Proceedings
FIFTY-SECOND
ANNUAL MEETING
of the
UNITED STATES
LIVESTOCK SANITARY
ASSOCIATION

HOTEL SHIRLEY-SAVOY
Denver, Colorado
October 13, 14, 15, 1948
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R. A. HENDERSHOTT, Trenton, N. J.

Alternates
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J. R. LUDWIGS, Fort Worth, Texas
R. W. SMITH, Concord, N. H.
**HISTORICAL**

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

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

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<tr>
<th>Meetings</th>
<th>Date</th>
<th>Place</th>
<th>President</th>
<th>Secretary</th>
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</thead>
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<tr>
<td>1</td>
<td>Sept. 28-29, 1897</td>
<td>Fort Worth, Tex.</td>
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<tr>
<td>2</td>
<td>1898</td>
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<tr>
<td>3</td>
<td>1899</td>
<td>Chicago, Ill.</td>
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<td>4</td>
<td>1900</td>
<td>Louisville, Ky.</td>
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<td>5</td>
<td>Oct. 8-9, 1901</td>
<td>Buffalo, N. Y.</td>
<td>E. P. Niles</td>
<td>F. T. Eisenman</td>
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<td>7</td>
<td>Sept. 22, 1903</td>
<td>Denver, Colo.</td>
<td>W. E. Bolton</td>
<td>Hon. W. P. Smith</td>
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<tr>
<td>8</td>
<td>Aug. 23-25, 1904</td>
<td>St. Louis, Mo.</td>
<td>J. C. Norton</td>
<td>Hon. W. P. Smith</td>
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<td>9</td>
<td>1905</td>
<td>Guthrie, Okla.</td>
<td>Hon. W. P. Smith</td>
<td>S. H. Ward</td>
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<td>11</td>
<td>Sept. 16-17, 1907</td>
<td>Richmond, Va.</td>
<td>D. F. Luckey</td>
<td>G. A. Jarman</td>
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<td>14</td>
<td>Dec. 5-7, 1910</td>
<td>Chicago, Ill.</td>
<td>Chas. E. Cotton</td>
<td>J. J. Ferguson</td>
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<td>15</td>
<td>Dec. 6-8, 1911</td>
<td>Chicago, Ill.</td>
<td>John F. DeVine</td>
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<td>16</td>
<td>Dec. 5-6, 1912</td>
<td>Chicago, Ill.</td>
<td>Mazyck P. Ravenel</td>
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<td>17</td>
<td>Dec. 2-4, 1913</td>
<td>Chicago, Ill.</td>
<td>Peter F. Bahnsen</td>
<td>J. J. Ferguson</td>
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<td>18</td>
<td>Feb. 16-18, 1914</td>
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<td>S. H. Ward</td>
<td>J. J. Ferguson</td>
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<td>20</td>
<td>Dec. 5-7, 1916</td>
<td>Chicago, Ill.</td>
<td>O. E. Dyson</td>
<td>J. J. Ferguson</td>
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<td>21</td>
<td>Dec. 2-4, 1917</td>
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<td>J. G. Wills</td>
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<td>22</td>
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<td>Chicago, Ill.</td>
<td>M. Jacob</td>
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<td>23</td>
<td>Dec. 1-2, 1919</td>
<td>Chicago, Ill.</td>
<td>G. W. Dunphy</td>
<td>D. M. Campbell</td>
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<tr>
<td>24</td>
<td>Nov. 29-30-</td>
<td>Chicago, Ill.</td>
<td>S. F. Musselman</td>
<td>D. M. Campbell</td>
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<td>25</td>
<td>Nov. 28-30, 1921</td>
<td>Chicago, Ill.</td>
<td>W. F. Crewe</td>
<td>Theo. A. Burnett</td>
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<td>26</td>
<td>Dec. 6-8, 1922</td>
<td>Chicago, Ill.</td>
<td>T. E. Munce</td>
<td>Theo. A. Burnett</td>
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<td>27</td>
<td>Dec. 5-7, 1923</td>
<td>Chicago, Ill.</td>
<td>W. J. Butler</td>
<td>O. E. Dyson</td>
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<td>28</td>
<td>Dec. 3-5, 1924</td>
<td>Chicago, Ill.</td>
<td>J. G. Ferneyhough</td>
<td>O. E. Dyson</td>
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<td>31</td>
<td>Nov. 30-</td>
<td>Chicago, Ill.</td>
<td>L. Van Es</td>
<td>O. E. Dyson</td>
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<td>32</td>
<td>Dec. 2-5, 1928</td>
<td>Chicago, Ill.</td>
<td>Chas G. Lamb</td>
<td>O. E. Dyson</td>
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<td>33</td>
<td>Dec. 4-6, 1929</td>
<td>Chicago, Ill.</td>
<td>A. E. Wight</td>
<td>O. E. Dyson</td>
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<td>34</td>
<td>Dec. 3-5, 1930</td>
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<td>J. W. Connaway</td>
<td>O. E. Dyson</td>
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<tr>
<td>35</td>
<td>Dec. 2-4, 1931</td>
<td>Chicago, Ill.</td>
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*Information not available.

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<tr>
<th>Date Range</th>
<th>Year</th>
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<th>Presenter(s)</th>
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<tr>
<td>Nov. 30-</td>
<td>1932</td>
<td>Chicago, Ill.</td>
<td>Peter Malcolm, O. E. Dyson</td>
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<td>Dec. 6-8,</td>
<td>1934</td>
<td>Chicago, Ill.</td>
<td>T. E. Robinson, O. E. Dyson</td>
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<td>Dec. 4-6,</td>
<td>1936</td>
<td>Chicago, Ill.</td>
<td>Walter Wisnicky, L. Enos Day</td>
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<tr>
<td>Dec. 2-4,</td>
<td>1937</td>
<td>Chicago, Ill.</td>
<td>R. W. Smith, L. Enos Day</td>
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<tr>
<td>Nov. 30-</td>
<td>1938</td>
<td>Chicago, Ill.</td>
<td>D. E. Westmorland, L. Enos Day</td>
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<tr>
<td>Dec. 6-8,</td>
<td>1940</td>
<td>Chicago, Ill.</td>
<td>H. D. Port, Mark Welsh</td>
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<td>Dec. 3-5,</td>
<td>1941</td>
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<td>E. A. Crossman, Mark Welsh</td>
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<tr>
<td>Dec. 2-4,</td>
<td>1942</td>
<td>Chicago, Ill.</td>
<td>I. S. McAdory, Mark Welsh</td>
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<tr>
<td>Dec. 6-8,</td>
<td>1944</td>
<td>Chicago, Ill.</td>
<td>J. M. Sutton, R. A. Hendershott</td>
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<tr>
<td>Dec. 5-7,</td>
<td>1945</td>
<td>Chicago, Ill.</td>
<td>C. U. Duckworth, R. A. Hendershott</td>
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<tr>
<td>Dec. 4-6,</td>
<td>1946</td>
<td>Chicago, Ill.</td>
<td>William Moore, R. A. Hendershott</td>
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<tr>
<td>Dec. 3-5,</td>
<td>1947</td>
<td>Chicago, Ill.</td>
<td>Will. J. Miller, R. A. Hendershott</td>
</tr>
</tbody>
</table>
WELCOME TO COLORADO

HONORABLE LEE KNOUS

Governor of Colorado

Governor KNoUs: Thank you very much, gentlemen. Mr. Chairman, I am very happy to come down here this morning for the purpose of welcoming to Colorado and to Denver this great organization and to express our appreciation that you chose Colorado as your meeting place. We are a rather new country out here compared to other sections of the United States, and we are always very happy to have visitors come here to exchange views and derive information from them.

Surely, in view of the fact that our livestock industry is one of the basic economic foundations of our whole Western country it is particularly fine that this group should arrive here. Welcoming statements always have some of the aspects of the superficial. It is difficult to get them as sincere as you really want them. The West has always been noted for its hospitality, and we trust that has not been lost and that your stay here aside from the things you discuss at this meeting and the programs that are developed, that you do have a pleasant time here. The welcome might be expressed something like the incident I heard in Wyoming the other day. I happened to be in one of the smaller towns in Wyoming, and a group had met in that locality. The Governor of the State had been there and extended his greetings and welcome. The Mayor of the town had also appeared and assured the delegates, if they were subject to any infringements of the law or had any conflicts with the law that he would try to arrange to take care of that too. Finally it got down to the President of the small organization that was sponsoring the meeting to extend his welcome, and he said, "Gentlemen, the Governor has given you the key to the State; the Mayor has told you he will help you out of any conflicts with the law; I can't do any of these things, but, if you land in jail, I will come down and get in with you."

The problems that you are going to discuss and the problems that attend the livestock industry and all branches today were probably never of more public importance than now. I think a large part of that may be due to the emphasis now being placed upon public health programs. The public is very conscious of those things, and in all States I believe there is attention being given to public health programs. In Colorado last year or in 1947 the Legislature adopted a very expanded public health code. We have now a larger technical force looking after the health affairs of preventative medicine and sanitation procedures than ever before and are expecting to expand that as times goes on particularly with reference to stream sanitation and several other matters that have not kept pace with our development here.

Naturally, in the expansion of a public health program where there are areas in which animal diseases that do have an effect upon the health of human beings are concerned there will be and already in Colorado there is somewhat of a tendency for a conflict in functions between the agencies devoted to sanitary procedures with reference to livestock and those having to do with the public health. One of the
things here—and I gather from what I know of troubles in other states—has to do with the problem of brucellosis which, of course, is the source of the infection or the bacteria that produces Bang's Disease which is a matter, of course, of great concern to the public health authorities.

When this particular legislation in Colorado was under consideration by the General Assembly some consideration was given this brucellosis problem and procedures for its control. Due to differences of viewpoint in various branches of the Livestock Industry that bill failed passage. We have had in Colorado a rather high incidence of undulant fever developed from the consumption of milk from animals affected with brucellosis so the matter has been very much in the public eye in the months since the Legislature adjourned. About a year ago, I think, or less in view of this particular interest in the problem I asked all of the various livestock groups in the State, the State Board of Health, the State Medical Association, and the State Veterinary Association to designate a representative from each of their groups to serve on a committee to consider the problem of brucellosis legislation with the view of making recommendations to the incoming Legislature which meets next January for a bill on that subject.

This committee has met. They have done considerable work and have accumulated a large amount of data and information on the subject and have tentatively approved a bill for submission to the Legislature. This bill, however, at the moment does not have the full approval of all of the livestock groups. There is apprehension, of course, about the inspection procedure, and even the difficulties that go with the detection and control of brucellosis are also a factor in the economic problems involved, and these things naturally complicate regulatory legislation. I do trust that before the Legislature meets that more harmony will have been developed on that particular subject. I am not sufficiently acquainted with your agenda to know whether this particular problem is included in discussions here. But I do trust that some reports may be made on it and that some information helpful to this committee may be gained from this very conference of yours.

One thing that has developed in connection with this little brucellosis program that we are trying to inaugurate here in Colorado is that a good many States seem to have the same problem all of which impels me to the belief that the experience in the control of animal disease and in which so much progress has been made that must be approached on the basis of interstate levels as well as intrastate programs. In fact, looking at the thing from the standpoint of Government, I doubt if any field of activity in which the public is interested has proceeded along broad interstate lines and even international lines as has the work you are particularly interested in.

My own home is in a section of Colorado which is devoted almost exclusively to the production of livestock. I have known the incidence of livestock diseases in the past, recall very vividly the attempts of control made at local levels and their utter failures, and it is gratifying to see over the years how cooperation between the states is extended and how, above all things, the cooperation between our Nations here in the North American Continent has been extended and certainly with the present threat of hoof and mouth disease, were it not for the highest type of cooperation between the United States and Mexico with the technical contributions
which have been made by those trained in those fields of service, there likely would have been a great epidemic of hoof and mouth disease throughout the United States. So, I know your thinking is proceeding upon a very sound level, upon a level which also well might be looked into by other branches of State Government with respect to the various commonwealths in our communities.

Here at the moment in the West as illustrative and typical of the thing you have been doing right along and yet working in another field is the effort of trying to induce the wool processing industry to come to the State where a considerable amount of wool in this country is produced. We also have interstate arrangements in this section over the distribution of our water and those things, and I am sure that the pattern has been set, as I say, in livestock and temporary arrangements, one that others will follow and, of course, has not been reached in its full potentialities even by your groups. I am very sure that never, as I said a moment ago, in the history of this United States, has there been as much interest in public health as there is today, and naturally, that implies that the same degree of interest goes with reference to livestock sanitary controls and those things in which you are so very interested.

I am also very sure that that interest and concern extends to the pollution of our waters and the things that are so closely associated that this program will move forward together. Out in the West we were blessed by nature with beautiful clear streams of water even far distant from the mountains where the snows fed the streams and they showed no contamination whatsoever. We have been lulled into the feeling that that fine condition might continue forever, but we find in Colorado, and I think it is true in most of the Western States, that our streams are being contaminated by raw sewage, by industrial development so we must take notice of that situation.

About a year ago I heard Governor Duff of Pennsylvania whom many of you know as being an expert in the field of stream sanitation say, after mentioning the great amount of money that the State of Pennsylvania spends each year for the purpose simply of keeping the present degree of contamination level, that any State who had their streams so the pollution could be arrested and did not do so at a early date, were certainly overlooking of the greatest services to the public. I know that is a little bit out of your field, but I am sure the whole program has to be considered together, and it has to be considered together for one other reason which I have suggested, and that is to keep from overlaps between boards and animal sanitary inspection units and also the stream pollution unit, because without a combined objective and without the elimination of overlaps the whole program is going to be delayed and obstructed.

I do feel sure and trust that many of these things will be discussed at this very meeting, because the reports of your organizations are very much sought after and will act as guideposts for the progress made in this particular field which even though you have been at it a long time is still in some degree a novel field in State Governments. I am very happy again to have been here and to have this little opportunity of talking to you and to extend our felicitations and greetings for your pleasant stay here and for your success and happiness in the future. Thank you very much.
RESPONSE TO ADDRESS OF WELCOME

BY R. W. SMITH, D.V.M.

Concord, New Hampshire

DR. SMITH (New Hampshire): Mr. President, your Excellency Governor Knous, and ladies and gentlemen of the convention, his Honor not only gave us a very warm welcome to this fine City of Denver in the great State of Colorado but, in addition, he gave us an address that we can think about for a long time. He has demonstrated in his talk to us this morning that, as the Chief Executive of the great State of Colorado, he knows some of the problems that we are here to discuss. In our President's address this morning he gave you a little of the history of this organization. I do not recall that he told you that 45 years ago the 22nd day of last month this organization met in this very city, and it is entirely fitting and proper that we should come back here at a later year, even though it has been 45 years since our last visit, to renew the programs that were started by the pioneers of our country in the control and eradication of contagious and infectious diseases. In glancing over the history of this organization it is very enlightening to me at least, to note that those men who gathered in Texas some 51 or 52 years ago to discuss some of the same problems that we are discussing here this week, that is the shipment of cattle from one area to another. We also note that among the personnel recorded and registered at that first meeting was the State Veterinarian of the State of Colorado.

President Knapp has told you that for 39 years without an interruption we have met in the City of Chicago, and that for the first time in 39 years we have put our convention on wheels and have come into the West, into the area and into the territory where much of our livestock is grown and where many of the problems that confront the livestock grower of the West can be discussed on home grounds. You know we as veterinarians and sanitarians are engaged in the number one industry of our country. No one can dispute that it is the greatest industry in my country. Someone has aptly said that livestock is the cornerstone of America's great agricultural wealth and that the veterinarian and sanitarian are its greatest safeguard.

Did you ever stop to think that, if agriculture should stop immediately, how long it would be before the industries of our country would stop? The City of Denver would become a ghost town. Our factory wheels would stop. In fact, there would be nothing on this earth. So, I say when we come here and discuss the problems that we do we are discussing problems that not only affect the livestock interests of our country but of the entire population, and I like to feel that back home I am not only representing probably fifteen or eighteen thousand herd owners in that little State of mine but I am also representing the half million people who make up the citizenry of the State of New Hampshire, and I feel that I owe to them just as much a duty as I do to the livestock interests that I am directly connected with.

In closing I want to read to you a little squib I picked up the other day that I think expresses the opinions of many of us today. It is entitled, "I am a Farmer." It is a farmer from the Midwest. It could be a farmer from any part of our country.
"I am the provider of all mankind, upon me every human being constantly depends;  
A world itself is built upon my toil, my products and my honesty,  
Because of my industry, America, my country, leads the world.  
Here prosperity is maintained by me, here great commerce is the work of my hands,  
Here balance of trade springs from furrows of my father,  
My reaper brings food for a day; my ploughs hold promise for tomorrow;  
In wartime absolute, in peacetime indispensable, my country's surest defense and constant reliance;  
I am the very soul of America, the hope of the race, the balance wheel of civilization.  
When I prosper men are happy; when I fail all the World suffers.  
I live with nature, walk in the green fields under the golden sunlight,  
Out in the great alone where brain and brawn and toil supply man's primary needs,  
And I try to do my humble part to carry out the great plan of God;  
Even the birds are my companions, they greet me with sympathy at the new day's dawn and chum with me until the evening prayer is said.  
If it were not for me the treasuries of the earth would remain surely locked,  
The graineries would be useless frames, man himself would be doomed speedily to extinction and decay."

Governor Knous, we want to thank you for your kind words of welcome, and we can assure you that we will go on during the next three days and carry on the work assigned to us knowing that the Chief Executive of the great State of Colorado knows something of our problems. We thank you.
This is the first meeting of the United States Livestock Sanitary Association held outside the City of Chicago in the last 30 years. There are many people in the United States and Canada interested in the purposes and problems of this Association. Therefore, it was decided to take the Association to the people, especially to those engaged in some phase of livestock production who, for various reasons, have not previously become associated with us.

On behalf of the Association, I am happy to extend to new members and others attending for the first time a cordial welcome. We appreciate your interest and invite you to participate in the proceedings, feeling that if you are a producer you can present your angles and we can then serve you to better advantage.

This Association was organized over 50 years ago by a group of men occupying positions very much the same as you and I occupy today. Then, as now, livestock producers of this country were faced with the problem of how to overcome economic losses occasioned by infectious and contagious diseases. Looking back, from our advantage of years and experience, we think their problems of cattle fever tick and scabies eradication were minor compared to the problems and losses confronting the livestock industry today. Since its organization in 1897, this Association has endeavored to correlate scientific information, sound thinking and practical experience in infectious livestock disease control and has become the agency which, through the years, has been largely responsible in formulating and conducting livestock sanitary disease control programs necessary to effect a profitable livestock industry and maintain a balanced agricultural economy.

How long this Association remains the effective agency it has been in the past will be determined by the manner in which it meets and solves the problems confronting it from year to year.

The livestock sanitary laws and interstate health requirements of the various states were designed to promote the health of their livestock and to protect such states from importations of diseased animals. Uniformity of state laws, interstate regulations and programs of disease control are not as simple as they appear on the surface. For instance, and speaking of cattle only, though the same conditions apply with reference to other livestock and poultry, each State or at least group of states within a given area, is interested in certain phases of livestock production, such as raising grazers or feeders, dairy cattle or purebred breeding cattle, and the laws of these particular states are enacted to best serve these interests. Likewise, the interstate regulations of each state are designed primarily to protect the phase of livestock production common to that state.

We find conflicting interests even within the cattle industry. Factors vital to the development of the industry in one state may be of little importance in another. Livestock disease control programs which exactly fit one state or area may seem unnecessarily stringent or entirely inadequate in another, but the producer knows
that livestock diseases eradicated from his state may be later re-introduced for lack of uniformity of livestock disease control programs among states.

Recognizing that these differences do exist, I suggest these problems may be solved through preparation and dissemination of complete and reliable information to the producer of the cause of his losses that he may, in the light of this knowledge, and with the aid of his practicing veterinarian, determine to work through his livestock sanitary official for uniformity of livestock disease control programs, as in such uniformity lies the basis of uniformity of interstate health regulations with their protection to the livestock industry.

The United States Livestock Sanitary Association is appealing to the livestock producers throughout the United States to become members of this Association, to the end that they may become better acquainted with the interests and desires of their fellow cattlemen and assist this organization in formulating future programs for livestock disease control and the promulgation of simplified interstate health regulations which will be more acceptable to all interests.

It is impossible in the time allotted me to cover all disease control problems which constantly engage the attention of this Association. However, I desire to call your attention to those which to my mind are of major importance.

**Rabies**

This disease continues to demand our attention, and interest in its control is shared by public health agencies because it affects man as well as animals. Much cooperative planning has been accomplished through joint meetings, looking to the enactment of federal and state laws that will effect uniform control and eradication measures. We should continue our efforts to mold public opinion and suggest proper legislation.

**Tuberculosis**

The most serious problem confronting us today in our tuberculosis eradication program is the belief that the task has been accomplished. We have long recognized that bovine tuberculosis is an insidious disease. To assume that we have eliminated this disease because every county is on the modified accredited tuberculosis free area list is to be blind to the facts. Late records show that bovine tuberculosis is increasing in some areas.

The spot or percentage method of testing cattle should not be considered sufficient to maintain area accreditation. I strongly urge that all livestock sanitary officials plan, beginning now, to carry out the recommendations of our 1947 Committee on Tuberculosis and again become sufficiently T.B. conscious to make each herd in which one or more reactors are found a special project for attention and use all recent developments in the application of the tuberculin test, including strict sanitary practices in an attempt to remove diseased animals which are known to sometimes escape detection in routine testing.

This Association has recommended that United States Bureau of Animal Industry Order 397 governing importations of cattle from Canada into the United States be amended to conform with state regulations governing interstate movements. I believe this request on behalf of the cattle industry is fair and should be granted.
I also believe that our Canadian friends and members of this Association will concede that our position is justified.

**EQUINE INFECTIOUS ANEMIA**

The outbreak of equine infectious anemia among thoroughbreds last year focused the attention of the racing world and livestock sanitarians on economic losses resulting from this disease. Not only is there the direct loss of the animals affected, but the indirect losses sustained through quarantines and revenue losses to states where paramutuel betting is permitted. Representatives of this Association, meeting with the Thoroughbred Racing Association in New York, prepared an outline of sanitary practices for adoption at all race tracks.

Based on my rather limited experience with this infectious disease of equines, I believe that if the recommendations of this Association are carried out at the several race tracks in the United States, and health certificates required on all horses and mules offered for interstate shipment, this disease will never again become a livestock sanitary problem.

**ANAPLASMOSIS**

The insidious nature of this disease makes it one of the most difficult to control. Progress has been made in the development of a test to detect carriers, but this test is too complex and expensive to apply except to the most valuable breeding animals. While we are waiting for research to develop a simpler and more practical test, much can be done in the educational field to reduce parasitic infestation and human carelessness in herd management, which are major factors in the spread of anaplasmosis.

**BRUCELLOSIS**

The success of any brucellosis control and eradication program depends upon the active cooperation of the livestock industry, and such cooperation can be expected only if and when the livestock producer becomes fully informed and determines that it is to his financial advantage to maintain a brucellosis free herd. Unfortunately, livestock producers do not always agree with livestock sanitarians regarding the necessity for and value of brucellosis control work. These differences of opinion are created in the minds of the producers by speakers and writers, presumed to be qualified on the subject, who give conflicting information. Another reason for existing differences of opinion lies in the fact that the laws of some of our states are inadequate or ineffectually administered. Adding to the confusion are articles printed in farm journals and magazines and even the local press, which gather their information from various sources, some of which are far from factual. This condition is the result of a critical shortage of reliable information, and to overcome this lack a committee was appointed at our meeting last year to prepare a bill of proven facts concerning brucellosis, which in due time will be published and should be used by all speakers and writers that identical information and facts regarding brucellosis and its control be given to livestock producers throughout the United States and Canada. I fully realize that my remarks here do not cover the various aspects of this intricate problem, but I want you to know that this Association is
cognizant of the tremendous economic losses occasioned through brucellosis, and is taking steps to bring to our best thinkers the scientific information gathered in an attempt to develop a practical and realistic program on a national level.

FOOT-AND-MOUTH DISEASE

The livestock interests in the United States are depending on the Federal Government to prevent foot-and-mouth disease from entering this country from Mexico and to aid that nation, by every means possible, to stamp the disease out there.

Obviously, keeping foot-and-mouth disease out of the United States depends upon successfully stamping it out in Mexico, because if foot-and-mouth disease continues prevalent, or even sporadic, in our neighbor nation, it will inevitably find its way across the border.

Preventing the entrance of foot-and-mouth disease into the United States and aiding in stamping it out in Mexico is not the simple act of setting a governmental function in motion and then going about business as usual. This task, even if vaccination proves successful, will take years to complete and at tremendous cost to the taxpayers of this country. It will be beset at every step with aggravating problems that must be shared to be appreciated, and only through the strength of united public support of both nations can there be any hope of its accomplishment.

