Alvin B.
Hoyt, Ed.
Jones, E. C.
Karre, D. L.
Kjar, H. A.
Klumskire, W. F.
Lott, B. F.
Matthews, Paul L.
McInlay, J. N.
Messersmith, F. E.
Norden, Carl J.
Norden, Carl J., Jr.
Olson, Carl
Peck, E. W.
Peterson, Irvin E.
Phillips & Magilton
Reece, F. M.
Reed, Earle G.
Rosner, S. F.
Ryan, E. P.
Skidmore, Louis Vallieras
Smith, Phillip T.
Stryson, C. C.
Thompson, Howard
Tucker, Roy
Van Es, L.
Warner, C. J.
Williams, Guy H.
Young, R. M.

NEVADA
Official Membership
Representative

Dr. Warren B. Earl, Director
ACTIVE MEMBERS, 1954

Division of Animal Industry,
P. O. Box 1027
Reno, Nevada.

NEW HAMSHIRE
Official Membership
Representative

Dr. R. W. Smith
State Veterinarian
Concord, New Hampshire

Individual Members
Allen, Fred E.
Christie, Andrew
Fessenden, Paul E.
Hill, Richard L.
Martin, Carl L.
Simmons, Eric W.
Smith, R. W.

NEW JERSEY
Official Membership
Representative

Dr. R. A. Hendershott, Director
Division of Animal Industry
1 West State Street,
Trenton 8, New Jersey

Individual Members
Armstrong, Robert S.
Batte, Edward G.
Beaudette, F. R.
Benton, Thomas H.
Bivins, James A.
Black, J. J.
Botwinick, Irving
Cebulka, Peter R.
Fogg, D. E.
Germanio, Lester
Germanio, Peter J.
Gibbs, Charles Shelby
Goldhaft, Arthur D.
Hagenbuch, J. B.
Haines, L. B.
Hendershott, R. A.
Herron, James M.
Huff, Carl P.
Ives, Leland D.
King, Harold C.
Lichtman, Norman N. & Bros.
McDaniels, J. S.
McKay Bros. Stock Farm
Melin, Nolo
Mennen, William G.
Metzger, H. J.
Michaud, Laurent
Mourey, Lou C., Jr.
Neuberger, Harry H.
Newman, Ed. P.
Nilsson, L. S., Jr.
Picot, Leonce L., 3rd
Porteus, J. R.
Ringleb, C. J.
Sacks, Sander A.
Schilf, E. A.
Schoch, Chas.
Siegmund, Otto H.
Sussman, Oscar
Thoms, Joseph C.
Tudor, David C.
Tyler, George W.
Villari, John
White, Henry H.
Wilson, Ralph A.
Zaitz, David
Zeissig, Alexander
Ziskind, M. L.
Zurbrugg, John T.

NEW MEXICO
Official Membership
Representative

Dr. F. L. Schneider,
Veterinary Surgeon
207 W. Gold Avenue
Albuquerque, New Mexico.

Individual Members
Benner, J. W.
Hammond, Lee R.
Kemper, Harry E.
Mitchell, Albert K.
Schneider, F. L.
White, J. P., Jr.

NEW YORK
Official Membership
Representative

Dr. I. G. Howe, Director
Bureau of Animal Industry
Albany, New York

Individual Members
Aronson, Harry P.
Baker, Donald W.
Baker, James A.
Barnes, Lowell R.
Beard, Stanley D.
Belloff, G.
ACTIVE MEMBERS, 1954

Bixby, D. O.
Bolton, Robert
Bottruff, C. A.
Brad, C. G.
Carolyn, John L.
Cleveland, E. C. & H. J.
Corwin, Louis A.
Cox, Herald R.
Danielson, I. S.
Dansky, Simon P.
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