I would like to call your attention to the quarantine station that has been authorized by our government to be established on Swan Island, which may possibly be used to facilitate the introduction of cattle into the United States from countries where foot-and-mouth disease is known to exist. I think this Association should very carefully consider the possibilities of the introduction of foot-and-mouth disease into this country through the use of the Swan Island quarantine station. The Bureau of Animal Industry, as I understand it, is without authority to deny the use of this facility to importers in this country making application and complying with Bureau regulations.

AUCTION AND LIVESTOCK MARKETS

We realize the auction and livestock markets give the livestock producer a stable and convenient outlet for his animals, but as many are now conducted throughout the United States, they serve as reservoirs and dissemination centers for practically all infectious diseases of livestock. There is need for state law regulating the operation of auction markets.

Much of the livestock traveling to and from auction markets is handled by trucks and trailers operating without restriction or supervision. This Association has previously gone on record favoring congressional action regulating vehicular traffic of livestock under supervision of the Interstate Commerce Commission. These problems should continue to receive our attention.

The gravity of the international situation brings to our attention the possibilities of a third world conflict and the effect of atomic or biological war on the livestock population of North America. I recommend to the incoming President that he give serious consideration to the appointment of a committee to work with the U.S. Bureau of Animal Industry and a group of scientists in animal diseases to outline a program of defense in such eventuality.
I feel there is a need for education in the field of livestock sanitary control work and believe much can be accomplished by holding meetings, covering large or small areas as conditions warrant, at which livestock producers, livestock sanitary control officials, transportation agencies, veterinary practitioners and public health officials would enter into open discussion of livestock disease control programs, and interstate health regulations, presenting their reactions and viewpoints. No single group possesses or is able to impart full information to another group, but when each group is in possession of all information, there can begin a unity of thought and purpose which will eventually lead to uniformity of procedure and programs.

I desire to express my appreciation to the chairmen and members of the various committees who have contributed generously of their time and energy, some of them being required to attend distant meetings in the accomplishment of their assignments. Their devotion to the work of this organization and its purposes should be recognized.

I particularly desire to pay my humble and sincere respects to the Secretary, who throughout the year carries on the work of the Association. The sum total of his activity under normal circumstances is a tremendous task, but this year, functioning under the handicap of his operations, it has been an amazing performance and never before have I observed the degree of fortitude, determination and devotion to duty shown by Doctor Hendershott.

The privilege of serving this organization as President is an honor that I shall cherish as long as I live. Our Association has a history of faithful service, and I know greater achievements lie ahead. I deeply appreciate the opportunity to make my small contribution. I have faith in the Association, its members, its purposes, and its destiny.
MEMORIAL SERVICE

DR. R. A. HENDERSHOTT: Mr. President and members of the U. S. Livestock Sanitary Association, ladies and gentlemen, we now come to that part in the program in which we pause for a few minutes to pay our respects to our brothers who can be with us in spirit only today. During the past year we have sustained a real loss in the passing of the following men who have for years maintained membership in this Association.

Dr. Harvey C. Givens (U.S.C.V.S. 1913) 60, Richmond, Virginia, long a member of this Association and a member of the Executive Committee, met an untimely death by drowning while swimming with friends on July 3, 1948. His early years were spent in the Federal Meat Inspection Service and later he served the city of Roanoke as health inspector. Since 1926 he has occupied the position of State Veterinarian in Virginia. Under his supervision bovine tuberculosis was eradicated in Virginia and many counties and herds freed from brucellosis. He will long be remembered in this Association for his work on major committees. During the past year he was instrumental in setting up the six state experimental project to determine the effectiveness of Huddleson's Mucoid Brucella vaccine.

Dr. E. C. W. Scheubel (U.S.C.V.S. 1911) 66, Blissfield, Michigan, died January 26, 1948 from a heart attack. Dr. Scheubel has maintained membership and an active interest in the work of this Association for a number of years. He was past president of the Michigan State Veterinary Medical Association and was recognized as a capable sanitarian in the community in which he served.

Dr. Glenn L. Ebright (C.V.C. 1908) 63, Indiana, an active member of the United States Livestock Sanitary Association died suddenly on April 20, 1948 while attending a meeting of the American Animal Hospital Association. For forty years he served the people in the vicinity of Hammond, Indiana as advisor on animal health problems.

Dr. James S. Healy (K.V.C. 1909) 70, Madison, Wisconsin, died January 17, 1948. Prior to his retirement in November, 1947 he served as Inspector in Charge of the Wisconsin office and was well known for his efforts in assisting in the eradication of tuberculosis and brucellosis.

Dr. Cassius Way (Cornell 1907) 67, New York City, died August 5, 1948 as the result of an accident received in treating a horse. In his early professional life, Dr. Way was prominent in the field of disease prevention in farm animals. He was one of the far seeing members of our profession who very early advocated and employed the tuberculin testing of dairy animals in pure milk production. He was an active member and worker in the interest of improved sanitation on livestock farms.

Let us rise for a moment and pause for a minute in silent prayer. . . . All of these men served well the Livestock Industry of this great Nation in their individual capacities. Though we are forever deprived of the privilege of personal contact with them the memory of them and the good they did shall always serve to stimulate us to great efforts in our particular field of service. May the Supreme Being who knows all our virtues and faults grant them peace in that land to which all must some day go. I move you, Mr. President, that this be accepted and referred to the Executive Board, this to become a part of the minutes of the Association, and that copies of it be sent to the relatives of the men who have passed on during the current year.
COMMUNITY AUCTIONS

Mr. Roy Tucker

President, National Livestock Auction Market Association, York, Nebraska

I live in Nebraska, and I have operated a livestock auction market for the past 26 years. I have been interested and an officer of our State Association for 15 years until the present time. At present I am President of the National Livestock Auction Association. This is my first meeting with this Association, and I expected Mr. Gade to be here to present the auctioneer’s viewpoint, and I have no prepared address for you gentlemen.

From the beginning of the auction markets, my time goes back to the time when the first livestock truck was yet to be put on the road in the auction business operating livestock auctions, I have always felt the need of livestock sanitary inspection that would be held at the auction markets. Before the State Law was passed and veterinarians were put on the markets with State regulations I employed a veterinarian and put him in charge of livestock inspection at my own market. Later on rules and regulations took care of this. I mention this merely to show my own personal viewpoint in regard to inspection.

The Association will cooperate, and that is the reason we are associated, for the purpose of cooperating and working with such organizations and groups as this who are trying to work out something that is practical, something that has sense to it, and will serve the purpose. The thing that the auction markets, of course, would like is to have freer transportation from one part of the country to another. The people in the Northwest complain of the obstacles, not only of the sanitation but wheel taxes and things of that kind from one State to another, particularly moving from the Northwest to the State of California, and I know the boys down in Kansas complain greatly of some of the movements and regulations the way they are operated between Oklahoma and Kansas—for instance, here is an auction market on one side of the line, and the neighbor out here three miles away is unable to bring his livestock over to this market. So, those are the things that the auction market would be particularly interested in, in seeing a freer movement of livestock from one part of the country to another with something that is effective and workable.

The Association will pledge its support for those things and try to assist this group in having something that is practical and something that will work. On the other hand, there have been times back in the history I can remember when the publications, for instance, had an article about the terrible auction markets of the country, how they were spreaders of disease, and all that sort of thing. We have always opposed regulations that have come in for the purpose of serving some political or private interest other than what it is intended to serve. Those things we have opposed and opposed very vigorously, and, of course, we would again.

The auction market, I feel, is here to stay. It has become a part of our marketing system. It has made many contributions to the marketing of livestock. One of the contributions, I would say that it has given the feeder the first opportunity to
meet the ranchman straight across the board on a deal on his cattle. I can remember back in the days—and some of you men can too—when all of the livestock that was shipped to the markets went through the hands of the trader before it could go into the hands of the feeder. So that is one of the great contributions the auction market has made. It is a help to the small producer in the marketing of his stock.

Today, small producers are able to receive as much for their livestock as large producers on the auction markets of the land. It has proven economy in transportation. It is practical from an economic standpoint. Not only that, we find it has won favor with the public, and the public supports it, and they have grown along with it. But with their growth comes problems, problems we are going to have to face. There is nothing that is new, nothing that is good but what sometime its advancement has created problems, and some of those problems were not very good but they had to be met. I feel that the auctions are part of the marketing systems of America today. They are a great part of it. They are here to stay and as time goes on, we will have additional regulations that will strengthen the markets and make them better. I don't think there is any particular competition with the terminal markets of the land as there was at one time. The auction markets of the country serve a different purpose. The local market is rendering a service that is impossible at any of the terminal markets of the country.

The auction market in some particular instances might be a competitor of the terminal market, yet at the same time the auction market, we find in many cases, becomes an outlet for some of this livestock that is being handled on the terminal markets. It works around that way. It appeals to the bulk of the people, the producers, to be able to go to a market that they can see, a market that they can hear, and understand and make their decisions in what they are going to purchase or when they wish to sell, we wish to thank you gentlemen for this opportunity of being here.
REPORT OF SPECIAL COMMITTEE ON COMMUNITY AUCTION SALES

A. E. FOGLE, Columbus, O., Chairman; T. C. GREEN, Charleston, W. Va.; S. M. FRIEDLEY, Indianapolis, Ind.; JUSTIN CASH, Kansas City, Mo.; C. E. FIDLER, Springfield, Ill.

All of us are more or less familiar with the evolution of the Livestock Auction Market or Community Sale and the many contributing factors that entered into its development and growth.

Today it is one of the foremost cogs in the machinery of marketing livestock and ranks highest as a first hand receiver of cattle, calves, sheep and lambs. It is outranked, only, by Terminal Markets and Concentration Yards in the receipt of fat hogs.

Since the Community Sale is here to stay, it is needless to discuss the many advantages in marketing livestock through such markets.

It is the disadvantages and evils charged to the Community Sale that concern us. As regulatory officials we must take cognizance of the foremost evil charged against it—that of being a "disseminator of disease." Other charges such as "not sound financially," "misrepresentation of livestock sold," "inaccurate weights," etc., although of secondary importance should be given consideration.

To write a law, together with the necessary rules and regulations, in detail, that would cover and be suitable to all the phases of the Community Sale in each State, would not be practical. In view of this your committee has incorporated in this report the salient features of laws, rules and regulations of States which have had considerable experience in such laws, rules and regulations.

Therefore, to bring the Community Sale under the control of the State regulatory officials and correct the evils charged to such sales, your Committee on Community Auction Sales recommends and submits the following subject matter for your consideration and adoption.

GENERAL

The enactment of a Livestock Auction Law designed primarily to prevent the spread of infectious and contagious diseases through such markets.

Such a law should provide for the licensing of market operators, their agents, weighers and auctioneers and the posting of such licenses in conspicuous places for the benefit of the public, the revocation of such licenses for certain reasons, the establishment of Veterinary Inspection, conferring powers on the Department of Agriculture or Livestock Sanitary Commission to make rules and regulations to carry out the purpose of the law and to provide penalties for violation or refusal to comply with the law or rules and regulations promulgated thereunder. The law should also provide for the establishment of a Rotary Fund into which all fees for inspection, licenses, etc. are to be paid. Such fund to be used solely to pay for administration of the law. The law should further provide for the testing of weighing facilities to assure accurate weights and the posting of an adequate surety bond. The basic law should be implemented by the adoption of Rules and Regula-
COMMUNITY AUCTION SALES—1948

1. Definitions of the words, "Department or Livestock Sanitary Board or Commission," "Animals or Livestock," "Agents," "Auction Market or Community Sale."

2. Requiring the licensing of persons, firms, corporations or associations operating an Auction Market, and the payment of a fee for such a license. The license to be issued annually and expire on a given date.

   The application to be in writing on forms furnished by the Department and stating the nature of the business to be conducted, the city, village, township, county and post office address at which the business is to be conducted, and such other information as may be required.

3. No License To Be Issued Until:

   (a) The applicant has furnished proof of his financial responsibility by filing a surety bond in an amount commensurate with the average weekly sales during the preceding calendar year or that part thereof the applicant did business.

   (b) The applicant has paid the license fee.

   (c) The applicant has filed a scale test certificate showing the weighing facilities to have been found in a satisfactory weighing condition.

   (d) The applicant has filed a certificate of sanitation showing the market facilities to have been found in a satisfactory sanitary condition.

4. Revocation or Refusal to Grant a License—When:

   (a) The applicant or licensee has violated laws or regulations of the State governing the interstate or intrastate movement of livestock.

   (b) The licensee has given false or misleading statements as to the health or physical condition of the animals with regards to official tests.

   (c) There has been a continual course of dealing of such a nature as to satisfy the Department of the inability or unwillingness of the licensee to properly conduct the business.

   (d) Where the licensee fails to practice measures of sanitation, disinfection and inspection.

   (e) Where there has been a continual or persistent failure to keep records and render reports required by the Department or where there is a refusal to produce records.

   (f) Where the licensee fails to maintain adequate bond or neglects to pay fees or inspection charges.

5. Requiring Licensing of Weighers of Livestock:

   (a) A fee to be charged for such license and the license to be issued annually. An application required setting forth experience as a weigher and references.
(b) A provision for the revocation of a license and a penalty with a fine when the licensee gives a false certificate of weight, or, for accepting, directly or indirectly, money or other consideration for improper performance of duty.

6. Requiring Licensing of Agents:
   (a) The market operator should designate, in his application for a license to operate a market, the names of the persons to act as agents in his behalf or give official notice in writing of the appointment of said agents and request the Department to issue licenses covering such agents.
   (b) Since the market operator is accountable and responsible for contracts made by the licensed agents, there should be a provision in the law to terminate such a license on written notice.

7. Testing of Weighing Facilities:
   (a) Should be under the supervision of the Department every six months or by an approved agency.

8. Veterinary Inspection:
   The inspection at the Community Sale in many of our States is done by a local veterinarian who has been approved by the Department of Agriculture or the Livestock Sanitary Official of the State. Under this plan the fee for inspection service is paid by the market operator. Although this system, of the veterinarian being employed by the sale management, may not be in some instances, conducive to the best interests of all parties concerned, it has on the whole proved satisfactory. This is especially true in States whereby authority is granted by law to any duly authorized representative of the Department to enter any Auction Market for the purpose of inspecting the facilities and livestock or to make examinations or apply tests necessary to determine the presence or absence of contagious or infectious diseases. Vested with this authority, the duly authorized representative, who should be a veterinarian in the direct employee of the State, can check the Auction Market to see that the rules and regulations are carried out and enforced.

   The plan of the Veterinary Inspector being in the direct employment of the State appears to be an ideal one. Such a plan is being carried out in some States. However, it must be borne in mind that, in several of our States the number of Auction Markets in operation range from 50 to 300 and the cost of Veterinary personnel to such States would seem prohibitive. Therefore, it is the belief of the Committee, that each State should follow the plan of Veterinary Inspection best suited to its well being.

   To establish veterinary inspection at the Auction Market the law should provide that the Department or Livestock Sanitary Commission or Board shall require an inspection and such treatments necessary to prevent the spread of contagious and infectious diseases of all animals when sold for purposes other than immediate slaughter. A certificate of such inspection and treatments shall be issued to the purchaser by the Veterinary Inspector, approved by the Department, and such certificate shall constitute the release of such animals.

9. Authority of The Department:
   The Department should be given authority to formulate, adopt, promulgate and enforce rules and regulations for the purpose of carrying into effect the provisions of the law.
10. Authority to Enter Any Community Sale:
Authority should be given any duly authorized representative of the Department to enter any Auction Market or Community Sale for the purpose of inspecting the facilities and livestock and should have the right to make examinations or apply such tests as may be necessary to determine whether or not any contagious or infectious disease exists.

11. Inspection of Records:
The Department or any of the duly authorized agents should have authority to inspect the records of any licensee at any time to determine the origin and destination of any livestock handled by the licensee and to determine if any of the provisions of the law or the rules and regulations promulgated thereunder have been violated.

12. Livestock Rotary Fund:
All fees for licensing, inspection, vaccination, testing and dipping collected under the provisions of the law should go into a fund to be known as the "Department of Agriculture's" or the "Livestock Sanitary's Fund" as the case may be. Such a fund to be created by law and to be used to carry out the purposes and provisions of the law.

13. Penalty:
Whoever violates or refuses to comply with any of the provisions of the law, or any of the rules and regulations promulgated thereunder, shall, upon conviction in a summary proceeding, be sentenced to pay a fine of not less than twenty-five dollars, or more than one hundred dollars and cost of prosecution.

Rules And Regulations to Implement the Law Should Provide for and Cover the Following Subjects:

1. Sanitation:
The premises of the Community Sale including all pens, alley-ways, chutes, docks, scale pens and auction ring should be maintained in a clean, orderly and sanitary condition at all times.

2. Cleaning and Disinfection:
All pens, alley-ways, chutes, scale pens, and auction ring used for the handling of livestock to be tested, vaccinated or dipped should be cleaned and disinfected by the sale management under the direction of the veterinary inspector before each sale. There should be an adequate water supply and the disinfection done with a power sprayer. All vehicles that have contained animals affected with a contagious, infectious or communicable disease should be cleaned and disinfected by the sale management under the direction of the veterinary inspector before such vehicles leave the premises of the auction market.

The building proper should be of good material, well roofed and provided with a sufficient number of windows to admit all natural light possible. The floors of testing, holding, vaccinating, quarantine and dipping pens should be constructed of concrete or similar impervious material so as to afford easy
cleaning and disinfection. The floors of such pens should have sufficient slope to afford good drainage.

4. Pens Set Aside to Receive Livestock for Purposes Other Than Slaughter:
Your Committee, relative to the above caption, endorses and recommends the Regulations adopted by the State of West Virginia, which briefly are as follows:

(a) For the purpose of testing female cattle and bull six months of age and older, each market should be required to construct or allocate and mark with the letter “T” a sufficient number of pens to be used exclusively for such cattle to be received and offered for sale for feeding and breeding purposes. In addition to these pens the market should be required to provide two connecting pens to be known as cattle testing pens accessible to the “T” holding pens and should be provided with a catching chute, connecting gates, and other conveniences necessary to expedite testing.

(b) For the purpose of vaccinating swine, each market should be required to construct or allocate and mark with the letters “S-V” a sufficient number of pens to be used exclusively for swine to be received and offered for sale for feeding and breeding purposes. Such pens to be located adjacent to each other. In addition to these pens the market should provide swine vaccination pens, conveniently located near the “S-V” holding pens, to receive swine consigned for feeding and breeding purposes. Such pens should be of suitable size and dimensions and equipped with all conveniences necessary to expedite vaccination.

(c) Markets, so designated by the Department or Livestock Sanitary Commission, located in a State where sheep scab exists should be required to construct or allocate and mark with the letters “S-S-D” a sufficient number of pens to be used for dipping of sheep and lambs for sale for feeding and breeding purposes. Such pens to be located adjacent to each other and near the dipping vat. Markets, so designated by the Department or Livestock Sanitary Commission, should be required to provide a sheep dipping vat and facilities for its operation.

5. Reactor Pens:
Each market should be required to provide sufficient number of pens, marked “Reactor Pens,” to be used exclusively for the handling of Brucellosis and Tuberculosis reactor cattle.

6. Each market should be required to provide and equip an office and laboratory for the Veterinary Inspector.
REPORT OF COMMITTEE ON MEAT AND MILK HYGIENE


In this present era of prosperity there exists an outstanding and ever increasing demand for meat and dairy products. If we are to rely on the statistics of the Bureau of Agricultural Economics, an ever increasing population will add to the gravity of supplying these foods in a safe, wholesome condition.

Again referring to the statistics of the Bureau of Agricultural Economics, it is worthy to note that there has been a significant reduction of our food producing animals since the early 1940's. If the wants and needs of our population are increasing, then it is important that meat and dairy products be produced with the maximum efficiency and sanitation for the greatest possible utilization and safety for consumption.

The ever present desire to produce more wholesome meat and dairy products has led to noteworthy advances in this field. The expansion of the poultry inspection service in addition to the regular Federal Meat Inspection Service is a fine example of such advance; another is the public health veterinarian. The latter appears to be a very commendable advancement as is evidenced by the ever increasing demand for veterinarians in public health service. The inauguration of a supplemental academic course of one year in public health for advancing the training of Medical, Dental, Veterinary and Engineering graduates at the University of Toronto is an effort to meet this demand. It is indicated by Canadian officials, where veterinarians are engaged in this work their services are highly valued not only by other personnel but also by the general population. There it is also felt that the veterinarian because of his training, is most ably fitted to act in a liaison capacity between the medical administration and the producer or processor.

If meat and dairy products are to reach the consumer in a safe, wholesome state with the minimum loss in processing, then they must originate from healthy animals. It is much more efficient and economical to process wholesome products than the unwholesome ones.

Currently we have witnessed great interest in milk hygiene from many locals, particularly the encouragement and recommendations for universal pasteurization as an adjunct in reducing the spread of brucellosis and other transmissible animal diseases to the human family. This is of particular importance to the farm family because it does not benefit directly from municipal pasteurization. However, many of our farm families today are afforded that same protection through the utilization of small home pasteurizing units available at nominal cost.

These advancements are quite commendable and practical but we should not overlook the possibilities of other means of disease transmission, such as direct human contact on the farm, in the stockyards, and abattoirs with animals infected with brucellosis. There exists the possibility of meat in the raw state posing as a threat in the transmission of disease to man. Here brucellosis is receiving much
consideration, discussion, and study. Work already done by some of the State Health Departments and other investigators is most enlightening and will assist materially in formulating plans for control measures. The report of Dr. Raymond Fagan of the Indiana State Board of Health, given at the 1947 meeting of the United States Livestock Sanitary Association is a fine example of such study. This type of study and investigation should be encouraged as through it we shall eventually obtain the factual data needed to formulate plans and measures whereby a higher degree of protection can be afforded the producer as well as the consumer.

During World War II it was forcibly impressed on many individuals, the great variation of the milk ordinances or sanitary codes of the many municipalities across the nation, and further their variation when compared to the standard milk ordinance of the United States Public Health Service. This variation was responsible for much controversy and misconception. In some instances municipalities had milk ordinances superior to and more stringent than the United States Standard Ordinance, causing much difficulty when enforcement of the United States Standard Ordinance was attempted by military inspectors. Since fluid milk is one of our finest and most complete foods, and a necessity in the diet of children, perhaps a study of the present United States Standard Milk Ordinance is warranted.

In summation it is evident that there will be apparently an ever increasing demand for meat and dairy products, that will far exceed the supply. During the existence of such conditions there is a tendency for the increase in sales of unwholesome products available for purchase. There has been progress made for advancing and diversifying the training of qualified personnel in sanitary service. Brucellosis may possibly be carried by meat products in the raw state, particularly pork, and pose as a threat to general health.

There still exists considerable variation in standards for quality and sanitation of fluid milk and dairy products when viewed from the municipal approach as compared to the United States Public Health Code.

Your committee therefore recommends, that if practical, a study be made to ascertain the danger involved in the handling of raw meat products as a possible source for Brucella infection. That all personnel engaging in the handling of fluid milk and dairy products increase their efforts to attain higher and more uniform standards, and that if the United States Health Code is not deemed adequate that recommendations be made to improve it after thorough study has been completed. This association should encourage and assist at all times the improvement of sanitary and health standards of all food products of animal origin.
TUBERCULOSIS ERADICATION IN COLORADO

R. M. Gow, D.V.M.

State Veterinarian, Denver, Colorado

Colorado in 1925 passed a tuberculosis law patterned after the recommendations of the U. S. Livestock Sanitary Association. From 1925 to 1934 there was testing of dairy cattle and pure bred cattle, no counties were accredited during that time for the reason the plan had not been presented to the live stock interests in the right way. From 1933 to September 1934, meetings were held with the live stock interests in the various parts of the State, the cattle interests accepted the program and in September 1934, testing was started in the entire State by counties and the entire State was accredited August 1, 1935, without a court case, the reason there were no court cases is this Department had the wholehearted support of the live stock interests in the State. In accrediting Counties ten per cent of the range cattle were tested, if reactors were found even though they failed to show lesions the entire herd was tested. All dairy and pure bred cattle were tested.

In 1935 there were a considerable number of herds on the western slope in which reactors continued to appear and on post-mortem showed no lesions, and were classed as no visible lesions. They were retested at intervals of 60, 90, 120 days, for a period of 18 months, and then at six month intervals for a period of three years, and no lesion cases were revealed, the cattle ceased to react after second or third tests at 60 and 120 day intervals. These herds have remained clean (the tests were made by a federal veterinarian).

In herds in which reactors are disclosed and no history of previous infection, the herd is sometimes immediately re-injected in a caudal fold and vulva, and re-read in 72 hours. In herds where there is a history of previous infection the herd is re-tested at 60 to 90 day intervals, until three clean tests are obtained; all infected herds are quarantined. On all reactors showing lesions on post-mortem and cattle slaughtered at the packing houses in Denver, showing lesions of tuberculosis, specimens are requested to be submitted to the Federal Pathological Laboratory at Denver for examination and a report of the laboratory examination is submitted to the Inspector in Charge and the State Official.

All herds in Colorado are identified by brand, we have a little over 42,000 brands recorded, if the inspector on the killing floor suspects from lesions found that the animal is infected with tuberculosis, he calls one of our brand inspectors, who inspects the hide giving the brand in the herd which the animal originated. For example in 1935 this Department received a report from a federal inspector at Sioux City, Iowa, that a hereford cow carrying a brand, in which he gave the brand, was condemned for generalized tuberculosis, this cow was shipped from Denver, Colorado. I gave the report to one of our brand inspectors. He reported that the cow in question was shipped from Glendale, California and billed out of Denver on New Mexico through billing. (Note) When cattle are billed on through billing they are not supposed to be changed enroute, but changes sometimes occur at national stock yards, where traders interchange cattle but use the same billing.
How well has Colorado eradicated tuberculosis in its herds? I have the following figures to present: Colorado ships from a Denver milk shed every year from 3000 to 4000 aged milk cows to the Los Angeles milk shed. The cattle are tested on arrival by Dr. Hurt's force.

In 1945 there were shipped 4,976 dairy cattle to California. They were tested on arrival, 21 reactors were disclosed, which on post-mortem showed 19 N.V.L., one showed skin lesion and one lesion case. In 1946 there were shipped 4,863 dairy cattle from Colorado to California; on arrival tests showed 9 reactors, on post-mortem 7 N.V.L. Two showed lesions. In 1947 there were 3,030 dairy cattle shipped from Colorado to California, on arrival were tested showing 5 N.V.L. and one lesion case.

The following report was given me by the Federal Meat Inspector in Charge. From May 1, 1946 to September 30, 1948, approximately 700,000 cattle were slaughtered in the federal inspected plants in Denver. There were 6 carcasses held as having been suspected of being infected with tuberculosis. Specimens were sent to the Federal Pathological Laboratory in Denver. One Hereford steer showed glandular lesions, we were unable to identify the herd this animal came out of. The second case showed lesions, the herd was identified, tested three times, clean. Third case showed skin lesions. The fourth case, herd from which this animal originated was located and three clean tests obtained. No reactors. The fifth case skin lesions. Sixth case was an out of the State steer.

To date I am of the opinion Colorado has about as free a State of tuberculosis as can be obtained. We have kept our re-accreditation as outlined by the United States Livestock Sanitary Association and did not let down during the war.

I now find we have other factors entering the control of tuberculosis in the State of Colorado. That factor is the U.S. Public Health Veterinary Service. The City of Denver has required for the past 20 years Annual Tests of all Dairy Cattle furnishing milk to the City of Denver in the Denver Milk Shed.

About a year ago U.S. Public Health Service loaned one of their U.S. Public Health Veterinarians to the Colorado State Board of Health. Later the Colorado State Board of Health loaned this public health veterinarian to the City of Denver, which was re-organizing its health department. In March 1948, he sponsored a request to the City Board of Health to discontinue Annual Tuberculosis Test of cattle in the Denver milk shed, I asked the reason and it was told that the incidence of tuberculosis was so slight and that the City did not have the personnel to file the test charts. I presented the testing problem to Dr. Steele of the U.S. Public Health Service, but he made no recommendations. Maybe the U.S. Public Health Veterinary Service have had more experience in the control of contagious and infectious disease, and they are right in discontinuing the annual tuberculin test of cattle in the Denver milk sheds. Time alone will tell.
TUBERCULOSIS ERADICATION IN CANADA

T. Childs, V.S., D.V.M.

Veterinary Director General, Ottawa, Canada

At the present time there are in Canada, three different plans in operation for the control and eradication of bovine tuberculosis. These plans or policies are administered by the Health of Animals Division of the Dominion Department of Agriculture, and authorized by Regulations made under The Animal Contagious Diseases Act. These plans or policies are designated as follows.

1) Accredited Herd Plan. This plan, intended to eradicate tuberculosis from individual herds, was put into effect by Order-in-Council dated September 20th, 1919, as Regulations for the establishment and maintenance of tuberculous-free accredited herds of cattle.

2) Restricted Area Plan. Testing of cattle for tuberculosis under the Restricted Area Plan, was commenced in Canada during 1922. The actual regulations relating to the establishment and maintenance of Restricted Areas for the eradication of bovine tuberculosis were enacted by Order-in-Council dated December 11th, 1922. Since that date, it has been found advisable to alter these regulations by amendments to the form in which they exist today.

3) Supervised Herd Plan. This plan does not actually possess regulatory force, being really a "gentleman's agreement" whereby it is made possible for owners whose herds are located outside restricted areas, and not eligible for acceptance under the accredited herd plan, to have the herd placed under supervision and tested with tuberculin by a salaried Divisional veterinarian. This is done by applying for assistance and signing an agreement whereby the applicant undertakes to observe certain sanitary requirements. The object is to establish and maintain a tuberculosis-free herd. Reacting animals are earmarked and slaughtered under Dominion Government veterinary inspection, but compensation is not allowed for the slaughtered animal.

Before a herd is acceptable for supervision under the Accredited Herd Plan, the following requirements must be met.

(a) Sanitary conditions of herd premises must be found satisfactory on inspection by a Dominion Government veterinarian.

(b) At least one third of the animals comprising the herd must be purebred and registered in the owner's name. Herds containing less than ten pure-bred registered animals are not accepted for accreditation, or, continued as accredited with less than that number.

(c) Prior to each tuberculin test satisfactory evidence of the identity of the registered animal must be presented to the veterinarian. Any grade cattle present or associated with the herd must be identified by tag or other satisfactory markings.

The herd which is accepted for accreditation is then tested with tuberculin by the intradermal and ophthalmic methods, the tests being conducted by a salaried Dominion Government veterinarian. If no animal affected with tuberculosis has been
found upon two annual or three semi-annual tuberculin tests, or by physical exam-
ination, and the owner is found to be complying with the regulations which govern
procedure for maintaining tuberculosis-free accredited herds, he is entitled to receive
a certificate "Tuberculosis-Free Accredited Herd" issued by the Veterinary Director
General and valid for one year from the date of test, unless revoked at an earlier
date. Tuberculin tests of accredited herds are conducted annually, and within the
year following the date of the last test.

No herd may be classed "accredited" in which tuberculosis has been found by
application of the tuberculin test, until that herd has been tuberculin tested with
negative results, sixty days after the tuberculous animals have been removed from
the herd, and twice thereafter at six month intervals.

Additions to Accredited Herds. The vehicles in which such animals are trans-
ported must be clean. Additions from herds of lower health status are not per-
mitted, with the exception of additions from accredited area herds, unless the entire
herd of origin has, within the preceding twelve months, passed a tuberculin test,
and the individuals intended as additions, tested within thirty days. In the case of
additions from herds in accredited areas the individuals only must pass a tuber-
culin test within thirty days. In both instances, however, the additions must go
into isolation on the purchaser's accredited herd premises for a sixty day retest.

This means that cattle are not allowed to proceed as additions to an accredited
herd from a herd in which tuberculosis has been found until such herd has passed
two negative tuberculin tests. These additions must also be isolated for a sixty
day retest on the purchaser's accredited herd premises.

Maintenance of accreditation requires strict observance of the regulations which
are embodied in the contract the owner signs when applying for accreditation, and
cover the following points.

(a) Prompt reporting of all removals of registered cattle from the herd, giving
the identification of the animals and the name and address of the person to which
they were transferred. If transferred to another accredited herd, the animals must
be transported in properly cleansed and disinfected vehicles.

(b) No cattle of lower health status may be allowed to associate with the accred-
ited herd.

(c) All reasonable sanitary measures and recommendations made by Dominion
Government veterinarians for the control of tuberculosis must be complied with.

(d) All milk or other dairy products fed to calves must be that produced by an
accredited herd, or, if from unknown or outside sources, must be pasteurized by
heating to 150°F. for not less than twenty minutes.

During process of accreditation, and subsequently, if reactor cattle are found,
they are branded with the letter "T" on left cheek, slaughtered under Dominion
Government Inspection, and the owner compensated for the slaughtered animal
as provided in the Animal Contagious Diseases Act. Cleansing and disinfection
of the premises must be done under supervision and at the expense of the owner be-
fore compensation is paid.

There are at present in Canada approximately 7,912 fully accredited herds com-
prising about 315,000 cattle, about 90 per cent of which are pure bred registered
The Restricted Area Plan for the eradication of bovine tuberculosis operates as follows.

The Government of any Province may request the Government of Canada for assistance in the eradication of bovine tuberculosis from a restricted area, in accordance with the regulations. The request shows location and boundaries of the proposed area, the number of cattle within it, that at least two-thirds of the cattle owners in the proposed area are desirous of having their cattle tested for the eradication of tuberculosis and that the Provincial Government whenever requested by the Dominion Government to do so, will assist in the enforcement of the regulations by conducting prosecutions of persons accused of obstructing or refusing to assist Dominion Government veterinarians engaged in the work of testing cattle, and persons who, in any way, refuse to obey the regulations. When these conditions are met, and the application approved, A Proclamation may be published in the Canada Gazette constituting the proposed area a Restricted Area within the meaning of the regulations, after which all provisions of the regulations shall apply to that area, which becomes a quarantined area insofar as bovine tuberculosis is concerned, adequate safeguards being provided by the regulations for the movement of cattle into or out of the area.

All cattle within the area are tested for tuberculosis by salaried Dominion Government veterinarians as rapidly as circumstances will permit. All reactor cattle are branded with letter "T" on left cheek, removed under licence by most direct route to an abattoir operating under Dominion Government Inspection and there slaughtered. Infected premises are cleansed and disinfected under supervision at the owner's expense. Compensation is awarded the owner for the diseased animal, the exception being grade bulls and animals affected with actinomycosis. The salvage value of the slaughtered animal is returned to the owner. Our post mortem records of reactor cattle show that in somewhat more than 91 per cent of such cattle the lesions are localized, or insignificant, the carcass being approved for food purposes after the lesions have been removed and condemned.

When all cattle within the restricted area have been tested, reactors removed, and infected premises cleansed and disinfected, if the incidence of tuberculosis does not exceed two-tenths (0.2) of one per cent, the area may be accredited for a period not exceeding six years. Herds where reactors have been found are placed under quarantine and retested after sixty days following removal of reactors, and twice at intervals of six months thereafter. Accredited area health status is not attained by the herd unless the three tests noted above, give negative results. If all cattle within the area are not retested before the period for which the area was accredited expires, the cattle of that area lose their accredited area health status, although the regulations concerning restricted areas remain in force, insofar as the movement of cattle is concerned.

If, when all the cattle within a restricted area have been tested, and the incidence of tuberculosis found to be not over half of one per cent, the area may be accredited for a period of three years. If the incidence of tuberculosis is more than one half...
of one per cent, but not more than one per cent, the area may be accredited for a period of three years, provided the infected herds are retested and the percentage of infected cattle on retest does not exceed one half of one per cent of the total number of cattle within the area. Procedure following in retesting infected area herds is the same in all cases.

Additions to accredited areas must be from herds of equal health status. When additions are purchased in other than fully accredited areas the entire herd of origin must have passed a tuberculin test within the preceding twelve months and the individual animals concerned must have passed a tuberculin test within thirty days. This means that the addition of cattle to accredited areas from non-accredited area herds and from herds not under supervision is not permitted unless such herds have passed a tuberculin test within the preceding twelve months and the individuals intended as additions within thirty days. Following this admittance the additions are still subject to isolation and a sixty day retest. Feeder additions to an accredited area are admitted under isolation following a negative tuberculin test immediately preceding their entry. Cattle for immediate slaughter are admitted only on direct consignment to an abattoir under Dominion Government veterinary inspection.

There are 152 fully accredited areas in Canada at this date. Cattle of accredited area health status number 2,009,023. There are 179 restricted areas in the process of accreditation containing 2,528,600 cattle.
REPORT ON BOVINE TUBERCULOSIS ERADICATION PROJECT

BY A. K. KUTTLER, D.V.M.¹

Recent reports to this Association have stressed concern over the future of tuberculosis control. This was largely because of two generally recognized conditions. One resulted from a period of veterinary personnel shortage, which continues in most sections. The other major cause for apprehension has been the attitude of the public, including many in the veterinary profession, that other diseases should now take precedence—with tuberculosis control efforts being limited in too many instances to perfunctory measures designed more to comply with existing regulations than with regard to the necessity or effectiveness of the work. While there is still some tendency toward this same thinking, we are pleased to report a change in attitude with respect to our continuing responsibilities in this field.

REVIEW OF PAPERS PRESENTED AT 1947 MEETING

In this connection, we believe much credit should be given the forceful thinking brought out in papers presented before this group at the 1947 meeting. Renewed interest in testing has been noted from a large number of States, and although the testing necessary for reaccreditation is behind in many areas, increased efforts under existing handicaps demonstrate a determination to hold the line and regain any lost ground as rapidly as possible.

CONCENTRATING ON KNOWN INFECTED HERDS

A further indication of interest in removing that last infected animal is the generally added importance attached by regulatory officials to the proper handling of known infected herds. There is still much to be done, however, to assure point-of-origin identity of infected slaughter animals if we are to benefit fully from this guide in tracing infection to its herd source.

A reawakening to the problem, and willingness to mend our fences, will go a long way toward effecting continued reduction of infection, even with our available implements. Work continues, however, in an effort to improve the present tuberculin so that it will be more specific in reaction. It is agreed that any improvement in this respect should favor the program, both by reducing the number of non-specific reactors, and by locating other cases not now being revealed.

INTRADERMAL TEST APPLIED IN CERVICAL AREA

Continued use of the cervical test during the year on problem herds in several States offered proof that the present tuberculin, when used in this manner, will disclose tuberculous animals that have been escaping detection, and will also elicit reactions at an earlier stage of the disease. Those two features, together with the fact that desensitization is confined to such a limited local area that retests may be applied at will, justify more general acceptance of its use in known infected herds.

¹ Dr. Kuttler In Charge of the Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture.
RECOMMENDATIONS

It is recommended that in all States the requirements as listed in the "Uniform Methods and Rules for the Establishment and Maintenance of Tuberculosis-Free Accredited Herds of Cattle and Modified Accredited Areas" be adhered to more closely than has been done in many of the States. It is further recommended that steps be taken if satisfactory procedures do not now exist, for some method of identification of cattle at the time of sale, so they may be traced to the farm or ranch of origin if found to be tuberculous on post-mortem inspection.

STATISTICAL REPORT

Statistical data covering progress of the tuberculosis eradication project through the past fiscal year have again been prepared for distribution. Copies will be available at the speaker's desk.

We hope future data will reflect favorably the results of our changing sentiment with respect to the importance of increased vigilance in the control of this disease.
REPORT OF THE COMMITTEE ON TUBERCULOSIS


Your committee has discussed several problems regarding the control of animal tuberculosis and presents the following for consideration of the association:

It has been brought to the attention of the committee that in scattered parts of the country some serious "breaks" of tuberculosis have occurred. Such incidents should not pass unnoticed. The committee is aware of the limitations of the tuberculin test and we realize that such unfortunate mishaps can happen, under certain conditions, in herds where careful testing by experienced operators has been done. Your committee was not in position to study the history of and details connected with these "breaks", and therefore are not in a position to point to the probable or suspected cause of these "breaks". We can state that at least in some of these herds there was gross carelessness, perhaps even bordering on dishonesty in performing, interpreting or reporting of the tests.

The committee cannot stress too strongly that every effort be made by those in charge of tuberculin testing in the various states to insist that tests be performed according to the best procedures at one's command, and that they should instill in those making the test a sense of individual responsibility for work well and honestly done.

All those in charge of this work should be more concerned with tuberculosis eradication than with the reaccreditation of areas as such. The committee suggests that at your next meeting a further report be made on "breaks" which should include the known or probable reasons for these mishaps.

It appears that there is no Federal regulation regarding the sale and distribution of tuberculin. We recommend that changes in Federal regulations, or statutory changes, be forthcoming to remedy this situation, requiring the reporting of all sales and shipments of tuberculin by any person, firm or corporation to the chief livestock sanitary official of the state of destination.

The committee continues to receive complaints regarding the tuberculin test provisions under which cattle may be imported into the United States from Canada. Your committee deplores the fact that adequate remedial action has not been taken by the Federal Government. We most urgently suggest the matter be acted upon promptly. We suggest that cattle imported from Canada into the United States, other than cattle for immediate slaughter, meet the following requirements:

(A) Have passed a tuberculin test approved by Canadian Governmental authorities within 30 days of entry into the United States.

(B) Be identified as originating in and members present on the last qualifying test of,

(C) Fully accredited tuberculosis free herds, or

(D) Qualified negative herds in modified accredited areas.
Appended as a part of this report is a proposed revision of the Uniform Methods and Rules For The Establishment and Maintenonce of Tuberculosis-Free Accredited Herds and Areas.

Your committee recommends that changes in uniform methods and rules for the establishment and maintenance of tuberculosis-free accredited herds of cattle and modified accredited areas, be considered during the coming year. The suggested changes are of sufficient importance that the committee feels that comments should be made by State and Federal cooperating officials in each of the states before final action is taken. Uniform methods and rules have been re-written to include the suggested changes, and will be published in the report of the U. S. Livestock Sanitary Association, as a part of the committee report.

Your suggestions should be directed to the secretary of the association, and a copy forwarded to the Chief of the Bureau of Animal Industry.

Since time will not permit a careful study of these recommended changes at this meeting, I shall not take time to read them.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
Bureau of Animal Industry

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

Unanimously adopted by the United States Livestock Sanitary Association, December 5, 1940, Amended December 3, 1943, and Approved by the Bureau of Animal Industry, Effective December 18, 1943

PART I

Individual Accredited Herd Plan

1. (a) A tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two (2) negative, successful annual physical examinations and tuberculin tests. Herds in which infection occurs shall be quarantined and shall be required to pass three (3) negative tuberculin tests to lift the quarantine; and further, such herds shall not be accredited until they shall have passed a tuberculin test without evidence of reaction, not less than 12 nor more than 14 months following the test on which infection was disclosed; such physical examinations and tuberculin tests shall be applied by a veterinarian regularly employed by the State or United States Bureau of Animal Industry.

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

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

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

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

2. The Tuberculin Test:
   (a) An official test shall be the intradermic or the subcutaneous test. The intradermic injection shall be a measured amount of tuberculin, not less than one-tenth \((\frac{1}{10})\) of a cc. for routine testing, nor more than two-tenths \((\frac{2}{10})\) or a cc. for testing known infected herds, when intradermic injections are made in the caudal, cervical or vulva areas. The intradermic injection of tuberculin in the cervical area in herds in which infection occurs may be used only when approved by State and Federal cooperating officials.

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

   (c) The veterinarian who applies the tuberculin test shall inform all cattle owners fully concerning tuberculosis of other domestic animals, including poultry and swine.

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

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

5. Reactors to the tuberculin test shall be promptly removed from the farm and after their removal, the infected premises shall be thoroughly cleaned and disinfected with a disinfectant approved by the U. S. Bureau of Animal Industry and in a manner satisfactory to the cooperating State and Federal authorities. The following information should be included in the report of the veterinarian making the test:

   - Past history of herd
   - Water supply
   - Light
   - Ventilation
   - Sanitation
   - Management
   - Manner of making additions to the herd
     a—source  b—isolation pending retest  c—retests
   - Disposal of waste products
   - Human infections
   - Avian infection.

6. Herd owners are required to house, feed and care for the cattle under such sanitary conditions as will tend to promote good health and to follow such recommendations as are made by the cooperating State or Federal authorities.
7. Calves 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. Herd Records:
   (a) The herd owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the grade animal to be marked by a tag or other marking satisfactory to the cooperating State and Federal authorities.
   (b) Each herd owner is required to keep a record of all additions and removals of cattle from the herd by sale, death, or slaughter.

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

10. Added Cattle: Herd additions must originate in tuberculosis-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.

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**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. No area* shall be reaccredited until at least two (2) herds in each township or subdivision of a county, representing at least five (5) per cent of the breeding cattle in the county, are tuberculin tested at not more than six (6) year intervals. Herds tested for reaccreditation, except when infection is disclosed, shall not be counted as retests on subsequent tests for reaccreditation. If, on this survey test, the number of reactors based on such tests, including post-mortem meat inspection reports accumulated for the area since the last reaccreditation test, exceeds one-tenth ($\frac{1}{10}$) of one (1) per cent of all cattle in the county, then all of the cattle in the county shall be retested. Infected herds shall be quarantined and tested as provided in paragraph 1.

15. If, on any reaccreditation test, the number of reactors, based on tuberculin tests and post-mortem meat inspection reports accumulated since the last reaccreditation test, shall exceed one-half ($\frac{1}{2}$) of one (1) per cent, the county shall not be reaccredited until the percentage of infection on the test of all cattle in the county shows the infection has been reduced to less than two-tenths ($\frac{2}{10}$) of one (1) per cent. Such counties may be reaccredited only for a three (3) year period. All infected herds shall be quarantined and tested as provided in paragraph 1.

16. Reaccreditation tests, as outlined in paragraphs 14 and 15, are to be con-

* Except as hereinafter provided in paragraph 19.
sidered as a minimum. It is not intended to interfere with more frequent tests than required under these paragraphs when State and Federal cooperating officials consider such additional tests necessary.

17. Post-mortem meat inspection reports shall be accepted in lieu of tuberculin tests required in paragraphs 14 and 15, when it can be established that seventy-five (75) per cent of all cattle from the area are slaughtered under State or Federal meat inspection, and post mortem meat inspection reports of all infection are made available to State and Federal officials in charge of tuberculosis eradication, provided State laws and regulations require identification of all cattle at the time of or prior to sale, in such a way that infected animals may readily be traced from point of slaughter to point of origin; provided, further, that State and Federal officials may require tests of as many herds of cattle in areas where post-mortem meat inspection reports are being accepted in lieu of tuberculin tests as deemed advisable. Infected herds shall be quarantined and tested as provided in paragraph 1.

18. No-visible-lesion reactors found in herds where no lesions of tuberculosis are found in any of the reactors, and no evidence of infection is found on subsequent tuberculin tests of such herds will not be counted in determining the percentage of infection. 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.

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

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

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

If, under paragraph (a) or (b) of this section, a reactor or any other evidence of infection is revealed in any herd by post-mortem reports, etc., including post-mortem inspection at packing plants, of those branded cattle that are sold direct from the range for immediate slaughter, then all of the cattle in that herd or associated with the diseased animal, shall be immediately tuberculin tested in accordance with the provisions of the Modified Accredited Area Plan. The area may then become a modified accredited area, and be reaccredited at the expiration of three years, if the total number of reactors and cattle found tuberculous upon post-mortem examination from the area is not more than one-half (½) of one (1) per cent of all the cattle tested in the area.

20. The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper livestock sanitary official of the state of destination.
DISCUSSION OF PAPERS ON TUBERCULOSIS

PRESIDENT KNAPP: We have time to continue our discussion on the question of tuberculosis or any of the others brought to your attention this morning. Does anyone wish to discuss the subject of tuberculosis eradication?

DR. STONE (New York): I would like to know where these areas are that have shown an increase in tuberculosis this last year. Where are the areas that have shown this increase?

DR. KUTTLER: I will read off the States that have a higher than the national average: California, Connecticut, Delaware, Iowa, Kansas, Maine, Massachusetts, Michigan, Nebraska, Pennsylvania, South Carolina, Utah, Vermont, and Hawaiian Islands.

H. R. SMITH (Chicago): I would like to say that I just recently compiled records on meat inspection. While there have been some bad breaks there must have been some very thorough work in other parts of the county for the records show there is a consistent decrease in a number of past years. It is down to the lowest point it has ever been before. I want to say, to give a little encouragement, though there have been bad breaks there has been each year a decrease in the condemnations of cattle in the percentage condemned. I will say also that there has also been a consistent decrease in the percentage of hogs retained, up to 14 per cent. It is down to 6 per cent now. Six per cent of all the hogs slaughtered from tuberculosis were retained.

PRESIDENT KNAPP: I think your figures, your statement is correct with reference to the condemned carcasses. However, there have been a greater number of reactors in the States enumerated. Fortunately or unfortunately, some of those did not show material lesions. Carcasses were not condemned. Any further comment? We should have considerable discussion on this question. Dr. Hendershott requests that I ask this question: Has there been any appreciable increase in NVL’s throughout the past year? That is directed to you Chiefs of Livestock Sanitary control work. Dr. Kuttler, have you an answer to that question?

DR. KUTTLER: I will have to apologize for just making a guess that there has not been an appreciable increase of NVL’s. I don’t have it in this report. I thought I did, but it doesn’t seem to be here.

DR. LASH: Mr. Chairman, I would like to ask what the greatest increase was in any one State and which State that was in. In other words, what I am trying to get at, if it is a big increase in a small State like Delaware, that would mean very little to the picture as a whole. I would like to know the greatest increase in any State.

DR. KUTTLER: The greatest increase was in the State that Dr. Lash has in mind —South Carolina. They had a very serious outbreak in one large dairy herd of about 1200 cattle. Some of the things that were mentioned in the report of the committee took place to create this condition. It happens that practically all of the replacements in this large dairy herd came from one stockyard center and were purchased through one dairy cow dealer, and the animals according to the record were tested at the time they were shipped. They were tested presumably to comply with the health ordinance of the City of Columbia, South Carolina.
DISCUSSION OF PAPERS ON TUBERCULOSIS

There was something wrong, of course. The Meat Inspection Service had to give us the lead when animals began to show up from that herd with extensive lesions of tuberculosis, and we found 25 per cent infection when we got into the herd which was much more than existed in any herd in South Carolina when the work was started. It shows what happens when we engage in traffic in cattle and disregard the importance of proper testing.

President Knapp: Compliance with interstate regulations is important. I would like to ask Dr. Childs if they have had any noticeable increase in NVL's.

Dr. Childs: No, we haven't had an increase. In fact, the last year or so NVL's have receded somewhat. In 1946-47, that fiscal year, our NVL's were about 46.07 per cent of the total reactors disclosed. For the past fiscal year—our fiscal year ends the 31st of March—our NVL's are 31 per cent. That takes in all testing, of course, initial general tests of areas, retests, and everything else. That is the way it stands. Our condemned carcasses condemned for tuberculosis on inspection, the over-all picture for the past fiscal year 8.92 per cent; the previous year 7.19 per cent; the year previous to that 5.59 per cent. There isn't a great deal of difference except our NVL's have receded somewhat.

That may be accounted for in this way: that there has been considerably more initial testing of areas in the past year to the years previous.

Dr. Hendershott: Dr. Childs, in your address you said additions to accredited areas must be from herds of equivalent health status, and I thought I heard you make a remark that “this is something you are striving for.” Is that right?

Dr. Childs: We are trying to do that at the present time, Dr. Hendershott.

Dr. Hendershott: That is what you plan to do?

Dr. Childs: That is what we plan to do. That is what we are working toward at the present time. It may take a little time to get it in full operation but we expect to do it quite handily.

President Knapp: Does anyone have any questions they would like to ask Dr. Childs?

Dr. L. V. Skidmore (Lincoln): I would like to ask Dr. Childs the incidence of tuberculosis in swine.

Dr. Childs: I haven't the figures with me on the incidence of swine tuberculosis uncovered in swine inspection, but I believe it has receded considerably in the past number of years. There is a direct relationship between the incidence of tuberculosis in swine from areas that are clean and those that are not clean of bovine tuberculosis. I haven't the figures with me, just what the incidence is uncovered in inspection, but I think for the over-all picture for Canada, it is probably around 10 or 12 per cent. In some districts, some areas there has been a much greater percentage than others.

Dr. Hendershott: Could you tell us what dose of tuberculin you employ in interdermic injections?

Dr. Childs: We employ one twentieth of 1 cc. of tuberculin for the intradermic tuberculin test or as near that amount as possible.

Dr. Hendershott: Your tuberculin is made from human strain, is it not?

Dr. Childs: The tuberculin is made from human strain, and we are also using tuberculin made from the bovine strain also.

Dr. Hendershott: Do you note any difference of reaction in the two?
DR. CHILDS: Yes. We have found that the tuberculin made from the human strain according to specifications over here has a considerably higher coverage, we can say, maybe a high antigenicity, sharper, and in certain areas we can say it really went to town and gave us reactions in which many herds which had been clean for many years gave us real typical reactions, and we were unable to find any evidence of tuberculosis on slaughter. Now, that occurred in certain areas, and it is my impression that this is due to the presence of acid-fast organisms non-pathogenic in nature of certain distinct sensitization by such organisms. In many other places it worked fine. Of course, we ran quite a few thousand comparative tests on the bovine tuberculin and the tuberculin of human origin and for the most part the results are very close, almost parallel though in certain cases the human strain will give you quite a flare-up. That is our experience.

DR. HENDERSHOTT: What is the incidence of tuberculosis in poultry in Canada?

DR. CHILDS: I haven't figures on that, Dr. Hendershott, at the present time. We haven't made any real national survey on that matter.

DR. HENDERSHOTT: You do find it up there?

DR. CHILDS: Yes, it is here and there. It is found at times.

DR. A. B. CRAWFORD (Md.): Mr. President, I would like to ask the gentleman from Canada if the tuberculin made from the bovine organism also causes reaction in the skin lesion cases that we observe in this country so often. That is, if there is any difference in the skin lesion reactions between the bovine type of tuberculin and the human type of tuberculin.

DR. CHILDS: It is my impression that the human type of tuberculin will give you deeper reactions in the skin lesion cases than will the bovine.

DR. CRAWFORD: Is that true in all cases of nonspecific types of sensitization?

DR. CHILDS: That is my impression. I haven't many facts to back that up. But that is my impression.

DR. CRAWFORD: Another question: Do you use a particular strain of bovine tubercle bacillus that can be easily grown or does that obtain with all strains, strains of Bovine tubercule bacilli?

DR. CHILDS: In so far as we know we have no particular difficulty in growing bovine strains in the production of tuberculin.

DR. CRAWFORD: I asked that question because of the fact that we, in the preparation of tuberculin, have difficulty in getting any of the bovine strains of tubercle bacilli to grow easily. Long ago in the days of Dorset and Henley in our Bureau they found after repeated tests that tuberculin made from the human tubercle bacillus caused sensitization which was almost identically parallel with that prepared from the bovine organism, but the human organism, as many of you know, will grow very readily, whereas, the bovine tubercle bacillus slowly and sparsely grows, it is very difficult to get enough growth to manufacture the test product or tuberculin, and, I am, therefore, quite amazed that in Canada they are able to get bovine organisms that will produce growth in sufficient quantities for the preparation of the tuberculin. We were not able to do that in our country, and that is the reason why in the United States tuberculin prepared from several strains of the human tubercle bacillus has been used.
A PRELIMINARY REPORT ON THE PROPAGATION OF THE
VIRUS OF EQUINE INFECTION AME
(SWAMP FEVER) IN RABBITS

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LEO J. POELMA, D.V.M.\(^4\), AND A. L. BRUECKNER, V.M.D.\(^5\)

Maryland State Board of Agriculture, Live Stock Sanitary Service, University
of Maryland, College Park, Maryland

Experimental data in regard to negative results on transmission of equine in-
fecious anemia to hosts other than the solipeds are too numerous to be cited.
According to Kral, Macek and Sobra (1) rabbits are slightly susceptible to the
disease. However, Carré and Vallesé (2), Todd and Wolbach (3), Balozet (4),
Rastegaeva, Siratkin and Artimova (5), Formina (6), Stein (7), and Stein, Osteen
and Mott (8) all reported the rabbit non-susceptible to the virus. Stein and Mott
(9) reported mild temperature reaction between the fifth and ninth days in rabbits
inoculated with equine infectious anemia virus, but continued serial passage failed
to produce clinical manifestations of the disease.

METHOD

The equine infectious anemia virus used to infect young rabbits in the present
study was obtained from Dr. C. D. Stein of the Pathological Division, Bureau of
Animal Industry, Agricultural Research Administration, Washington, D. C. The
virus was from infected horse No. 1401 of the 1947 New Hampshire outbreak of
equine infectious anemia.

The lyophilized serum containing the virus was diluted with physiological saline
with 0.5 cc. of this suspension. On the 13th day after inoculation, the temperature
reached 103.8°F. The horse was bled on the 14th and 16th days after inoculation,
at which time the temperature was 104.0°F., and 106.0°F., respectively. Serum
removed from the blood was passed through a Seitz filter and stored at -60°C.

Five young rabbits of mongrel stock weighing approximately three pounds each,
and numbered 1 to 5, were injected intravenously with 5 cc. of serum from horse
No. 1. Temperatures were taken daily between 9 and 10 a.m. On the tenth day
after inoculation rabbit No. 1 showed a temperature of 105.2°F., and was bled from
the heart. Rabbits Nos. 6 and 7 were injected intravenously with 5 cc. of this
citrated blood. Rabbit No. 4, of the first serial passage, had a febrile tempera-
ture the 12th day after inoculation, but was not used for passage.

On the eighth day after inoculation rabbit No. 6 had a temperature of 105.0°F.,

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\(^2\) Assistant—Veterinary Virology.
\(^3\) Bacteriologist.
\(^4\) Chief of Laboratories.
\(^5\) Director.
and was bled from the heart. The citrated blood was passed to Nos. 9, 10, and 11 for the third passage.

Five cc. of citrated blood from rabbit No. 11 taken 28 days after inoculation was administered subcutaneously to horse No. 6. Five cc. of citrated blood from a pool of rabbits No. 9 and No. 10 of the third passage taken 15 days after inoculation, was injected into horse No. 7. Horse No. 6 developed a temperature of 103.0°F.

CHART 1

CHARTS 1 AND 2.—Temperature Curves* of Horses Inoculated with Citrated Blood from the Third Serial Rabbit Passage of Equine Infectious Anemia Virus

* H—horse.
MNT—maximum normal temperature.

on the 11th day after injection. There was another increase in temperature ranging from 101.4°F. to 102.6°F. and lasting for a period of four days, beginning on the 50th day. Horse No. 7 showed the first increase in temperature on the 42nd day after injection when the reading was 101.6°F. For the three following days the temperature was normal, but rose to 102.0°F. on the 46th day. Following this latter rise the temperature again dropped to normal for a ten day period. On the
56th day the temperature was again elevated reaching its peak, 103.6°F., on the 57th day. Since that time temperature reactions have developed intermittently.

Charts 1 and 2 show the temperature reactions of horse No. 6 and horse No. 7 over a period of 54 and 63 days respectively.

After the third serial passage in rabbits, the next five passages were made in
### Chart 5.—Summary of Data on the Serial Passage of Equine Infectious Anemia Virus (Swamp Fever) in Rabbits

<table>
<thead>
<tr>
<th>Passage No.</th>
<th>Rabbit No.</th>
<th>Inoculum Source</th>
<th>Type</th>
<th>Number of Days after Inoculation</th>
<th>Febrile Temperatures</th>
<th>Day of Passage</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>H4</td>
<td>Serum</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>H4</td>
<td>Serum</td>
<td>12</td>
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</tr>
<tr>
<td>2</td>
<td>6</td>
<td>R1</td>
<td>Serum</td>
<td>8</td>
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<tr>
<td>3</td>
<td>9</td>
<td>R6</td>
<td>Cit. bl.</td>
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<tr>
<td></td>
<td>10</td>
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<tr>
<td></td>
<td>11</td>
<td>R6</td>
<td>Cit. bl.</td>
<td>15,22,27,28,52,53,54</td>
<td>18,25*</td>
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<tr>
<td>4</td>
<td>15</td>
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<td>Cit. bl.</td>
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<td></td>
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<td>R11</td>
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<td>10</td>
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<td></td>
<td>23</td>
<td>R11</td>
<td>Cit. bl.</td>
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</tr>
<tr>
<td></td>
<td>63</td>
<td>R51</td>
<td>Cit. bl.</td>
<td>8–11,13,15,16</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>R51</td>
<td>Cit. bl.</td>
<td>29,38</td>
<td>—</td>
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</tr>
<tr>
<td></td>
<td>81</td>
<td>R51</td>
<td>Cit. bl.</td>
<td>21,22,24</td>
<td>—</td>
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<tr>
<td></td>
<td>82</td>
<td>R51</td>
<td>Cit. bl.</td>
<td>26</td>
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</tbody>
</table>
VIRUS OF EQUINE INFECTIOUS ANEMIA

CHART 5—Continued

<table>
<thead>
<tr>
<th>PASSAGE NO.</th>
<th>RABBIT NO.</th>
<th>INOCULUM</th>
<th>NUMBER OF DAYS AFTER INOCULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Source</td>
<td>Type</td>
</tr>
<tr>
<td>7</td>
<td>52</td>
<td>R41</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>53A</td>
<td>R41</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>53B</td>
<td>R41</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>R55</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>87</td>
<td>R55</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td>R55</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>89</td>
<td>R63</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>R49</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>91</td>
<td>R54</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>92</td>
<td>R54</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>93</td>
<td>R42</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td>8</td>
<td>95</td>
<td>R85</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>99</td>
<td>R53B</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>R53B</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>101</td>
<td>R53B</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>111</td>
<td>R88</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>112</td>
<td>R88</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>117</td>
<td>R92</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>119</td>
<td>R87</td>
<td>Cit. bl.</td>
</tr>
<tr>
<td></td>
<td>121</td>
<td>R87</td>
<td>Cit. bl.</td>
</tr>
</tbody>
</table>

* P.M. Temperature.
10—No increase temperature.
H—Horse.
R—Rabbit.
Cit. bl.—Citrated blood.

duplicate as shown in Charts 3 and 4. In several cases when rabbits failed to develop febrile reactions blood was drawn for passage but the rabbits of the succeeding passage also failed to develop increased temperatures, as shown by rabbits numbered 2 and 7 of the first and second passages. In the fifth and sixth serial passages, rabbits numbered 31, 41, 46 and 47 had no febrile temperatures. This seems to indicate that certain rabbits are much more refractive to infection with the infectious anemia virus than others. In most cases, however, passages were made on the day of the first febrile temperature as shown in Chart 5. The daily temperature curves of rabbits numbered 11, 16, 85, 95 and 99 are given in Charts 6, 7, 8, 9, and 10 respectively. Rabbits No. 11 and 16 of the third and fourth serial passages showed four periods of febrile reaction over a period of 54 and 67 days respectively. Rabbits numbered 85, 95 and 99 of the seventh and eighth serial passages had three periods of febrile temperature over a period of 23 days. Chart 5 also indicates that the intermittent periods of febrile temperature in rabbits is comparable to those of horses which have a chronic form of infection. This is shown in the case of rabbits numbered 11, 16, 69, 70, 71, 42 and 48. In certain
Charts 6, 7, 8, 9, and 10.—Temperature Curves of Rabbits Inoculated with Equine Infectious Anemia Virus

R—rabbit.
sp—serial passage.
——no temperature recorded.
MNT—maximum normal temperature.
other instances the infection is latent in form, such as in rabbits numbered 24, 53B and 64. The first febrile reaction appears suddenly between the 6th and 28th days after inoculation. However, in the majority of rabbits showing febrile reaction the first increase in temperature occurred between the 12th and 18th days after inoculation. In approximately half of the infected rabbits only one short period of increased temperature occurred.

SUMMARY

Equine infectious anemia (swamp fever) virus has been passed in young rabbits of mongrel stock through eight serial passages using infected citrated rabbits blood as transfer material. Citrated rabbits blood of the third serial passage produced a chronic form of disease in a horse characterized by intermittent periods of high temperature, similar to the conditions noted in chronic infectious anemia.

The authors wish to acknowledge the technical assistance of Lois Simonton, Dorothy Schenck and Virginia Carney.

REFERENCES


ANAPLASMOSIS IN CATTLE

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The history of anaplasmosis is a fascinating one. It reaches back to 1795 when North Carolina passed a law forbidding the entry of cattle into that state from South Carolina and Georgia because it was recognized that cattle from those states when driven to more northern points would carry with them the seeds of a certain fatal disease of cattle. In 1814 Virginia passed a law prohibiting the entry of cattle from certain sections of North Carolina. In 1836 North Carolina again legislated against the movement of cattle into that state from the south. When the great ranges of Texas became populated with untold thousands of cattle which were driven to northern markets in the early fifties the death losses from this disease, now having become known as Texas fever, along the trails followed by these cattle were taking on serious proportions. Missouri in particular suffered heavy losses and in 1861 passed a law regulating the movement of cattle from the south.

Many investigations were held as to the probable cause of the disease and its true nature. The cattle tick, *Margaropus annulatus* was strongly suspected as playing a role in this connection but it was not until Smith and Kilborne (1) undertook their classical work on Texas fever in 1889-1893 that the true picture of the trouble gradually began to take form. They showed conclusively that Texas fever was indeed transmitted by the larvae of the cattle tick, *Margaropus annulatus*, the previous generation of which had matured on infected cattle and that its cause was a pearshaped protozoon parasite invading and destroying the red blood cells. This parasite became known as *Piroplasma bigeminum*. They also saw in so-called mild cases what they termed “peripheral coccus-like bodies” in the red blood cells of sick cattle and interpreted these as a developmental stage of *P. bigeminum*. Theiler (6) later recognized these “peripheral coccus-like bodies” as a separate and distinct blood parasite and gave it the name *Anaplasma marginale* and thus the disease they produced became known as anaplasmosis. It thus became apparent that Texas fever was a double infection, a piroplasmosis and an anaplasmosis, the latter having the longer period of incubation.

The author has examined many of the old records on Texas fever with the purpose of determining whether they contain any information that in the light of our present knowledge justifies the conclusion that anaplasmosis was observed in this country even before the description of *P. bigeminum* by Theobald Smith. (1) At least one very definite statement to this effect was found. This statement was made by Paul Paquin, State Veterinarian of Missouri, in 1887. (2) In speaking of the death losses from Texas fever among northern cattle Paquin says: "Ten to fifteen per cent recover, and a very few die from the effects of a relapse after one or two weeks of convalescence.” In the light of our present information there is no acute relapse in piroplasmosis terminating in death such as referred to here. Furthermore the one to two weeks for convalescence added to the period of incubation and duration of
illness from piroplasmosis places the time of the beginning of the so-called relapse well within the period of incubation of anaplasmosis. In view of the many opinions published with reference to the probable cause and the many detailed histories of the origin and movements of the "southern" cattle and records of heavy death losses among the northern cattle in areas visited by southern cattle, it is surprising that only one of the many investigators should take note of the future fate of the 10 to 15 per cent of the animals recovering from the first illness (Texas fever).

The author has checked some of the records of Smith and Kilborne (1) and compared them with his own observation on the transmission of Texas fever and of anaplasmosis as a pure infection. It is safe to assume that the behavior of the animal in case of anaplasmosis is the same whether it exists as a pure infection or as a double infection as it was in Texas fever. All available data indicate that recovery from *P. bigemini*um infection has no influence upon a later infection by *A. marginale*, regardless whether the infection occurs simultaneously or whether the infection with *A. marginale* is superimposed at a later date. We may, therefore, use the data accumulated in work with Texas fever to obtain a picture of the behavior of anaplasmosis in the animal. Smith and Kilborne in their classical work on Texas fever have given many records of the behavior of this disease including the appearance of what they call "peripheral coccus-like bodies" in the red blood cells. In these records the author has found two points at variance with his own experience and in trying to satisfy himself regarding these has checked the work of others. The two points at variance are that Smith and Kilborne report the occurrence of numerous "peripheral coci" in the red cells, sometimes over long periods, without the animal showing an elevation of body temperature, or if an elevation of body temperature was recorded, it many times occurred only in the evening.

In the author's experience (3) an elevation of the body temperature is an inseparable phenomenon from anaplasmosis in animals one year old or older. In such animals the author in his work has always accepted the dictum, no fever no anaplasmosis. Francis and Connaway (4) who speak of the typical reaction in susceptible cattle to inoculation of blood carrying both *P. bigemini*um and what we now call *A. marginale* as the primary and secondary fever reaction, respectively. du Toit defines anaplasmosis in part as follows: "a specific disease of cattle characterized by a high fever, an acute anemia, and a degeneration of the large parenchymatous organs. . . .". He further states: "These bodies (anaplasma) appear with the greatest regularity in all cases of anaplasmosis." It is noteworthy that he mentions fever in first place. Theiler (6) in his original work on *A. marginale* (gen. and spec. nov.) likewise speaks of a high fever during which the marginal bodies, *A. marginale* make their first appearance in the blood, that they increase in number from day to day as the temperature rises and that the peak of the temperature and the peak of infection of red cells with marginal bodies coincide.

Boynton (7) speaks of the animal showing a "high temperature" in his peracute type and in his acute type he reports "a temperature over 40° C." at the time when the marginal bodies are present in the red blood corpuscles. Dikmans (8) also speaks of his animals reacting with fever when the marginal bodies were in the red blood corpuscles.

Regarding the second point the author has only indirect data of his own, namely,
in all his work, be it premunization of young animals against piroplasmosis and anaplasmosis combined (Texas fever) or be it in his experimental work with anaplasmosis as a pure infection, he has always found an elevation of the body temperature in the morning. Francis (9) tested this point on 5 animals. He inoculated 5 cattle, age 13 to 21 months, subcutaneously with 1 cc. blood taken from a ticky cow. During the primary fever reaction (piroplasmosis) he took the body temperature at 3-hour intervals during ten 24-hour periods until the temperature had returned to normal for a day or two. In a like manner he took the body temperature at 4-hour intervals during the second (anaplasmosis) fever period following a week or two later. His record shows that the fever is continuous in both cases and that there is very slight if any difference between the morning and evening temperature during both fever periods.

In the author's experience the marginal bodies appear in the blood about the time when the body temperature begins to rise, increase in number as the body temperature rises or continues at a high level until they have reached a peak and decrease again with the fall in body temperature and finally disappear from the red cells, the whole process being completed in 10 to 20 days. An infection of 10 to 20 per cent of the erythrocytes is a well marked one and one that is not always attained although it may be exceeded. Now let us cite two cases recorded by Smith and Kilborne, (1) namely, cow 95 in Experiment 9 which was exposed to and infected by ticks and cow 219 which was inoculated intravenously with 28 cc. of blood drawn from a ticky cow, in both of which the recorded data are at variance with the observations stated. There are other similar cases recorded in their records.

Cow 95 was placed in a tick-free pasture July 4 simultaneously with ticky cattle. Now it is known that in summer young ticks may be expected to hatch from eggs laid by ticks which had dropped to the ground from cattle about 27 days previously and that susceptible cattle attacked by such young ticks may fever 8 to 10 days later or 35 to 37 days after the ticks have dropped to the ground. This first fever is due to \textit{P. bigeminum}. At a later date, probably never less than 17 days after the young tick has attached but usually much later, a second fever sets in due to \textit{A. marginale}. In the light of our present knowledge in the matter, and assuming that replete female ticks dropped from the ticky cows on the first day, the ticks in this experiment would have hatched and could have attached to cow 95 about August first. The first fever (piroplasmosis) would then have appeared about August 8th to 10th and the second fever (anaplasmosis) about August 18 to 20 but more likely not before August 26th. What actually happened according to the record is that "peripheral cocci" appeared in 5% of the red blood cells on August 7th, in 20 per cent on August 13 and 14, in 75 per cent on August 15 and in 10 per cent on August 17 and 18 with the blood count falling from 5,988,500 on August 7 to 3,300,000 on August 18 and yet this 4-year-old cow at no time showed a rise in body temperature during this period. Such a rise did occur (104° F.) on August 19 on which day the first red cells infected with \textit{P. bigeminum} were found. The rise in body temperature continued and the red cell count dropped quickly to 2,090,000 during the next four days and the cow was destroyed \textit{in extremis} on August 25th when 5 per cent of the red cells were infected by \textit{P. bigeminum}. If the ticks did not attach on the day they hatched then the period of incubation for anaplasmosis would have been still shorter
than calculated above. The question now arises, how come this very short period of incubation, shorter by ten days than it possibly could have been by any mode of transmission known at present and shorter even than that for piroplasmosis in this case? And why no fever? Was this animal infected by other insects before it was exposed to ticks? If it had, it still should have shown a rise in temperature. The history of the animal seems to exclude this possibility. And the last question is, were the "coccus-like bodies" which Smith saw really *A. marginale*?

Now let us examine the record of cow 219 inoculated with blood from a ticky cow on July 16. If the blood of this ticky cow carried both *P. bigeminum* and *A. marginale*, then cow 219 would likely have reacted to the former on July 24 and to the latter not earlier than August 2nd and probably not after September first. Actually the cow showed its first morning fever on July 23 and continued for 12 days. *P. bigeminum* were found in the blood during this time and the red cell count dropped from 6 million to 2,397,000. The animal showed no rise in body temperature thereafter as far as recorded (Oct. 3). The first "peripheral cocci" infecting 30 per cent of the red cells were found on August 29 but the last previous examination recorded was made on August 19 when the red cell count recorded was 3,693,000. On August 29 it had dropped to 1,725,000 and to 1,294,000 on September 1 with "peripheral cocci" still in 15 per cent to 20 per cent of the red cells. This high percentage of infection continued until September 28 when the red cell count was recorded at 1,628,900 and yet during all this period no rise is recorded in the morning body temperature of the animal. Anaplasmosis, as we know it now, does not behave like that. That the evening temperature of this animal can not be considered as "fever" becomes apparent from the following consideration. In the first place, the animal showed a distinct rise in the morning body temperature when *P. bigeminum* were found in the blood. In the second place, the "evening" temperature of the animal taken at 5 p.m. and recorded 61 times during the following 79 days was above 104° F. on 38 days, above 103° on 54 days and below 102.6° F. on only 4 days. In other words it probably was the normal temperature.

Due note was taken of the discovery of the true nature of the marginal points by Theller (6) at the Texas Station at the time, but since the eradication of the only transmitter of Texas fever known in this country at that time was in progress, it was assumed without demonstration that the eradication of the tick *M. annulatus* would also eliminate anaplasmosis. When many years later anaplasmosis was found in the tick-free area it became clear that it must be transmitted in this country by a vector other than the tick *M. annulatus*.

Anaplasmosis is a febrile disease characterized by a progressive anemia caused by a destruction of the erythrocytes. The symptomatology presented depends primarily upon the age of the animal, its resistance to the invasiveness of the cause, its blood regenerating power, the virulence of the infective agent and weather conditions. Extensive records accumulated by the author at the Texas station on the premunization of cattle against anaplasmosis show clearly that between birth and three years of age the mortality following infection with the anaplasmosis agent increases with advancing age in such a manner that nursing calves up to about 5 months of age do not respond with any manifestation of disease other than probably a slight but transient rise in body temperature. Beyond this age a rise in body
temperature is the first manifestation indicating infection. The reaction accompanying this rise in body temperature is comparatively mild in calves between five and ten months of age and more severe beyond this upper age limit. Indeed when the animal has reached the age of one year a low death rate of probably one per cent may be expected. This death rate may double in case the animal has reached 15 months of age before infection and may run to 20% if it has reached the age of 18 months to two years.

Between the age of two and three years the mortality rate rises sharply and reaches its maximum. In animals one year old or older the period of incubation, following the subcutaneous injection of carrier blood in amounts of one to two cubic centimeters, varies from 17 to 48 days with 60% of the animals reacting between the 29th and 38th day. The initial reaction consists of a rise in body temperature and the presence of anaplasma bodies in the red blood corpuscles. More severe symptoms such as loss of appetite, anemia, sometimes icterus, increased respiration, loss of condition, weakness, depression, etc., follow only after the animal has been fevering for two or more days. When loss of appetite appears, the animals enter the period of gravest illness. Anemia is already developing as is manifested by the increasing pallor of the mucosae and the watery condition of the blood. The latter is easily recognised when blood is drawn by such a simple operation as the puncture of an ear vein but may also be determined by the haemocrit. Following the development of anemia, icterus may or may not develop as manifested by a more or less distinct yellowish color of the mucosae and the skin. It will show most prominently on the white parts of the skin, especially the teats but in Herefords one must be cautious in interpreting a yellow color of the skin around the eyes because this yellow color of the skin around the eyes in this breed of cattle is very frequently observed in perfectly healthy animals. In the severer cases, depression and weakness develop so that the animal may spend much of its time lying down or when it walks it may sway from side to side or stagger and lose condition rapidly. Often the animal walks or stands with its head lowered and its back arched. In case of a fatal termination the body temperature frequently falls below normal before death. In case the animal recovers the temperature falls to normal, the appetite returns after 2 to 3 or even 5 to 6 days, the animal grows stronger and soon may be observed licking dirt for extended periods of time.

Should an autopsy be held one is perhaps first of all struck by the watery condition of the blood and the paleness of the muscles. Should icterus have developed during the course of the disease then one will also observe the yellowish tinge of the mucosae and subcutaneous tissue. The lungs are normal or slightly icteric, the heart muscle pale with epigastric and endocardial hemorrhages. The peritoneum may be icteric, the spleen much enlarged and on section the dark, jam-like parenchyma bulges from the cut surface. The liver may be enlarged and is yellowish-brown in color. The gall bladder is distended with a thick, dark green bile. The kidneys are usually normal or may appear icteric especially on the papillae. The urine is either normal or yellowish in color. The intestinal tract shows signs of a catarrh. Anaplasma bodies are found in the red blood cells.

These bodies stain well with any of the Romanowsky stains. They appear as round or oval, sometimes more or less irregular bodies usually located near the
margin of the red blood corpuscle and range in size from 0.3 to 0.8 micron averaging about .05 to 0.6 micron. They usually appear singly or in pairs but occasionally 3 or 4 may be encountered in a corpuscle.

The number of corpuscles infected varies with the severity of the disease. In mild cases less than one per cent may be infected while in very severe cases the number infected may run to 50 per cent or over. The marginal bodies usually appear in the erythrocytes with the onset of fever or several days thereafter and can often be detected in small numbers for days after the fever has subsided. During the fever period their number gradually increases until a maximum is reached and then gradually decreases again. Other changes in the blood picture such as anisocytosis, chromatophilia, basophilic granulation and the appearance of normoblasts occur towards the end of the fever period but since these also occur in other forms of severe anemia they are not characteristic for the disease. Their occurrence in anaplasmosis, however, usually presages recovery. The presence of marginal bodies in the red cells of clinically sick animals is prima facie evidence of the existence of anaplasmosis in the animal even though the precise nature and significance of these bodies is still in dispute.

The clinical symptoms presented by animals suffering from anaplasmosis are such that the possibility of confusion with other diseases exists and undoubtedly many cases have been reported as anaplasmosis which is truth and fact were some other disease. It is imperative therefore that the presence of marginal bodies be established in fevering and otherwise manifestly sick animals before a diagnosis of anaplasmosis can be considered as established. No additional criteria are needed for the establishment of such diagnosis. Such marginal bodies can readily be demonstrated microscopically in properly prepared and properly stained blood smears from the sick animal. Without the use of the microscope a reliable diagnosis of anaplasmosis can not be made.

Transmission of anaplasmosis in this country can be effected by the following ticks Rhipicephalus sanguineus, (10) D. andersoni, (11) D. variabilis, (12) D. occidentalis, (13), D. albipictus (14) and Argyus persicus (24). Only D. variabilis has a large distribution in this country but is seldom found on cattle. D. andersoni is more or less limited to the Rocky Mountain states and D. occidentalis to California. Rh. sanguineus and A. persicus seldom if ever attach to cattle in nature and thus may be excluded as vectors. Since anaplasmosis has been reported in a majority of the states of the union, it is apparent that on the whole, ticks play only a minor role in the transmission of the disease. In Germany Helm (15) has shown that Ixodes ricinus transmits the disease.

Besides the ticks mentioned certain mosquitoes have also been shown to be vectors of the disease. Sanborn (16) and his co-workers were the first to show that flies may transmit the disease. These workers experimented with three flies, Tabanus gracilis, (Wiedemann), T. sulcifrons (Macquart) and Chrysops sequax (Williston) allowing all three species to feed on the same animal. It was not determined in this case which of the three transmitted the infection. Morris (17) succeeded in transmitting the disease with T. atratus (Fab) and Lotze & Yiengst (18) with T. sulcifrons, the same species as was involved in the experiments of Sanborn and his co-workers. Howell (19) and his co-workers, investigating the possibility
ANAPLASMOSIS IN CATTLE

of mosquitoes to act as vectors, succeeded in transmitting the disease with *Psorophora columbicae* (Dyer & Knab) *P. ciliata* (Fab) and *Aedes aegypti* (Linn). These vectors are a most serious menace to our herds where anaplasmosis is endemic. Their control is difficult. Especially the horseflies are capable of traveling swiftly from animal to animal in a closely grazing herd. Whether they travel long distances from place to place or from herd to herd is not known. Since these vectors transmit the disease only mechanically with the small quantity of blood which might adhere to the mouth parts and which will most likely dry rapidly during flight especially when the air is warm, the danger of carrying the disease to other animals far removed from the carrier host is not very great. This probably explains why anaplasmosis often remains confined to the herd in which it was originally observed and does not spread to neighboring herds.

Another vector is man. He can and very frequently does carry the infection from carrier to susceptible animals in the performance of such simple routine operations as earmarking, castration, dehorning, the use of nose tongs, vaccination or other bloody operations when the instruments used for such operations are not thoroughly cleaned and all traces of blood removed therefrom between operations on the different animals. Perhaps mechanically cleansing the instruments in cold water and dropping them in boiling water for a minute is a safe procedure. Anaplasmosis occurs most frequently during the warm season of the year even in the warm south and southwest but definite records as to the exact seasonal limits of its occurrence are lacking. This would indicate that the vector is either more active or present in larger numbers during the warm season. This in turn would point to insects as the most likely vectors especially in the absence of ticks known to be transmitters. In Texas it occurs most frequently in the Gulf Coast area where *Amblyomma maculatum* and *A. americanum* are the only ticks found and neither has been incriminated as a vector.

No satisfactory treatment for anaplasmosis is known. Good results have been claimed for the arsenicals, sodium cacodylate, trypanflavin, mercurochrome 220 and perhaps others but on the whole they are not specific and are mostly disappointing. In the many cases of anaplasmosis encountered by the author in premunizing many hundreds of animals against piroplasmosis and anaplasmosis he has relied chiefly on good nursing. In these premunizations the animals were under close daily observation for 50 to 60 days with the body temperature recorded every morning. Of first concern was a laxative diet. On the first day that the animal refused its grain ration and the body temperature registered 105° F. or above it received a large dose of Epsom salts in hot water. This would physic the animal in about 6 to 8 hours and had the almost invariable effect of lowering the body temperature one or more degrees within 24 hours. The salts were never repeated. In troublesome cases the sick animal was placed in a stall and never allowed to be disturbed by strangers. If the weather was hot and the animal's temperature much above 105° F. cool water from a hose was run over its back for 15 minutes at 30 minute intervals. In obstinate cases rectal injections of cool water were tried.

Great care was taken to keep the animal quiet and to prevent every bodily exertion. The writer on a number of occasions has tried injections of arsenicals and sodium cacodylate but he invariably had the conviction that the struggle put up by
the animal did more harm to the weak heart of the exhausted animal than could be offset by any good derived from the drug. The same holds true for blood transfusions which basically are indicated in all cases of marked anemia. Weak and violently resisting animals may be killed in the struggle while making the transfusion. The author believes that a shady place, abundance of fresh water and quiet surroundings, palatable feed with exertions on the part of the sick animals discouraged or prevented is the best treatment we can give the animal regardless whether it be a gentle milk cow or a wild range animal. In this connection one must keep in mind that in range animals the disease is well advanced and the animal already weakened before the diseased animal can be recognized. Occasionally an animal is found which, after the fever has subsided will continue to refuse all feed. In such cases the use of drugs that stimulate the rumen such as a barium chloride, nux vomica, tartar emetic or nicotine sulphate will have the desired effect. The administration of iron compounds is helpful in regeneration of red blood cells.

After the animal has recovered from anaplasmosis a serious problem remains, namely, to determine what to do with it, since such animals are carriers. If there is an unknown carrier in the herd then the animal that has just recovered is, together with the unknown carrier the safest animal in the herd as far as anaplasmosis is concerned. The carrier state is undoubtedly the heart of the whole anaplasmosis problem. Were it not for the carrier state there would be no anaplasmosis problem. The difficulty of the carrier problem lies in the fact that (1) many animals develop the carrier state as young calves in which clinical manifestations are practically absent, (2) the disease remains unrecognized in the sick animal, or (3) the animal does not come under observation during its period of sickness. In all such recovered animals the carrier status necessarily remains unknown to the owner and thus they become a real menace to the remaining susceptible animals in the herd. To detect these carriers so they may be eliminated from the herd constitutes the real problem. At present the carrier state of an animal can only be detected in all cases by the injection of its blood into another susceptible bovine. This method is quite satisfactory in an emergency and where only a few animals are involved but is too expensive and requires too much time as a practical procedure on a large scale. Furthermore, for each carrier detected by this method another one is created. A rapid, reliable and inexpensive method of diagnosis of the carrier state is really needed. Rees and Mohler (20) tried the complement fixation test and obtained encouraging results. Recent advances in the diagnosis of malaria by means of the complement fixation test and the possibility of the adaptation of this method to the detection of anaplasmosis carriers holds much promise of successful application to the problem, however, much additional work is necessary to explore and perfect the test to practical usefulness.

Veterinary literature in this country is silent on the subject of anaplasmosis until many years after the tick eradication campaign got under way in 1906. It was reported as occurring in Kansas by Gish (21) in 1928 and Dikmans (22) reports it from Louisiana where it was first recognized some 20 years after the only vector known at that time, the tick *M. annulatus* had been eradicated. It was not until most of the territory formerly occupied by this tick had been released from quarantine and declared tick-free that anaplasmosis began to spread into areas far removed
from the original habitat of the tick. Why its spread should proceed so slowly can only be conjectured. Certainly it could only be carried into the new areas by animals of carrier status and the infiltration of the clean areas by carrier animals must needs have been a slow one.

When Theiler first recognized anaplasmosis as a distinct and separate disease, due note was taken of this fact at the Texas Station and the interpretation of the two temperature reactions observed in animals being premunized against Texas fever was changed from "primary" reaction and "secondary" reaction to piroplasmosis and anaplasmosis, respectively. No concern was felt regarding anaplasmosis at the time because the only known vector of Texas fever was fast being eradicated and it was assumed without demonstration that piroplasmosis as well as anaplasmosis would disappear from this country together with the tick. The later appearance of anaplasmosis in areas free from ticks for some 20 years definitely showed that this concept was not tenable and that other vectors besides the tick must be at work, because by that time all originally infected cattle must have been dead of old age.

The question now arises, where did anaplasmosis suddenly come from and where has it been all this time? Evidently there remained more carriers than were suspected and evidently the vectors now spreading it were also at work when the tick was still present and now took over, so to speak, so that even now there may be many more carriers present in our herds, especially in the south and southwest than we suspect. This may explain the comparatively low percentage of cases of anaplasmosis in many home grown herds in many areas where anaplasmosis is endemic. It is quite possible that most of the animals in such herds are carriers having become infected as calves at a time when the disease would have passed unnoticed.

In our efforts to solve the anaplasmosis problem we must also direct our attention to the present vectors with the hope of finding some means of controlling them, be it by the application of toxicants to the animals upon which they must feed or be it by interruption of their life cycle at its most vulnerable point.

All known vectors are not of equal importance in every area where anaplasmosis occurs. Thus of the tick vectors, Rh. sanguineus, aside from having a restricted distribution, is seldom found on cattle and may therefore be disregarded. The dog tick, D. variabilis although having a wide geographical distribution also is seldom found on cattle. D. occidentalis is confined to the west coast and D. andersoni to the Rocky Mountain States. Neither of them occur in the south and southwest and hence have no significance in that area. The insect vectors have a greater distribution and are therefore of greatest economic importance. Of these the horseflies must receive our first attention. They are vicious biters and blood readily escapes from the bite puncture so that blood may readily soil their mouth parts and may thus be carried from animal to animal when their feedings are interrupted by the host. They are capable of flying swiftly from animal to animal in a closely grazing herd and thus can readily spread the infection. No information is available on just how great their menace is to neighboring herds some distance removed. It may be expected that the small quantity of blood adhering to their mouth parts at the time their meal is interrupted will dry quickly in the flight of the insect especially in warm weather. Information is therefore needed just how resistant the
causative agent of anaplasmosis is to drying. This may explain why anaplasmosis does not have a tendency to spread to neighboring herds. In considering the carrier problem due regard must be had for carriers other than those of the bovine species. It is known that deer may carry anaplasmosis in the natural state (22) but their importance in serving as a reservoir has not yet been established. It is known that the sheep upon inoculation also acquires the carrier status but loses it again after some months. It is possible that this is also true with the deer.

Herd owners have come to expect adequate relief or protection from any infectious disease regardless of the percentage of losses and for this reason cattlemen in many sections are clamoring for relief from losses due to anaplasmosis and the matter of premunition may be forced upon us regardless of the hazards involved as long as no practical method of carrier detection or effective therapeutic remedy is available. In the event that a rapid, practical diagnostic test for the detection of all carrier animals cannot be developed soon the feasibility of premunition as a means of controlling the disease may have to receive serious consideration. The fact that anaplasmosis was unknown in the south previous to the eradication of the fever-bearing tick because all animals were carriers, is a powerful argument in favor of premunization. A practical method of premunization is already available but the hazards involved for exposed susceptible animals by the creation of numerous carrier animals in this process have not been fully explored.

REFERENCES

(2) Paquin, Paul: Texas fever and other diseases. Missouri State Agricultural College, Bul. No. 31, 1887.
ANAPLASMOSIS IN CATTLE

REPORT OF THE ADVISORY COMMITTEE ON ANAPLASMOSIS

A. H. Groth, Auburn, Alabama, Chairman; J. Adrain, Fort Worth, Texas; D. A. Sanders, Gainesville, Florida; R. R. Dykstra, Manhattan, Kansas; Hubert Schmidt, College Station, Texas; L. T. Giltner, Washington, D. C.; Herman Farley, Stillwater, Oklahoma.

Your committees on anaplasmosis have in past years reported on various phases of the disease, with special emphasis on our general lack of knowledge of control and eradication. The 1947 report was a notable exception in that it contained information on a method, by which carriers of the disease can be detected. While this method, which is a complement-fixation test, is not perfect, it is an encouraging addition to our knowledge.

During the past year much interest in anaplasmosis has been shown by state and federal research groups. On February 10 and 11, 1948, a conference on anaplasmosis called by Dr. B. T. Simms, Chief of the Bureau of Animal Industry, was held in Washington, D. C. Representatives of the following states and federal agencies were present: Alabama, California, Colorado, Florida, Kansas, Louisiana, Maryland, Oklahoma, Texas, Virginia, the Pathological and Zoological Divisions of the Bureau of Animal Industry, and the Bureau of Entomology and Plant Quarantine. Regulatory as well as research agencies were represented.

The purpose of the meeting was to plan for a co-ordinated research program on anaplasmosis. With this objective in mind a thorough discussion was carried out under the following headings:

A. Distribution, Extent, and Losses caused by the disease.
B. The Causative Agent.
C. Diagnosis of the disease.
D. Therapeutics.
E. Prevention.
F. Control of the disease.
G. Formulation of a program.

In March of 1947 at the Conference of Research Workers in Animal Diseases in the Southern States held at the Regional Animal Disease Research Laboratory, Auburn, Alabama, a committee on anaplasmosis, consisting of Drs. Farley, Schmidt and Piercy, was appointed by the president of the conference. This committee met in 1947 and again in March and April, 1948 and prepared the outline for a research project on Anaplasmosis in Cattle. This outline was submitted to a representative group of Research Workers in Animal Diseases in the Southern States when they met in Atlanta, Georgia, on May 26, 1948. At this conference another committee was selected, of which Dr. Hubert Schmidt of Texas is Chairman and Dr. D. A. Sanders of Florida, is secretary. The original committee was discharged after submitting its report.

At the Atlanta meeting, Dr. L. E. Hawkins, Vice-Director of the Oklahoma Agricultural Experiment Station, presided. Dr. Hawkins is Regional Administrative Advisor on animal diseases and parasites for the southern region in connection with the Research and Marketing Act.
The objectives of the project as set forth at the Atlanta conference are as follows:
1. To determine the nature of the causative agent.
2. To develop methods of diagnosis.
3. To determine the agents of transmission and develop methods of their control.
4. To develop methods of controlling the disease by use of biologics.
5. To develop methods of controlling the disease by use of chemotherapeutics.

Methods of procedure for accomplishing each objective, the statement of the problem and the plan of organization were set forth in detail.

The following eleven states were represented at Atlanta: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, North Carolina, Oklahoma, Tennessee, Texas, and Virginia. The Division of Insects Affecting Man and Animals of the Bureau of Entomology and Plant Quarantine, the Zoological Division of the Bureau of Animal Industry and the Regional Laboratory were also represented.

The primary objective in outlining a regional and even a national research project on anaplasmosis is to coordinate efforts of the various agencies that have personnel and facilities for working on this disease. It is anticipated that there will be a minimum of duplication and that there will be a free exchange of ideas that will be mutually beneficial in speeding up research designed to provide information so vitally needed.

Tentatively the various states and federal agencies have signified their intent to work on anaplasmosis as follows:
California—Cultivation of the causative agent and diagnosis.
Florida—Chemotherapy of acute and carrier cases. Also control of external blood-sucking Arthropods, Vectors and Potential Vectors in cooperation with the Bureau of Entomology and Plant Quarantine.
Louisiana—Diagnosis of carriers and chemotherapy of acute and carrier cases.
Maryland—Chemotherapy of carriers and diagnosis of carriers.
Oklahoma—Diagnosis of carriers, Chemotherapy and biological treatment and prevention.
Texas—Chemotherapy of carrier and acute cases. Biological means of prevention and treatment including studies on premunition.
Zoological Division, Bureau of Animal Industry—Chemotherapy. The nature and cultivation of the causative agent.
Pathological Division, Bureau of Animal Industry—The nature of the causative agent. Diagnosis of carrier animals.


A disease of horses characterized by febrile attacks lasting 3–7 days, recurring at intervals of 1–4 weeks has been recorded since 1941, from the Haute-Savoie district of France being prevalent from June to December. The onset of an attack is sudden, accompanied by symptoms of extreme prostration, weakness of the hind limbs, fever, and subicteric mucous membranes. The urine contains bilirubin, but no hemoglobin or bile salts. Treatment with sulphonamides, acriflavine, neoarsphenamine, antrypol, “trypoxyl” or acetarsol was neither curative nor effective in preventing subsequent attacks.
During febrile attacks anaplasma bodies occurred in the r.b.c. being 0.5–0.7 microns in diameter when single and 0.3–0.5 microns when occurring in pairs. No piroplasms were detected nor were nucleated red cells, poikilocytosis or polychromatophilia present.

The inoculation of washed r.b.c. from an affected animal into a healthy horse resulted in an attack of the disease 24 days later, with the appearance of anaplasma bodies, typical symptoms followed by death in four days.

It is concluded that the disease is an anaplasmosis, resembling the disease in cattle in the length of the incubation period, and in its seasonal occurrence. The mortality was difficult to determine, as affected horses are usually sold for slaughter. The name, Anaplasma equi is proposed for the causative organism. U. F. Richardson.

The Meat Inspection Division, Bureau of Animal Industry, has furnished the following figures on cattle condemned in official establishments on account of anaplasmosis for the first 7 months of this year: January—11, February—5, March—6, April—8, May—26, June—16, July—30. The data for the last 5 months can be had later.

The figures for 1947 are as follows: January—9, February—6, March—3, April—9, May—11, June—22, July—32, August—36, September—129, October—101, November—52, December—19. The high figure for May this year is due largely to 19 cattle condemned from a lot of steers which had been shipped from the Kansas City yards to Chalmers, Indiana, and about 3 weeks following dehorning had shown symptoms of anaplasmosis. There were 40 animals (long yearling Herefords) in the lot which were shipped from Indiana to Cincinnati, Ohio, where they were slaughtered under Federal inspection on May 4. The disease was first detected on April 28 and one animal died April 29. Post mortem examination revealed typical anaplasmosis and the diagnosis was confirmed both by Dr. Moses of Purdue and by the Pathological Division. Dr. T. R. Myers reported another outbreak of anaplasmosis in May this year in Idaho. The disease occurred in a lot of steers several weeks after dehorning.
PROGRAM FOR THE ERADICATION OF THE FOOT-AND-MOUTH DISEASE

LIC. OSCAR FLORES

MEXICO CITY, MEXICO

1948

I. General Considerations.
   The Advance of Foot-and-Mouth Disease has been stopped.
   The extent of the infected area has been reduced.
   Distance of the infected zone to the North and South borders of Mexico at the peak of the infection.
   Distance of the infected zone to the borders North and South of Mexico at present.

II. Extent of the Infected Area (in Square Kilometers).
   Total square kilometers in the infected zone.

III. Vaccination Program.
   Vaccine Production.

IV. Vaccination.
   Division of the infected zone into districts.
   Division of the districts into areas.
   Division of the areas into sections.
   a) Information and publicity.
   b) Organizers and line-up men.
   c) First pre-vaccination inspection.
   d) Vaccination.
   e) First post-vaccination inspection.
   f) Second post-vaccination inspection.
   g) Third post-vaccination inspection.
   h) Fourth post-vaccination inspection.
   i) Fifth post-vaccination inspection.
   j) Survey by the brigade.

V. Advantages of the Present Plan.

I. General Considerations.
   The problem of Foot-and-Mouth Disease in Mexico is considered one of the most serious faced by the country in its history, as much because of the economic damage caused thereby as because of the specially-qualified personnel required for the campaign.

   The disease, however, has not gone beyond the originally set quarantine lines. Its advance has been stopped and, further, the infected zone has been reduced on three occasions. The first two comprised 140,000 square kilometers (14,000,000 hectares or 34,594,560 acres), and the third, which became effective on September 20 comprised approximately 62,000 square kilometers (6,200,000 hectares or
15,320,482 acres). The distance between the infected area and the Northern border has been increased from 400 kilometers (248.547 miles) at the beginning of the campaign to a present maximum of 559 kilometers (372.200 miles). The distance from the infected area to the Southern border, which was originally 190 kilometers (118.060 miles) is now approximately 440 kilometers (273.402 miles).

II. Extent of the "Infected Area" (in Square Kilometers).

The "infected zone at one time consisted of 586,440 square kilometers (58,644,000 hectares or 144,911,990 acres), and included 16 states of Mexico. This area has been reduced by 200,080 square kilometers (20,009,000 hectares or 49,440,680 acres), freeing several states from the infection and reducing the entire infected zone to 384,440 square kilometers (38,440,000 hectares or 94,996,870 acres). It is expected that in the near future two additional areas will be declared clean, one in the Southeast and the other in the Northeast bounded by the Tampico-Valles, Tamazunchale-Dos Hermanos lines.

III. Vaccination Program.

Vaccine Production. At the time the Commission adopted the vaccination, quarantine and disinfection plan as a means of eradication, it faced two major problems:

a) The production of the necessary vaccine.

b) Intensive vaccination within the infected zone.

In order to produce an effective vaccine it was first necessary to construct buildings, laboratories, test units, etc., in Mexico, as well as to train technical personnel to be in charge of the production and application of vaccine. Since these activities had not been undertaken in Mexico before, it was necessary to send Mexican technicians to the different scientific centers of the principal countries producing vaccine in South America and Europe, where they observed and studied the different procedures of production.

At the same time, the necessary steps were taken to build the essential units for the vaccine production in Mexico.

During this time, while production of vaccine was not yet possible, vaccine was imported from Argentina, and from Holland, Switzerland and Denmark, so that the program might be started. These products were tested in Mexico for their value before being sent to the field for application.

Meanwhile the most famous and widely experienced scientists of Foot-and-Mouth Disease and vaccine production met in Mexico. From their conferences many important facts were learned and it was confirmed that the means adopted by the Commission were considered as the most effective.

The production of vaccine in Mexico with Mexican virus was made possible in a very short time. This vaccine was tested before being used in order to study its efficacy and potency and it can be affirmed proudly that the Mexican vaccine is one of the best in the world. This fact was corroborated and highly praised by well known scientists throughout the world.

Once the vaccine produced in Mexico had been submitted to the necessary
CHART 1.—Map with the distances to the border and extension of each district
controls, with satisfactory results, the production rate was rapidly increased. The amount of vaccine produced, per month, is as follows:

- May: 36,000 doses
- June: 9,000 doses
- July: 135,000 doses
- August: 354,000 doses
- Sept.: 630,000 doses

This amount will be increased during the final months of the present year, at the end of which we expect to have reached a production of more than 1,500,000 doses monthly.

It is vitally important that two factors be stressed: first, the quality of the Mexican vaccine, which is considered one of the best in the world, and second, that actual Mexican production now exceeds that of South America, and once a monthly production of 1,500,000 doses is reached will be the largest in the world.

The foregoing paragraphs describe the provisional plan of vaccine production in Mexico. Furthermore, an Institute for Production of Vaccine and Foot-and-Mouth Disease Research is presently being built at Palo Alto, in the Federal District. This Institute will be built in accordance with approved plans, and will be one of the first Institutes of its kind.
IV. Vaccination.

Once the necessary vaccine has been produced, the Commission has developed a great program for its intensive application in the infected zone. Due to its character and magnitude, this program may be considered as the most important work now being carried out anywhere in the world in relation to the Foot-and-Mouth Disease.

**Division of the Infected Zone into Districts**

For the purposes of this program the Commission has considered the “infected zone” as though it were one large ranch, and plans to vaccinate about 1,500,000 head of livestock per month. To facilitate this work the infected zone has been divided into nine districts, as follows:

<table>
<thead>
<tr>
<th>District</th>
<th>Sq. Kilometers</th>
<th>Hectares or Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st District</td>
<td>35,870</td>
<td>(3,587,000 8,863,640)</td>
</tr>
<tr>
<td>2nd District</td>
<td>58,500</td>
<td>(5,850,000 14,455,616)</td>
</tr>
<tr>
<td>3rd District</td>
<td>65,650</td>
<td>(6,565,000 16,222,413)</td>
</tr>
<tr>
<td>4th District</td>
<td>57,740</td>
<td>(5,774,000 14,267,816)</td>
</tr>
<tr>
<td>5th District</td>
<td>38,430</td>
<td>(3,843,000 9,496,227)</td>
</tr>
<tr>
<td>6th District</td>
<td>19,380</td>
<td>(1,938,000 4,788,886)</td>
</tr>
<tr>
<td>7th District</td>
<td>22,310</td>
<td>(2,231,000 5,512,902)</td>
</tr>
<tr>
<td>8th District</td>
<td>38,750</td>
<td>(3,875,000 9,575,301)</td>
</tr>
<tr>
<td>9th District</td>
<td>47,810</td>
<td>(4,781,000 11,814,068)</td>
</tr>
<tr>
<td><strong>Total Kilometers in the infected zone:</strong></td>
<td>384,440</td>
<td>(38,440,000 94,996,870)</td>
</tr>
</tbody>
</table>

**Approximate Number of Head in the Infected Zone**

The number of head to be vaccinated in the infected zone has been calculated approximately, as follows:

<table>
<thead>
<tr>
<th>District</th>
<th>Cattle</th>
<th>Small Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st District</td>
<td>Number of head</td>
<td>743,090</td>
</tr>
<tr>
<td>2nd District</td>
<td>Number of head</td>
<td>985,047</td>
</tr>
<tr>
<td>3rd District</td>
<td>Number of head</td>
<td>1,158,005</td>
</tr>
<tr>
<td>4th District</td>
<td>Number of head</td>
<td>959,372</td>
</tr>
<tr>
<td>5th District</td>
<td>Number of head</td>
<td>857,584</td>
</tr>
<tr>
<td>6th District</td>
<td>Number of head</td>
<td>193,007</td>
</tr>
<tr>
<td>7th District</td>
<td>Number of head</td>
<td>406,521</td>
</tr>
<tr>
<td>8th District</td>
<td>Number of head</td>
<td>357,086</td>
</tr>
<tr>
<td>9th District</td>
<td>Number of head</td>
<td>371,496</td>
</tr>
<tr>
<td><strong>Total of Cattle:</strong></td>
<td>6,031,208</td>
<td></td>
</tr>
<tr>
<td><strong>Total of Small Animals:</strong></td>
<td>8,751,324</td>
<td></td>
</tr>
</tbody>
</table>
CHART 3.—Map of the republic with zones gained to the infected area
These estimates have been taken from the census of 1940, increased by the corresponding percentage. They are ample; nevertheless, it is estimated that the total cattle and small animals would not be more than fifteen millions.

**Division of the Districts into Areas and Sections**

In order to create greater responsibility in the development of activities in the districts, each District will be divided into at least two working areas, larger Districts will be divided into a greater number of areas. In turn, each area will be divided into the number of sections considered necessary.

**Working System.** The work in each section will be carried out as follows: brigades will start from the North or South quarantine line, according to the particular district, and work straight through the district undertaking the operations outlined below:

a) **Information and Publicity.** One information man will be sent out in front of the brigade to prepare the area to be worked on the purpose of the vaccination program, and to complete the information already in the hands of the district supervisors as to the number of animals in each section. At the same time he will carry out educational propaganda among the farmers and stock owners of the region, to convince them of the effectiveness of the procedure and the necessity of giving complete cooperation to the vaccination brigades.

b) **Organizers or Line-up men.** Immediately following the information man, the organizers, or line-up men will go into the area. It will be their duty to gather together all the animals for pre-vaccination inspection and for vaccination, as well as for the first post-vaccination inspection. It will be their responsibility to see that one hundred per cent of the animals in the area are gathered together for inspection and vaccination at the hour previously arranged upon.

c) **First Pre-vaccination Inspection.** A group will follow the organizers or line-up men, in order to inspect the cattle that have been gathered and ascertain that no acutely infected animals are vaccinated.

d) **Vaccination.** The vaccination group will follow the inspection group. They will vaccinate all of the animals within the area assigned to them, beginning at the quarantine line and progressing through the district. All animals will be tagged at the time of vaccination in order to control these activities.

e) **First Post-vaccination Inspection.** Not less than 10 days after the vaccination, the first post-vaccination group will go through the area to ascertain that no animals have been left unvaccinated. This group will carry vaccine and necessary equipment to vaccinate any animals missed by the vaccination group. They will also observe the results of the vaccination.

f) **Second Post-vaccination Inspection.** Thirty days after the first post-vaccination inspection, a second group will go through the area to be sure that no animals have been missed and to observe any suspicious animals that may be found.

g) **Third Post-vaccination Inspection.** Thirty days after the second post-vaccination inspection, the third group will go through the area to inspect all the animals therein in a search for suspicious animals; in case any are located the district supervisors will be informed immediately and all information considered important.

h) **Fourth Post-vaccination Inspection.** The fourth post-vaccination inspection
will take place 45 days after the third and will be undertaken by a group of livestock inspectors. This group will inspect all the vaccinated animals, search for suspicious cases and if any are found, report their findings to the district supervisors immediately.
i) Fifth Post-vaccination Inspection. The fifth post-vaccination inspection will be carried out by a group of livestock inspectors 45 days after the fourth. This group will inspect 100% of the cattle in the area assigned to them and report any suspicious cases to the district supervisors.

The above plan proposes to vaccinate all the cattle within the infected zone. The division of the infected zone into districts and sections was made in order to facilitate carrying out this activity.

If it is possible to eradicate Foot-and-Mouth Disease on a farm by vaccinating all the livestock on that farm, then considering the infected zone a large farm and vaccinate all the stock therein, the disease can likewise be eradicated in this zone.

Survey of a District by Brigades

The various groups of a brigade in a District (Information, Vaccination and Inspection groups) will begin their surveys at a quarantine line bounding the district to which they are assigned, and work toward the opposite boundary of that district. In other words, they will begin at one end and finish at the other. These inspections will continue until the purpose of the program is carried out, which it is estimated, will take about 10 or 12 months at the longest.

The immunity established by the vaccine is estimated to be effective for a period of six to eight months.

At the end of that period the brigade would have to return to its starting point and start to re-vaccinate all of the animals; this would mean that that part of the district still unvaccinated would remain so until the brigade had advanced through the second vaccination. To eliminate the disadvantage of such a method, the original brigade will continue through the district with the first vaccination until it has vaccinated all of the animals in the district. Six months after the beginning of the vaccination work in a district, a new brigade will be formed, similar to the original brigade, which will begin at the starting point on the quarantine line and work down through the district. In this manner all of the cattle will be revaccinated within six months.

Twelve months after the second brigade has left the quarantine line, a third brigade will go through each section to inspect and vaccinate all the cattle in the district, in the same manner as the former brigades have done.

In other words, if the minimum immunity of the vaccine is six months, at the end of six months new brigades will start at the quarantine line and revaccinate all the animals in each district; twelve months thereafter a third brigade will operate in exactly the same manner. In this way we will be able to ascertain that all of the cattle in all of the sections and therefore in all of the districts have been vaccinated. Thus the disease will be eliminated, as all the susceptible animals will be immunized.

V. Advantages.

The plan outlined herein is original and of huge proportions. It means total vaccination in the infected zone, reducing that zone daily; constant inspection, enabling us to state that no animals remain unvaccinated; brigades starting from the quarantine lines every six months, furnishing complete assurance. This plan, in addition to being rapid, as its results will be evident within 18 months, is one of
constant progress. It enables us to place full responsibility in each District, area or section, as well as in each individual included in the various brigades. It will be economical in the long run because it shortens the campaign and at the same time gives a large margin of safety.

In order to comprehend the magnitude of this plan and the great effort required to carry it out, it must be realized that during the first six months 1,500,000 doses of vaccine be applied monthly (9,000,000 doses within six months) and that during the second phase, that is when the second brigade begins its activities, 3 million doses per month will be used in revaccination (18,000,000 in six months). During the first phase, when the third brigade starts its activities, 4,500,000 doses will be applied monthly. This phase undoubtedly will be of short duration and may even be unnecessary since brigade No. 1 will have arrived at the central goal twelve months after its departure and will go back to its initial point of its departure; but it may happen, due to the irregular conformation of the territory that in some places the third phase to which we have previously referred will be necessary.

The complete accomplishment of the plan means the massive but coordinated and rapid application of 45 million doses in 18 months and maybe if the third phase is required will go up to 54 million doses.
Dr. Knapp and gentlemen: It gives me a great deal of pleasure to be here. I am sure you have already heard a lot about the Foot and Mouth Disease in Mexico and I will try to make my remarks brief. However, before proceeding, I want to thank this Association, sincerely, for its support, and I assure you the committee you sent to Mexico was most helpful. I might add, the livestock industry of the United States and of northern Mexico has likewise been most helpful.

First, I should like to tell you that the problem, as you all know, is a tremendous one. I think the conception that Judge Flores has given you shows what we really think we can do. The Mexican Government and the Mexican people are squarely in back of the program and they are doing everything in their power to support it. Having contributed so little to the accomplishment of vaccine production, I am a trifle reluctant and feel somewhat out of place in talking to you gentlemen. I should like to say that at one time the Commission's morale was extremely low. It is my contention that morale is a by-product of accomplishment, and our morale is increasing daily as we step up the vaccine production program. The week we left Mexico City, 470,000 doses of vaccine had been produced, and we now have 470,000 doses of vaccine available for use in the field. The week ending Saturday, the brigade that Judge Flores mentioned was planning to use 150,000 doses. Now that is just tuning up—in other words, we are just getting ready to commence to begin to start.

As to costs, the United States is contributing a little over a million dollars a month to the program and this sum is exclusive of the contribution being made by the Mexican government. Let me call your attention to this first chart I have before you and which is referred to as the Efficiency Chart. The heavy line at the top is the amount of money that we term “energy that goes into the program”. The black line at the bottom is rising as the vaccine production increases. The red line indicates the amount of vaccine being used. We are thinking along the following lines: We spend this money. What are we getting for it? What is it going to do? When the two lines at the bottom approximate the line at the top, the efficiency rating will be in the neighborhood of 95 to 98%, and I feel certain that both the Mexicans and ourselves will be satisfied that we are doing an effective job when that situation comes about. You see here, the money, the vaccine being produced, and the vaccine being used. There is a 42 to 50 day lag due to tests, as no vaccine goes into the field before it is thoroughly tested in the Commission's laboratory.

Here is another chart that we use in Mexico and the break down of money that is expended. This is a financial statement, but there is no revenue coming in except that obtained from cattle we slaughter for virus production. The yellow portion of the column represents salary, and the other colors indicate how it is spent. From this chart we are able to keep control of the expenditures and see
exactly what we are getting for our money. I knew you people would be interested in seeing that some executive decision controlled the expenditure of funds.

This other chart shows the vaccine production and the peaks Judge Flores pointed out to you. Standing beside this chart places me somewhat in the position of the Oklahoman who had applied for a professorship. He appeared before the trustees and felt as though he had favorably impressed them. They told him to retire to the ante room so that they could arrive at a decision. As soon as he stepped out of the room, one of the trustees stated “This fellow looks as though he will make a type of teacher the community may well be proud of, but what is his theory about the world being round or flat? You remember that Illinois religious leader who insisted the world was flat.” So they called in the applicant and said, “We like you well enough but what is your theory as to whether the world is round or flat?” The prospective teacher immediately replied, “Don’t be concerned about that. I know both theories and I will teach either one you wish.”

We believe the best defense is a strong offense. Fifty per cent of our mission has been accomplished by stemming the spread of the disease. Moving the quarantine line south on three different occasions was not due to political expediency, but was based on the sound belief of veterinary scientists that the areas were free from disease and could be released. There are a great many people who think that vaccine has never eradicated any disease. At least, that is what I have been told. I do not believe there is anyone in the Commission who will tell you we know, definitely, that we can eradicate the disease. Nevertheless, we do believe that by following out the program that has just been outlined for you, by working it enthusiastically, we will be able to break the cycle and, therefore, eradicate large areas and at least reduce infected zones so that we can deal with the disease in the same fashion we would handle it had it broken out in the United States. The enthusiasm which prevails from top to bottom in this Commission personnel prompts us to come to that conclusion.

Perhaps you would be interested in learning something of the personnel participating in this program. We have 2,600 employees, and of that number 458 are Americans. All of the States in our Union are represented on the Commission except four.

The problem in Mexico is not insurmountable. The terrain is rough, but the people are accepting the program, and I mean they are accepting the vaccine program. They are also accepting eradication when necessary and I think you will be pleasantly pleased on your next Mexican visit when you get the reaction of the populace first hand. I will be the first to tell you if we fail and I promise you we are not going to give any body any riddle talk. We are going to vaccinate one million head of cattle per month and I am sure with the present program, we will even be able to go over that goal.

Now that Dr. Simms is here, I should like to talk shop a little. The Bureau of Animal Industry has been extremely cooperative. They have given me all the authority I have needed and were I to tell the Department of Agriculture that the Bureau was not supporting us fully, it would be a misrepresentation. We are getting all the support that anyone is entitled to from every possible source.
It was nice of you gentlemen to ask me to appear before you, and I am happy to tell you that any reported discord between the Mexican and American Sections is a gross exaggeration. We are marching hand in hand toward our common objective. I have high hopes that very shortly we will have accomplished much toward the success of our mission. I hope to have the pleasure of seeing each of you individually on our Foot and Mouth Battle Front in Mexico.
DISCUSSION OF FOOT AND MOUTH DISEASE ERADICATION IN MEXICO

By J. Elmer Brock

Kaycee, Wyoming

Mr. Brock: Mr. President, members, and guests, I regret very much that Mr. Mitchell could not be here to report to you as Chairman of this Committee of which I am a member. As you perhaps know, immediately after the disease became recognized in Mexico the Secretary appointed an Advisory Committee of nine Stockmen. That committee has now been expanded to 12.

After the exhaustive discussion which you have heard already I am going to make my remarks as brief as I can. I can tell you many things that would perhaps be of interest. I could offer my criticism of our State Department, which I feel very strongly, for not having acted more efficiently, and which I think could have prevented the disease from entering Mexico. I could tell you many other things, but that is water over the dam. The important point is this: The disease is in Mexico; we know it is there. Our problem now is to deal with it leaving the troubles of the past to the past. This program has gone through a stage of trial and error with a vast amount of both which is unavoidable in a program of this magnitude. This Committee very early in, I think, its first meeting—and I have been to all the meetings, some seven or eight—recommended scientific research and a border fence.

I went to Mexico with a subcommittee and traveled some two or three thousand miles over that area when the outbreak was in its early stages. On my return and on the strength of the report which our Committee made, certain recommendations were set down specifically and submitted to the Secretary of Agriculture. Those recommendations were continued and expanded very little until we finally had ten recommendations. I want to say a word as to the soundness of those. When I say we never made one single recommendation from which we had to retract I mean just that.

I will not read those recommendations, because eight of the ten have either been completed or are now in operation. There are two yet which we made and emphasized that are not completed to our satisfaction, one of those being the border fence and the other a laboratory for the research and study of this disease. I will speak more of those later.

When the program was changed it was the result of one of the recommendations which was for a study by those in the higher levels. We found that the program could not continue on a total slaughter basis. The country could not stand either the economic or the political impact of that program. This Committee was in full accord, at a regularly called meeting, with the modification of that program. I think I speak for the Committee when I say we passed through a stage of doubt as to the possible success of the combined slaughter and vaccination method of treating this disease. The committee now feels and I feel that this program has promise of success. There is one thing certain and is not debatable: Either we had to mod-
ify that program or we would not be in Mexico today and the program would not be carried on in the manner in which it is now. That was inevitable.

There are two or three things I would urge upon the Commission, and I think the Committee will support me in it: We hope that you will not relax the pressing of this program in the slaughter of infected animals as vaccination is increased. That is a thing that might be a little dangerous and we hope that the Commission will continue to slaughter these infected animals in the area where they are working and not permit any relaxation of that part of the program. Secondly, as your production of vaccine increases, I am sure that under the efficient management of the Joint Commission you will step up the personnel and not allow the vaccination program or your whole program to lag in any way. I think that would be a serious mistake. In June of a year ago our Committee met with the cattlemen in northern Mexico and with the Bureau officials and at that time we endorsed a canning program to relieve the pressure of those people who were in an area where they had a surplus of cattle and no outlet for them.

That program has been developed and to the best of my knowledge is being carried on very, very efficiently. I believe as recently as last month we have contracted for some 133,000,000 pounds of that processed meat. It is being distributed in foreign nations and it has, I think, been very worth-while in the program in that, had we not taken care of those people, we know we would have had trouble against our border. They were desperate. I think also that the development of those plants is going to be of great value to the Mexican cattlemen in the future when this program is over and completed successfully.

The border fence is a great disappointment to the Committee. That is one of the first things we urged and if we ever need it very badly, it will be when a situation arises whereby we will not have time to build the fence. I was very, very badly disappointed when the Secretary of National Defense Forrestal turned thumbs down on that fence. I would charge him and our State Department in Washington with the responsibility of erecting that fence and with dereliction in not having the job done. As to the research laboratory we recommended that and I believe there has been an allocation of fifteen million dollars for that in lieu of appropriation. That makes me think of a man up in my country who writes for the livestock papers under the name of Neckyoke Jones. You know Neckyoke Jones writes and he has a partner that he calls Greasewood. He says Greasewood is very, very smart, very highly intelligent.

He said he came along one day and saw Greasewood standing there, and he was holding a halter in his hand and looking this way and that, and he said, "Greasewood, what is the matter?" And Greasewood said, "I have either found a halter or lost a horse, and I don't know which."

Well, that is about the way with our laboratory. I think perhaps that the Bureau of Animal Industry themselves are responsible for the fact that we don't have that laboratory, and in making that charge against them I think I am paying them a very high compliment. For 40 years they have preached to the stockmen never to allow that germ within the continental United States, and then when the Bureau turns around the next day and says, "Let's bring it in and put up a laboratory inside the country," they can't expect to overcome the results of 40 years'
work in a very short time. I hope we will get that straightened out and find a place that is satisfactory because again, we have nothing now in our own country to take the place of that laboratory which we should have.

We want to watch at this time to maintain all of the safeguards that we have ever had and increase them. Remember we only have one type of this disease in Mexico today, type A which I am told is the mildest type. I have seen this disease in Mexico and in three South American countries where they have the other types, and I can tell you people and speak advisedly, you don’t want the other types on top of this one. I might say at this time that with my limited knowledge as a layman I don’t believe there has ever been a disease eradication program of this magnitude attempted in the whole world. It is the biggest thing I know of and the most important.

When I talked to the Ambassador in Mexico, who has been very friendly at least to the best of my knowledge to our program, I said, “I understand President Alemán says this program is the most important thing in Mexico today.” The Ambassador said, “Mr. Brock, this program is the most important thing in the Western Hemisphere today.” And I think he is right. If this program is a success, it will do more towards increasing the food supply throughout the entire world than anything I know of that has ever been done. So, I would certainly say it is most meritorious and should be pursued to a complete and successful conclusion.

Whatever money has been spent, whatever mistakes have been made, the results are most gratifying to us. The disease is not in the United States. It is getting farther and farther from our borders. Whatever has been done the expenditure is more than justified. However long it may take to press this program the expenditure will be most worth-while. I want to caution you people both here and members of the Commission that I think there are three stages to this program. We are now in the second stage. The first is hysteria when there is chaos, mistakes, pulling and hauling. Then we settle down to work and we are in that stage now. The next stage will be that of indifference. We are going along. And that is the dangerous stage. I want to caution you people when we reach that stage that is the time to watch. This third stage that we are coming to is the dangerous stage. I want to say further that this Committee—I am sure they will all agree with me—are most highly pleased with the personnel of this Commission both in Mexico and in this country. We could make no suggestions; we hope that they will be allowed to continue their work. I do not believe you can improve on them.

That concludes my report unless there are some questions some of you may want to ask which I might answer and I thank you.
COMMITTEE ON FOOT-AND-MOUTH DISEASE


This report of your Committee deals with the broad problems of foot-and-mouth disease as they concern the United States, but it emphasizes particularly the Mexican problem. Since the submission of the report of the Committee on Foot-and-Mouth Disease of the Association at the annual meeting in Chicago last year, the situation regarding foot-and-mouth disease in Mexico has continued to be of foremost concern in the minds of livestock sanitarians and the livestock industry of the United States. Despite the fact that the cooperating officials of the United States and Mexico have been successful in preventing spread of the disease beyond the quarantine lines and in reducing the extent of the previously quarantined area in Mexico, and although recent reports indicate that the disease is quiescent, the infection has not yet been extirpated from our neighboring Republic. Consequently there is continued grave danger of the introduction of the disease into the United States.

The program of slaughter and disinfection of premises originally invoked against foot-and-mouth disease in Mexico was, for economic and other important practical reasons, necessarily abandoned earlier this year. Instead, a plan of prophylactic vaccination for the protection of all susceptible livestock was inaugurated, this to be supplemented by quarantine and the slaughter of infected and exposed animals as outlined further in this report.

The many economic, political and other conditions which led to abandonment of the slaughter program for eradication of the disease in Mexico also suggested that a realignment of the top executive office in the program might be of value. The Federal Bureau of Animal Industry established an eradication program on a sound basis. As the program developed, however, it became increasingly evident that the task of actual disease eradication was only one of many problems to be overcome if the campaign was to be successful. A congressional Committee and the Secretary's Industry Advisory Committee recommended the appointment of a co-administrator for the United States with the authority of an Assistant to the Secretary of Agriculture, and one who through this capacity might more readily receive the full cooperation of all agencies. A change was made during July of this year in the American co-director of the joint Mexico-United States Commission in charge of the eradication of foot-and-mouth disease in Mexico. General Harry H. Johnson of Texas was named by the Secretary of Agriculture to head the American section in Mexico with full authority to act for him.

The patrol activities by the Federal Bureau of Animal Industry along the United States-Mexican border has become well organized and is functioning efficiently; however, it must be taken into consideration that a predominating portion of our
southern border remains unprotected or is incompletely protected as far as a stock-proof fence is concerned. To persons definitely interested in prevention of the introduction of foot-and-mouth disease into the United States from the south, even casual observation of this situation along our southern boundary line is convincing of the need for an adequate international boundary line fence as a further aid in keeping infection of foot-and-mouth disease from entering the United States from Mexico. Cattle in the more arid sections of northern Mexico, in areas contiguous to our border, due to a lack of drinking water, instinctively drift toward our line, where, at many points on this side, watering facilities have been provided by American ranch owners. These cattle must be stopped at the border or they will come in. Instinctively too, these animals linger at the border; on occasions for several days, awaiting opportunity to reach watering places on the United States' side of the boundary. Only an adequate fence can certainly prevent some of these cattle from trespassing on United States soil. However, any cattle apprehended in trespass on our side of the line are promptly destroyed and carcasses thoroughly incinerated on the spot, this part of the job being also very thoroughly accomplished by our border patrolmen.

Directly connected with the border patrol activities and eradication of foot-and-mouth disease in central Mexico was the problem of disposing of hundreds of thousands of excess cattle in northern disease-free Mexico which would normally have been shipped into the United States. To allow the cattle to remain and increase in Northern Mexico with no available market would have led to an intolerable situation which might easily have shattered all of our efforts in Mexico. The Bureau of Animal Industry and the Production and Marketing Administration of the Department of Agriculture and the cattlemen of Northern Mexico are to be commended for the efficient and effective manner in which this problem was met. It was determined that the most practical and in fact the only method of disposing of this surplus livestock, would be through a meat canning program. The cattlemen of northern Mexico favored such a program and with the assistance of our government, the meat canning program was put into operation. In less than two years canning plants were established in northern Mexico, markets for the product were secured and today there are canning facilities in northern Mexico capable of handling the entire annual cattle production output of that region at a fair market price.

At this meeting, it is anticipated that you will have heard the informative addresses of Mr. Oscar Flores, Director, and General Harry H. Johnson, Co-Director of the Joint Commission for the Eradication of Foot-and-Mouth Disease in Mexico, and Mr. Elmer Brock of Secretary Brannan's Industry Advisory Committee. These men, particularly Mr. Flores and Gen. Johnson, have the direct responsibility for eradication results in Mexico.

The time tried and well demonstrated successful method of eliminating foot-and-mouth disease: that of quarantine, slaughter and disinfection; having been unavoidably modified in Mexico, with reliance being placed largely in preventive vaccination of susceptible livestock, this now constitutes the principal weapon of attack in Mexico. In addition to vaccination, quarantines are to be maintained, pre-vaccination inspections and postvaccination inspections are to be continued for a
FOOT-AND-MOUTH DISEASE

minimum period of six months after each vaccination, and infected and exposed herds are to be slaughtered if outbreaks occur in areas now free of the disease or in the work areas (inspection and vaccination). Many questions naturally arise as to the certainty with which the eradication goal may be reached in Mexico under the present plan. The present plan, with such improvements as may be evolved, is considered as the only practical one under conditions existing in Mexico. If potent prophylactic vaccine can be produced in sufficient quantities; if all susceptible livestock is properly vaccinated at suitable intervals; and if new outbreaks are promptly dealt with, those engaged in the work will be doing all that can be done at present. It is, therefore, the consensus of the Committee that the program in Mexico should have the full support of this Association.

The United States has remained free from foot-and-mouth disease for almost twenty years since the last outbreak was promptly stamped out. Ours is one of the few countries left in the world in which the disease has not become established. Chiefly, this has been made possible by wise legislation and strict enforcement of sanitary safeguards, rigid adherence to the traditional national policy of eradicating the disease on each and every occasion of its introduction and the relative isolation of the country from other infected countries. Legal powers to exercise protective precautions against the disease have been sustained, and there has never been any weakening of the policy of outright eradication. On the other hand, our southern land barriers continue to be directly threatened by the disease from Mexico and modern transportation has shortened both time and distance by land, sea and air between remote parts of the world, all of which make our country more vulnerable to foot-and-mouth disease than at any time in our history. There is every expectation and assurance that our livestock sanitary officials will attack the disease unrelentingly in the event of an invasion or repeated invasions of the disease, just as had been done in the past. Experience has amply demonstrated the effectiveness and sound economics of this principle and certainly it should be adhered to unequivocally unless some more effective method of handling the disease is demonstrated. However, it is possible that conditions may arise where it would not be feasible or possible to resort to the slaughter method alone in dealing with an outbreak. Under such conditions it would be highly important to have at hand the best possible information, the necessary facilities and properly trained personnel to inaugurate an alternate or supplementary program offering the best chances of success in the particular situation. To supplant as soon as possible, the cooperative research work being carried on by the Bureau of Animal Industry in foreign countries, your Committee considers the immediate establishment of adequate independent research facilities in United States territory essential for the welfare and proper defense of the livestock industry and the nation as a whole.

During the past July our President, Dr. J. V. Knapp, together with Dr. Ralph L. West of Minnesota, and Mr. Will J. Miller, past president of the Association, made an informal trip of observation into Mexico; these members reported their findings to this committee. Their report indicated to this committee the tremendous handicaps under which the eradication work in Mexico has thus far proceeded. These are largely if not entirely beyond immediate control or complete correction, the net effect being that eradication of foot-and-mouth disease continues to be the
cooperative responsibility of both countries. The report of Drs. Knapp and West and Mr. Miller pointed out the tremendous obstacles with which our Bureau of Animal Industry has had to contend in Mexico and which have in large measure, accounted for the lack of more definite progress.

There must be no relaxation in the enforcement of our laws and regulations which protect this country against the accidental or intentional introduction of foot-and-mouth disease from any foreign country. To make these laws and regulations more effective; all official agencies concerned with the inspection of foreign commerce capable of introducing this disease should be brought into a coordinated and cooperative organized effort.

In view of the existing foot-and-mouth disease situation in Mexico and elsewhere in the world, your committee makes the following recommendations:

1. That the United States Livestock Sanitary Association approve the current program for eradication of foot-and-mouth disease in Mexico, since it appears to be the only practical and favorable plan for eradication which could effectively be put into operation in that country. We do believe, however, that continuing efforts should be made towards improving the program insofar as possible.

2. That this organization go on record as not only continuing to favor the construction of an adequate fence along our Mexican border, but that efforts be extended through the livestock sanitary officials of the several states, livestock associations, farm organizations, and other agencies interested in agriculture and livestock to urge the Congress to provide ample appropriations for this purpose.

3. That this Association memorialize the incoming Congress to immediately provide adequate funds to be used in developing research work on foot-and-mouth disease as authorized by Public Law 496 enacted by the 80th Congress.

4. That the United States Livestock Sanitary Association unequivocally oppose any modification in our laws or regulations which might hamper the precautionary measures now being taken to prevent the introduction of foot-and-mouth disease into the United States from any foreign country in which the disease is known to exist.

5. In order to assure prompt detection and eradication of foot-and-mouth disease should it appear in the United States from any source whatever, that all livestock sanitary authorities, veterinarians and livestock owners alike maintain constant watchfulness and alertness.
The common liver fluke, *Fasciola hepatica*, of cattle, sheep and goats is cosmopolitan, being found wherever the conditions for completion of its complicated life cycle are satisfactory. In the United States, this parasite is prevalent in the Gulf Coast region, the Rocky Mountain area, and along the Pacific Coast.

Of 14,093,769 cattle slaughtered under federal inspection during the fiscal year 1947, the livers of 368,095, or 2.61 per cent, were condemned on account of liver fluke infection. Liver condemnations because of fluke infection were distributed as follows: 51 per cent from California, Oregon, Washington, Idaho, Nevada, and Utah, 23 per cent from the Gulf Coast States, and 26 per cent not indicated as to origin (28). Inasmuch as only about 65 per cent of the cattle slaughtered in this country are subject to federal inspection (11), the number of condemnations for liver flukes is doubtless much greater than shown by the figures here given.

**DAMAGE CAUSED BY LIVER FLUKES**

Flukes cause serious damage to the liver, beginning at the time they enter it as minute, immature forms and continuing throughout the period of their development and activity. Through their wanderings, the young flukes destroy much liver tissue; introduce, from the intestine, bacteria, some of which find the dead and damaged liver cells ideal for growth and reproduction; and eliminate waste products, doubtless more or less toxic (6), from their own bodies.

As a result of repeated infections by the flukes and the cumulative damage caused during their early migrations, the livers become greyish in color and very hard because of the great amount of scar tissue present. Irritation by the flukes to the walls of the bile ducts causes the latter to become greatly thickened and often filled with a stone-like deposit of calcium phosphate. This deposit may become so great as to occlude the ducts and prevent the free flow of bile (fig. 1).

**LOSSES CAUSED BY LIVER FLUKES**

Losses to the livestock industry as a result of infection of cattle by liver flukes are difficult to estimate because of the insidious manner in which these parasites affect the animals. Only the losses resulting from liver condemnations can be stated rather precisely. At an average weight of 10 pounds each for beef livers, the amount lost owing to flukes in the United States during the fiscal year 1947 would be 3,680,950 pounds. This amount of liver is an important source of nutritious food and valuable medicinal products.

Losses other than liver condemnations caused by liver flukes in cattle, as given

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by various investigators, include: (1) Lower prices paid for heavily infected animals because of the poor quality of meat (9); (2) 1.7 per cent (4) to 2.5 per cent (12) loss in weight of grown cattle; (3) based on questionnaires returned by German veterinarians, a death rate of 1 to 3 per cent for grown cattle and 3 to 10 per cent for young cattle (12); (4) reduction of milk flow of 16 per cent (8) to 24 per cent (12) below average during years when the incidence and degree of liver fluke infection were high because of abnormally wet seasons; (5) carrying capacity of pastures reduced to 85 per cent because of the lowered ability of infected animals to utilize their feed efficiently, together with the increased need for more forage to maintain

their condition (12); gains of infected animals in the feed lots only about half as much as those of comparable non-infected ones on the same rations (6); (6) volume of milk in dairy cows reduced (29) and greater losses in the total cattle population caused by subclinical fascioliasis than by the more severe and fatal form in sheep from the same region (19); and (7) curtailed breeding in animals suffering from clinical fascioliasis (22).

LIFE HISTORY OF THE LIVER FLUKE

A knowledge of the basic aspects of the biology of the liver fluke is requisite to the development and execution of a sound control program. The life cycle of the liver fluke is complicated in that the parasite can become infective to cattle only
after undergoing a period of development in certain species of fresh-water snails that live on wet pastures (fig. 2).

Fig. 2. Illustrating schematically the life cycle of the common liver fluke, *Fasciola hepatica*.

The adult fluke (A, approximately natural size) in the liver produces many eggs which are expelled to the outside with the droppings. The egg (B, enlarged about 100 times) develops in wet places on the pasture and a free-swimming larva (C, enlarged about 100 times) issues from each normally developing egg. The larva is attracted to certain aquatic snails (D) which it penetrates. After development in the snail, a new type of larva with a tail (E, enlarged about 30 times) emerges and settles on grass (F) or other objects in water and encysts there. Cattle grazing on contaminated pastures (G) swallow the encysted larvae with forage and water.

Eggs deposited in the bile ducts by the flukes reach the pasture in the droppings of the cattle. When in water and under favorable conditions of temperature, the microscopic eggs hatch in 7 to 10 days. Development of the eggs is retarded by low temperatures and stopped at below 45° F.

The microscopic larvae (miracidia) hatching from the eggs penetrate the snail's body and pass through certain stages of development before becoming infective
to cattle, multiplying several hundred times during this period. After about 7 weeks, small, tadpole-shaped larvae (cercariae), which are barely visible to the unaided eye, issue from the snails. After a short period of swimming about, the cercariae come to rest on blades of grass, on debris in the water, or on the surface of the water. They then shed their tails and secrete a cyst about themselves which serves both to attach them to grass or other objects in the water and to protect them from drying when the water recedes. The encysted stage (metacercaria) is infective to cattle when taken into the digestive tract with feed or water.

The young flukes escape from the cysts in the small intestine of the cattle. Once free, they burrow through the intestinal wall into the body cavity, migrate to the liver and penetrate the liver capsule. During the next 2 months the young flukes wander in the liver, feeding and growing. At the end of this time they enter the bile ducts where sexual maturity is attained about 1 month later. Under favorable conditions, about 5 months is required for the liver fluke to complete its life cycle. This period may be divided as follows: (1) Hatching of the eggs, about 7 to 10 days; (2) development in the snail, about 7 weeks; and (3) development in the liver before reaching sexual maturity, about 3 months. Flukes are known to live in sheep for at least 7 years.

The life cycle of the liver fluke is divided into 4 distinct and separate stages. They are: (1) The first free-living stage in which water is essential to the hatching of the eggs and locomotion of the miracidia in search of the snail host, (2) the intramolluscan stage in which necessary development occurs before the young flukes become infective to cattle, (3) the second free-living stage in which the cercariae emerge from the snails and swim to objects on which they encyst, and (4) the intra-mammalian stage in which the flukes develop to maturity.

**DIAGNOSIS OF LIVER FLUKE INFECTION**

Infection with liver flukes can be determined by (1) finding the worms in the liver through post-mortem examination and (2) finding the fluke eggs in the feces by examination under a microscope. Clinical symptoms, when present, are not sufficiently clear to be distinguished from those caused by other factors, such as nematode infections or malnutrition arising from causes other than parasitism.

Post-mortem examinations are not always possible for determining parasite infections. Fecal examinations, on the other hand, provide a rapid and practical means of diagnosing liver fluke infections. Chronic infections, however, cannot be distinguished from light infections by this method as both cases may show the same number of eggs per gram of feces. Moreover, the extent of liver damage cannot be ascertained. These deficiencies of the fecal examination method, however, are not of practical concern since general infection as revealed by it indicates the presence of flukes and the need of control measures.

Two methods of fecal examination developed in our laboratory for detecting and comparing liver fluke infections are rapid, easily applied and reasonably uniform in results. They consist of dilution and flotation methods. The former is the more accurate, but the latter is the more rapid.

Fecal samples collected from the rectum of cattle were prepared in the same manner for both techniques, as follows: 30 gram of feces were weighed into a 300-
LIVER FLUKES IN CATTLE

cc. Erlenmeyer flask calibrated for that volume and the flask filed to the 300-cc mark with 0.4 N sodium hydroxide. Although the examination can be made immediately upon liquefying the feces, best results were obtained when they were comminuted overnight in the sodium hydroxide.

To measure the samples, the flask was shaken to thoroughly mix the contents and a 5-cc. aliquot containing 0.5 gram of feces for examination by dilution, or a 2.5-cc. aliquot containing 0.25 gram of feces for examination by flotation was transferred to a 15-cc. centrifuge tube by means of a 10-cc. Mohr measuring pipette fitted with a 15-cc. rubber bulb. The tip of the pipette was removed to utilize the full bore, thus allowing free passage of the fecal material.

To make the examination by the dilution technique, the 5-cc. samples were cleaned of coloring matter and fine debris by repeated centrifuging in sodium chloride solution having a specific gravity of approximately 1.2. Each set of tubes was centrifuged 5 to 6 times, or until clear, with a hand-driven centrifuge at the rate of about 1,600 r.p.m. for 10 to 12 turns of the handle. The fluke eggs and the heavier debris were driven to the bottom of the tube by centrifugal force whereas the fine particles remained in suspension. After each centrifugation, the supernatant fluid containing the suspended debris was drawn off by means of a filter pump. When the sample was sufficiently cleared, it was passed through first a 100- and then a 150-mesh screen into a counting chamber. The latter consisted of 70-mm. Petri dishes marked by means of a diamond point pencil with parallel lines 3 mm. apart. Counting was done with a dissecting microscope using a magnification of 32 or 50.

Concentration of liver fluke eggs for examination by the flotation technique was made by centrifuging in an electrically driven centrifuge at about 2,000 r.p.m. for 2 to 3 minutes, the precipitate from the 2.5-cc. samples of the fecal suspension in commercial sodium silicate solution having a specific gravity of 1.28 to 1.30. Sodium silicate of this specific gravity levitates most of the eggs but allows the greater portion of the debris to precipitate. The eggs were transferred from the surface of the fluid to a slide by means of a wire loop. Although the liver fluke eggs were collapsed by the action of the sodium silicate, they were readily identified and differentiated from those of the rumen fluke. In addition to the fluke eggs, nematode eggs also were floated by this method.

CONTROL OF LIVER FLUKES BY MEDICATION

Practical methods of controlling liver flukes by medication require (1) an efficacious and relatively non-toxic medicament that is inexpensive and easily administered, and (2) treatment when the greatest number of flukes can be killed, which time is when they are mature and in the bile ducts.

Hexachloroethane, a halogenated hydrocarbon, is both efficacious in killing flukes and relatively non-toxic to cattle. It was first used in Germany as a solution in tetrachloroethylene. Later it was used in various ways, the most important being in the form of boluses. In Hawaii, Alicata administered 10 grams of hexachloroethane and 1.75 grams of kamala extract in capsules at the rate of 1 capsule per 70 pounds of body weight. In Texas Olsen prepared an aqueous suspension by mixing 500 grams of finely ground hexachloroethane, 50 grams of bentonite,
\[\frac{1}{2} \text{ to } \frac{3}{4} \text{ teaspoonful of white flour and water sufficient (about 750 cc.) to make 1,000 cc. of the mixture. Each cubic centimeter of the suspension contained 0.5 gram of the drug. Adult animals were given, by means of a drench syringe, 200 cc. and young animals up to 1 to 2 years of age 100 cc. of the suspension. Treatment was completed with a single dose of the suspension without fasting the animals. This suspension was tested for efficacy and toxicity on a large number of cattle under field conditions in Texas. The results of these tests, which are given below, were based on egg counts and on post-mortem examinations (24).}

\textit{Egg counts.} Of 463 mature cattle with an average pretreatment egg count of 26.4 fluke eggs per gram of feces, only 35 animals were still passing fluke eggs, with an average of 4.9 eggs per gram, when tested 2 to 3 weeks after one treatment with hexachoroethane suspension. It cannot be concluded, however, that all the cattle that were no longer passing eggs were actually free of liver flukes. Cattle in which one or only a few live flukes remain may have passed too few eggs to be detected in routine examinations.

An experiment was conducted over a period of 3 years to determine the effectiveness in controlling liver flukes of a regimen of semi-annual treatments of all cattle on a pasture. Two herds, numbering about 300 and 350 head, respectively, at the beginning of the study were selected for this work. One herd was on a river bottom pasture where the average annual rainfall was about 45 inches and the other was on a prairie pasture where the rainfall was about 35 inches. Medication was administered late in the spring and late in the fall. The results of these tests were determined by making random pre- and post-medication egg counts on large numbers of the animals.

Both the incidence of infection and individual egg counts were reduced following each of these treatments. After medication, however, infection generally recurred so that by the next treatment it was up again, even exceeding the original infection on several occasions. This condition was especially true in the cattle on the prairie pasture where not only a high incidence of infection but also a high egg count constantly recurred after each treatment.

This study showed that although semi-annual treatment of cattle on these pastures did not prevent reinfection with liver flukes it did reduce the number of flukes in the cattle on the river bottom pasture and prevented clinical fascioliasis in both herds where it was known to occur prior to the beginning of treatment. The constant recurrence of the infection following the marked drop after each treatment indicated that some factors other than the cattle were responsible for the reinfection. They are (1) a residue of flukes remaining in the cattle after treatment, (2) large numbers of the snail intermediate host on the pastures and (3) the presence on the pastures of numerous wild rabbits and hares, many of which were naturally infected with liver flukes.

On the prairie pasture, where the greatest resurgence of infection occurred, rabbits were especially abundant. Of 309 jack-rabbits and 24 cottontails examined post-mortem from the prairie pasture over a period of one year, 32 and 20 per cent, respectively, were infected with liver flukes (96). The fecal pellets of the rabbits which contained many fluke eggs were scattered thickly over the range wherever choice grazing occurred. Moreover, being buoyant, the pellets were washed read-
LIVER FLUKES IN CATTLE

ily by the rains into the low places where moisture conditions for the development and hatching of the eggs and infection of the snails were best.

In the Gulf Coast region where the snail hosts depend on rainfall for water, they estivate in the soil during dry periods. Snails emerging from the soil following a dry period of over 4 months, during which there was no opportunity on the pasture for infection, were found to harbor fully developed cercariae of the liver fluke. This observation indicated that snails may carry liver fluke infections through a period of inactivity and shed fully developed cercariae immediately upon emerging from the soil when water reappears.

Post-Mortem. Post-mortem examinations. In order to determine the fasciolicidal efficacy of hexachloroethane more accurately than was possible by the egg count method, post-mortem examinations were made on 143 adult cattle. Ninety-one were medicated with 200 cc. of hexachloroethane suspension about one week before slaughter; the remaining 52, which grazed on the same pastures as the others, were not medicated and served as controls.

The results of these examinations showed (1) an average of 23.9 flukes of all sizes in each untreated animal as compared with only 3.3 in each treated one (15 per cent of the untreated and 56 per cent of the treated ones were negative); (2) 20.8 adult flukes per untreated animal and 1.4 per treated animal (27 per cent of the untreated animals and 70 per cent of the treated animals were negative); and (3) 3.5 immature flukes per untreated animal and 1.9 per treated animal (65 per cent of the untreated and 80 per cent of the treated cattle were negative).

Although hexachloroethane was effective against adult flukes, it was less effective against immature forms in the bile ducts and wholly ineffective against the small forms migrating in the body and liver parenchyma.

Adult flukes surviving medication were found most often in livers or sections of livers showing marked changes due to damage caused by flukes. This naturally suggested a relationship between the damaged liver and the lowered fasciolicidal efficacy of the drug.

In order to compare the efficacy of hexachloroethane in animals with normal and diseased livers, 29 unweaned calves about 8 months old were obtained from a single herd of cattle. Of the 15 calves medicated with 100 cc. of hexachloroethane, 9 were infected as determined by fecal examination for liver fluke eggs. Of the 14 unmedicated calves, 4 were positive by fecal examinations, 3 negative, and 7 unavailable for pretreatment checking. Post-mortem examination one week after medication showed no living flukes in the medicated calves although one dead and partially decomposed fluke was found in a calf designated as being negative by fecal test. Of the 14 untreated calves, 12 harbored from 1 to 20 living flukes each in their livers.

These tests showed that the fasciolicidal efficacy of hexachloroethane, and presumably fasciolicides in general, was greater in animals whose livers were normal, or nearly so, than in animals whose livers were pathologically altered as a result of much fluke damage.

Time of medication. In view of the greater susceptibility of adult flukes to hexachloroethane, as well as other fasciolicides, a program of medication should include treatment at the time when only adult flukes are present, insofar as possible. Medication at such a time assures the greatest kill of the parasites. Animals treated
at such times distribute fewer eggs on the pastures, thus affording less opportunity for infection of the snails.

In the Gulf Coast region, it was found that the cysts were destroyed on the pastures by the heat and drought occurring during the summer and fall (24). Moreover, when the pastures are dry and the snails are in the soil (21) there is no opportunity for infestation. The period during which the pastures are free of the infective cysts is sufficiently long to permit all the flukes to reach the bile ducts and develop to maturity before the onset of the fall and winter rains (24). With the reappearance of surface water and reactivation of the snails, new cysts appear on the pastures and infection of the cattle begins.

In regions where cold winters prevail and animals are not subjected to infection while stabled or kept in feed lots, all the flukes in them would be mature and in the bile ducts about 3 months after removal from the infested pastures. Medication at this time would destroy the maximum number of flukes. A second treatment is indicated about 6 months after the first. In the Gulf Coast region, it is given in the late spring and early summer. In other regions, the date should be determined on the basis of the season of infection and the time when the flukes reach maturity.

Workers in Hawaii found that large numbers of flukes were killed in adult cattle when the dosage was 20 cc. of suspension, or 1 capsule, to each 70 pounds of live weight and one-half the total calculated amount given on 2 successive days (2). This procedure has not been tried in the Gulf Coast region primarily because of the difficulty in penning wild cattle for medication.

Although medication of cattle with hexachloroethane suspension was efficacious in destroying adult flukes and effective in preventing or curing clinical fascioliasis, it did not preclude recurrence of infection. The residue of flukes remaining in the cattle after medication and the presence of a reservoir host so ubiquitous as wild rabbits and hares on pastures having heavy snail populations partially nullified the effects of the treatment. Medication alone, therefore, is ameliorative rather than preventive.

**HEXACHLOROETHANE IN THE TREATMENT OF CLINICAL FASCIOLIASIS**

Cattle suffering from clinical fascioliasis, in a poor and weakened condition with abnormally high fluke egg counts but without accompanying, significant nematode infections, usually made rapid recovery following medication with hexachloroethane suspension and expulsion of the flukes (figs. 3 and 4). These animals were losing weight under pasture and feed-lot conditions that maintained others in excellent physical vigor and flesh. Occasionally, however, the removal of heavy fluke infections as indicated by pre- and post-medication egg counts, and finally autopsy, failed to result in recovery (fig. 5) (22).

**PREVENTION OF INFECTION BY LIVER FLUKES**

Preventive measures against liver fluke infection must preclude, insofar as possible, exposure of the cattle to the infective cysts. This objective can be achieved by (1) killing the snails by draining their habitats or treating them with copper sulfate, and (2) exclusion of cattle from infested areas. Medication of the cattle in conjunction with these methods aids in destroying the flukes. The first of these
Fig. 3A. (Upper) This bull was so weak from a heavy infection of liver flukes that it was necessary to assist him to his feet after he had been lying down. He had lost weight rapidly even though he was in a feed lot.

Fig. 3B. (Lower) Three months after medication with one dose of hexachloroethane suspension and expulsion of the flukes, this bull had greatly improved in health and weight. He became very fat 6 months after treatment.
FIG. 4A. (Upper) This cow had been losing weight for a long time. She had become progressively thinner and weaker, in spite of the improved pasture conditions. She had failed to bear a calf during the season prior to medication.

FIG. 4B. (Lower) Following medication with hexachloroethane suspension and elimination of a heavy fluke infection, she rapidly recovered her condition, came into oestrus, conceived and bore a calf.
methods is aimed directly at the 3 stages of the life cycle of the liver fluke in which water on the habitat is the single factor necessary for their development, as previously mentioned. The simultaneous application of all these methods is recommended when conditions warrant their use.

**Drainage.** Where it is possible and feasible to drain wet places and destroy the snails, permanent and complete control of liver flukes is assured; all other methods are secondary (18).

The establishment, under the direction of the U. S. Bureau of Animal Industry, of extensive drainage systems in the western part of the United States cleaned up liver flukes in the affected regions (17). Abandonment of these drainage projects, however, resulted in reestablishment of the snails which was followed by severe and costly epizootics of liver fluke disease in cattle and sheep.

In the Gulf Coast region, where the moist climate and high rainfall on the low, flat terrain provide a continuous snail habitat for hundreds of miles (21), drainage sufficiently effective to destroy the snails would be both difficult and costly.

**Copper sulfate.** Snails can be destroyed in their habitats by dilute solutions of copper sulfate.

In streams snails were killed by introducing sufficient copper sulfate to make a concentration of 1 part of the chemical to 500,000 parts of water (3, 10). Under less favorable conditions, where more plants and algae were present, concentrations

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**Fig. 5.** Liver fluke disease had so weakened this bull that he was unable to recover even though all the flukes were removed by one treatment of hexachloroethane suspension. He steadily declined in strength until the sixth week after medication when he was unable to rise, at which time he was destroyed. No liver flukes were found at post-mortem examination.
of 1:200,000 to 1:300,000 were necessary to destroy the snails ($\xi$). Instructions for measuring and applying solutions of copper sulfate to streams in the desired lethal concentrations are given by Chandler ($\zeta$), Jay ($\eta$), and Alicata ($\xi$).

When applied to pastures by spraying, dusting, or broadcasting, copper sulfate has been found to be effective in killing the snails. The manner of applications and amount of chemical used depend on the type of pasture and amount and kind of vegetation.

Sprays are useful on damp pastures with heavy herbage. Solutions containing 0.5 per cent copper sulfate applied at the rate of 137 gallons per acre killed the snails ($\xi, \eta$). This rate of application required 5 to 6 pounds of copper sulfate per acre.

Dusting with 1 part by weight of copper sulfate and 4 parts of kaolin (china clay) killed all the snails when applied at the rate of 27.5 pounds of the chemical to 110 pounds of the diluent per acre. This method of application is especially useful for small areas, narrow ditches, and margins of ponds. The ingredients are easily mixed and readily applied with suitable dusting equipment ($\eta$). Aeroplanes may be used for dusting open areas ($\eta$) but the indiscriminate use of this method in thickly populated regions may produce undesirable effects ($\iota$).

Broadcasting a mixture of 1 part by weight of copper sulfate to 4 parts of dry sand ($\xi$), 1 part of copper sulfate to 8 parts of sand ($\eta$), or 1 part of copper sulfate to 8 parts of land plaster ($\iota$), when applied at the rate of 20, 27.5, and 33.75 pounds of copper sulfate, respectively, per acre, killed the snails. This method of application was suitable for treating large areas of swampy land over which spraying and dusting equipment could not be taken ($\eta$).

A number of conditions reduce the efficiency of copper sulfate on the pastures. In water having a high alkalinity, the copper is precipitated as insoluble salts. Diluents used in preparing the mixtures should not contain materials that react with the copper to form insoluble salts. Algae and organic matter take up copper. These conditions reduce the amount of available copper in the water and render the treatment less effective ($\iota$).

Inasmuch as copper sulfate does not kill snail eggs, new generations of snails will soon reappear after treatment of the pastures and streams ($\xi$). For this reason the chemical is most effective when used in conjunction with drainage in killing the snails in the drainage ditches and in small areas not adequately drained.

Because lymnaeid snails enter the soil during periods of drought or excessive heat and cold, application of copper sulfate should be made when the conditions for snail activity are universally favorable on the pastures. Otherwise, snails estivating in the soil or mud would not come in contact with the chemical before it lost its effectiveness and survive. They would soon repopulate the pastures under favorable conditions of breeding.

Commercial fertilizers have been advocated for controlling snails on pastures and at the same time improving the forage ($\iota, \zeta, \eta$). They are not so effective as copper sulfate for killing snails and their use for this purpose is not recommended.

Exclusion of animals from infested areas. Where small areas cannot be drained, the cattle should be excluded from them by fences. The fences should be placed sufficiently far from the wet places to prevent cattle from reaching the infested grass ($\xi$). Forage from these areas should not be fed to cattle.
Other methods. Flocks of young Pekin and Indian Runner ducks have been suggested as a means of destroying snails in streams, springs, and other places on farms where snails live (7). The difficulty in placing the ducks in the various snail habitats limits their usefulness as a means of snail control (16). Other animals are of little or no value in destroying snails (16).

Sterilization of feces containing fluke eggs before being used for fertilizing pastures is recommended. The eggs can be destroyed by allowing the manure to decompose in bins constructed for this purpose (7). Medication of stabled animals and those kept in feed lots would greatly reduce the necessity of sterilizing the feces.

SUMMARY AND CONCLUSIONS

The toll exacted from the livestock industry by liver flukes is significant. The effects of these parasites are manifested in clinical symptoms ranging from unthriftiness to emaciation. Death from liver fluke infection occurs frequently in sheep and goats, and occasionally in cattle. Other losses include liver condemnations, poor quality of flesh, decreased ability of the infected animals to utilize efficiently their forage, decreased milk secretion, and curtailment of breeding in advanced clinical cases.

Medication of cattle with hexachloroethane is an effective means of controlling liver flukes to the extent that clinical symptoms can be prevented and cured. This method will not prevent reinfection and liver losses because it does not kill all the flukes. These surviving flukes together with those in the wild reservoir hosts maintain a high incidence of infection in the snails and ultimately in susceptible ruminants.

The most important method of liver fluke control is snail eradication. When the snail hosts are eliminated from the pastures the cycle of the fluke cannot be completed and livestock do not become infected. This method of fluke control will eventually eliminate infections in wild reservoir hosts.

Cooperative efforts on the part of land owners are necessary in establishing drainage systems in large areas where adequate drainage is essential to liver fluke control and improved agriculture, as in the Gulf Coast region. Much can be done, however, on individual farms and ranches to improve drainage for the purpose of controlling liver flukes and at the same time increasing the productivity of the land. Once established the drainage systems require attention to assure continuous and effective removal of the water; otherwise the marshy conditions and the snails will recur.

Copper sulfate is useful for destroying snails when drainage and flood control are not practical. Methods of its application vary, however, depending on the soil, kinds and amount of vegetation present, and the area to be treated. It is useful in destroying snails in drainage ditches and streams. In conjunction with the use of copper sulfate on the pastures, medication of the livestock is an important aid that should not be overlooked in controlling liver flukes.

The use of natural enemies for destroying snails has not been successful in controlling liver flukes. Although young Pekin and Indian Runner ducks eat snails in streams and springs, the difficulty of placing them in all the areas where the snails live makes their use impractical and undependable.
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LIVESTOCK INSECTS AND THEIR CONTROL, WITH COMMENTS ON THE NEW INSECTICIDES

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The external parasites of livestock number several hundred species, which vary in habits and life history. Many aspects must be considered in developing methods for their control. Satisfactory means of protecting farm and ranch animals from attack by insects, ticks and mites have not been developed for all the important species, although marked progress has been made during recent years. This progress in great measure has been due to the development of DDT and other chlorinated hydrocarbon insecticides.

Since DDT has come into use, a number of new insecticides and acaricides have been developed and are now available to livestock growers for controlling various arthropods attacking animals. It has been extremely difficult for research workers during this short period of time to evaluate thoroughly the several new chemicals which show promise in the veterinary-entomology field. Such materials or combinations of them are frequently offered to the public before adequate information has been obtained on their efficiency against the many parasites involved under the diversified conditions under which control measures must be applied. Moreover, many questions remain unanswered relative to the acute or chronic toxicity to man and animals of the insecticides themselves or the many formulations of such insecticides.

The new insecticides currently under investigation by the Bureau of Entomology and Plant Quarantine laboratories at Kerrville, Texas, Corvallis, Oregon, and Savannah, Georgia, include benzene hexachloride, chlordane, chlorinated camphene TDE (or DDD), methoxychlor, and a combination containing pyrethrum and piperonyl butoxide. These materials have been tested in direct comparison with DDT and other standard insecticides against most of the important livestock pests. Studies are also underway at Kerrville, in cooperation with the Bureau of Animal Industry and the Texas Agricultural Experiment Station, to gain more information on the toxicity of insecticide materials when applied to various classes of livestock.

In this paper I will review briefly the approved control measures most generally employed against the more important insects and ticks attacking livestock and will summarize available information on the insecticidal properties and toxicity to animals of the newer compounds. For the most part, the data on the relative performance of the new insecticides are presented as a report of progress rather than as recommendations for their use in controlling livestock pests. Because of possible toxic effects on man or animals, some of the materials cannot be recommended at this time, even though they might be highly effective in controlling certain parasites.

1 The technical material used in all tests discussed in this report contained from 10 to 12 per cent of the gamma isomer.
In addition to this general review, some comments and recommendations will also be offered for consideration in connection with further research and control of livestock pests.

CONTROL RECOMMENDATIONS, WITH A REVIEW OF RECENT INVESTIGATIONS

_Cattle Grubs_

Although many materials and methods for controlling cattle grubs have been investigated, rotenone is the only known insecticide which will destroy the larvae of the two species, _Hypoderma lineatum_ (DeVill.), and _H. bovis_ (Deg.), occurring in this country. The finely ground derris or cube root is the most economical form of the insecticide to employ for this purpose. It may be applied as a dust, spray, dip, or wash. For small herds, dusts or washes may be the most practical methods of applying the insecticide, but high-pressure sprays, which during recent years have become extremely popular, are most desirable for larger herds. The treatments, regardless of method, should be applied at 30-day intervals during the grub season.

Rotenone dusts for grub control should contain 1.67 per cent of rotenone. They are prepared by adding 1 part of finely ground derris or cube root (containing 5% rotenone) to 2 parts of a suitable diluent, such as pyrophyllite or tripoli earth. The dust should be thoroughly rubbed on the backs of animals at the rate of 3 ounces per mature animal. The washes are prepared by adding 12 ounces of the 5 per cent-rotenone product to 1 gallon of water containing 2 ounces of soap or 6 ounces of wettable sulfur. For use in high-pressure sprayers no wetting agent is necessary. The spray material is prepared by adding 7½ pounds of the 5 per cent-rotenone material to 100 gallons of water. The sprays are most effective when applied with sprayers developing a nozzle pressure between 400 and 500 pounds per square inch.

The newer insecticides, including DDT, chlordane, chlorinated camphene, and benzene hexachloride, have not proved effective for controlling the grub larvae in the backs of animals. The application of DDT to animals to prevent oviposition by the flies or hatching and penetration of the young larvae has also proved unsuccessful.

_Lice_

_Cattle lice._ DDT is effective and has been widely used for controlling all species of cattle lice. A single treatment, either dip or spray, employing a concentration of 0.5 per cent DDT is most generally recommended. The standard 50 per cent-DDT wettable powder is the preferred material to employ, although certain emulsions have also been used extensively with satisfactory results. The amount of spray required for a thorough treatment will vary with the breed of animal, amount of hair, equipment used, and other factors. Complete elimination of lice within a herd with a single spray treatment can seldom be accomplished in actual practice, but one treatment will provide excellent practical control.

In the southern states, where the recently discovered tail louse (_Haematopinus quadripertiusus_ Fahr) occurs (Bruce 4), thorough treatments with 1.5 per cent DDT sprays applied to Florida native cattle are reported necessary for adequate control. A limited number of tests in Texas indicate that in this area satisfactory control of this species can be obtained with the usual 0.5 per cent concentration.
Rottenone as a dip or a spray is also still recommended for controlling cattle lice. It should be applied twice, 14 to 18 days apart, and used at the rate of 1 pound of 5 per cent rotenone bearing powder to 100 gallons of water. In dips 10 pounds of wettable sulfur should be added.

Among the newer insecticides still in the experimental stage, benzene hexachloride is the one that has been investigated most extensively for controlling lice on cattle. Various investigators have reported this insecticide to be an efficient louse-killing agent. Concentrations of 0.25 to 0.5 per cent of technical benzene hexachloride (0.025 to 0.05 per cent gamma isomer) prepared from a wettable powder will give excellent control.

Chlordane, chlorinated camphene, TDE, and methoxychlor are also indicated to be effective in controlling short-nosed and long-nosed cattle lice (Haematopinus eurysternus (Nitz.) and Linognathus vituli (L.)). Investigations to date indicate that results comparable with DDT are obtained when these materials are used at the same concentrations. A recent insecticide mixture containing pyrethrum and piperonyl butoxide has also been tested against cattle lice. An emulsion containing 0.005 per cent of pyrethrins and 0.1 per cent of piperonyl butoxide gave complete control of the mobile forms of sucking lice, but some of the nymphs hatched and survived after treatment.

Hog louse. The hog louse (Haematopinus adventicus Neum.) can be controlled effectively with DDT. A thorough spraying or dipping with 0.5 per cent of DDT is recommended. Technical benzene hexachloride at the same concentration has also been reported to be effective in controlling this pest.

Chlordane, chlorinated camphene, TDE, and methoxychlor are also highly effective for controlling the hog louse. Preliminary tests indicate that chlordane and chlorinated camphene may be superior to either DDT or benzene hexachloride against this insect.

Sheep and goat lice. Biting lice (Borricola spp.) on sheep and goats are effectively controlled with DDT dips (Parish and Rude 14). Emulsions or wettable-powders containing 0.2 per cent of DDT are recommended. The DDT treatment has largely replaced wettable-sulfur dips for controlling lice on these animals.

Benzene hexachloride, chlordane, and chlorinated camphene are highly effective against biting lice on goats. Chlorinated camphene has provided complete control at concentrations of 0.1 per cent and less in some tests and is considered superior to DDT. Chlordane and benzene hexachloride are indicated to be comparable with DDT. Dips prepared with TDE and methoxychlor are also highly effective for controlling these insects, although preliminary indications are that higher concentrations are required than for DDT.

Ticks

The various ticks attacking livestock differ in their life history and resistance to insecticides, so that specific control measures are not uniformly effective. For controlling the cattle tick (Boophilus annulatus (Say)) the Bureau of Animal Industry still recognizes the arsenical dip as the standard treatment. However, this treatment does not provide adequate control for other species and it is not recommended for ticks in general.
DDT has provided a new weapon for controlling these parasites and recent studies with the newer materials show some of them to be superior to DDT for this purpose.

Cobbett (8) has shown that DDT and a combination of DDT and benzene hexachloride are more effective than the arsenical treatment for controlling the cattle fever tick. Blakeslee and Bruce (8) have also published preliminary data showing that DDT offers promise for controlling *Boophilus annulatus* var *microplus* (Can.). Blakeslee et al. (8) have investigated DDT and found it promising for controlling the Gulf Coast tick (*Amblyomma maculatum* Koch), and Portman (15) has employed benzene hexachloride for controlling the lone star tick (*Amblyomma americanum* (L.)). Kemper et al. (10) have proved that benzene hexachloride is effective against the ear tick (*Otobius megnini* (Dugés)).

The various new insecticides have been tested extensively at the Kerrville laboratory against the lone star tick and the winter tick (*Dermacentor albipictus* (Pack.)). Some tests have also been conducted against the Gulf Coast tick and the ear tick. These data have not yet been published, but findings will be briefly summarized.

Benzene hexachloride is by far the most effective of the new insecticides from the standpoint of initial killing action. Excellent kill of all stages (including fully engorged forms, which are most difficult to kill) of the lone star tick is obtained when infested animals are thoroughly saturated with a wettable-powder spray containing 0.25 per cent of technical benzene hexachloride. A concentration as low as 0.1 per cent of the technical material kills most of the engorged forms of the winter tick. Chlorinated camphene and chlordane require approximately 0.75 per cent concentration to kill the engorged forms of the two species mentioned, whereas 1.5 to 2.5 per cent of DDT is required. TDE in preliminary tests was equally as effective as DDT, but methoxychlor was distinctly inferior.

There are also marked differences among the insecticides from the standpoint of protecting animals from reinfection. Technical benzene hexachloride at a concentration of 0.5 per cent or even higher is relatively ineffective from this standpoint. In Texas retreatment of cattle within 7 days is necessary for adequate control of the lone star tick. Portman (16) reports adequate protection for 7 to 10 days with various types treatments at a concentration of 0.5 per cent. DDT, chlorinated camphene, and chlordane are about equally efficient as residual insecticides for this tick and at concentrations of 0.5 to 0.75 per cent give fairly satisfactory control for 2 weeks. No information is available regarding the lasting effects of TDE and methoxychlor.

Much longer protection against reinfection is afforded when the winter tick is involved. Tests were conducted on horses and cattle in the vicinity of Kerrville. Concentrations of 0.25 and 0.5 per cent of technical benzene hexachloride provided good control for about 2 weeks. At 0.5- to 0.75-per cent concentration DDT remained effective for about 4 weeks, whereas chlordane and chlorinated camphene prevented reinfection for 6 to 8 weeks. TDE in these tests was comparable with DDT. Methoxychlor, however, was distinctly inferior in that concentrations as high as 1.5 per cent protected animals from reinfection for only 2 weeks and failed to give good control of the initial infestation.

Preliminary tests indicate that the Gulf Coast tick in general shows the same
degree of susceptibility as does the lone star tick when cattle are thoroughly treated with the various insecticides. Some of the new materials are also promising against the ear tick. DDT is relatively ineffective, but spraying the ears with benzene hexachloride (0.25 per cent) and chlordane or chlorinated camphene (at 0.5 to 0.75 per cent) shows promise of being a simple and effective treatment.

At the present a mixture of technical benzene hexachloride at a concentration of approximately 0.25 per cent and DDT at 0.5 to 0.75 per cent is suggested as the best all-around treatment for ticks that might be used for experimental purposes. Chlordane and chlorinated camphene at concentrations of 0.75 per cent provide excellent initial control of all stages of ticks investigated thus far and also provide good protection against reinfestation, but because of possible adverse effects their use cannot be recommended at this time.

**Flies**

*Horn flies.* No generally practical method of controlling horn flies on range cattle was available prior to the development of DDT. This insecticide has therefore provided a much-needed control for this insect. On dairy cattle fly sprays containing pyrethrum or some of the thiocyanate insecticides were used extensively in the past for temporarily controlling this insect. This type of treatment, however, has been largely replaced by DDT. A wide range of concentrations of DDT are used for treating horn flies on cattle. Some states recommend sprays containing as little as 0.25 per cent, whereas others recommend up to 1.5 per cent. However, when the amount of spray applied is taken into account, the amount of DDT used does not vary greatly. In the southeast, where 1.5-per cent DDT spray is employed, the volume of spray averages about 1.5 pints per mature animal. A 0.5 per cent spray is most generally used, however, at the rate of about 2 quarts for a mature animal. The Bureau of Entomology and Plant Quarantine suggests about 8 to 10 grams of actual DDT per treatment. This amount will generally provide adequate control for about 1 month, whereas 4 to 5 grams will usually remain effective for about 3 weeks. The lower rate may be most economical for use on dairy and other cattle readily available for treatment. This lower rate will also tend to decrease the amount of material absorbed and secreted in the milk.

The wettable-powder preparation is preferred, but certain emulsions have been shown to be equally effective and can be used safely if accurately and thoroughly mixed. Emulsions offer certain advantages from the standpoint of application, particularly with hand sprayers, but they are generally more expensive per unit of DDT and there is more likelihood of misuse, which may result in toxic reactions to the animal.

Extensive tests have been run during the last 2 years to evaluate the various new insecticides for controlling horn flies. Tests have been conducted in Texas, Kansas, and Missouri. The tests in Kansas and Missouri were conducted during 1947, in cooperation with the National Livestock Loss Prevention Board of Kansas City and the experiment stations and extension services of the two states.

These tests have shown that chlorinated camphene, chlordane, the methoxy analog of DDT, and TDE are all effective in controlling the horn fly. In general DDT is the most effective. Available data indicate that about 28 to 30 days' protection
can be obtained with this insecticide when it is employed at a concentration of 0.5 per cent. Chlorinated camphene may be equally as effective, whereas TDE and the methoxy analog on the same basis average about 24 to 26 days' protection. Chlordane has been tested less extensively, but available data indicate that it is about as effective as TDE and methoxychlor. Benzene hexachloride does not provide sufficient lasting action to be considered effective for horn fly control. The possible use of these materials in practical horn fly control is discussed further in connection with the review of their toxicity.

**Stable flies.** The prevention and destruction of breeding places and the use of DDT as a residual spray (as recommended for controlling house flies) around barns and other places where the flies congregate offer the most effective means of control for this insect. These measures, however, do not provide a high degree of control under some conditions and may have to be supplemented by mist sprays containing pyrethrum or the thiocyanates.

The application of DDT to cattle provides very little protection to the animals. The insecticide is not repellent, but some of the flies died after feeding. Further studies are required to determine how effective it is in this respect.

Methoxychlor and the pyrethrum-piperonyl butoxide combination offer the most promise in providing long-lasting protection of animals from attack by stable flies. However, insufficient data are available at this time for the Bureau to suggest proper concentrations or frequency of treatments. Like DDT, benzene hexachloride, chlordane, chlorinated camphene, and TDE are of little value in protecting animals from stable fly attack, although some of them may kill the flies for some period after treatment of the animals.

**House flies.** The application of DDT residual sprays to the interior of barns, sheds, and any other places where flies concentrate has offered an effective means of controlling the house fly. For these sprays to be effective, however, rigid sanitation to prevent fly breeding must be practiced. Wettable powders, emulsions, or solutions of DDT may be used. For the wettable powder a 2.5 per cent concentration is recommended, whereas 2.5 to 5 per cent is suggested for the emulsions and solutions. The volume of spray or the amount of DDT to apply will vary with the type of surface being treated, but in general a deposit of 200 milligrams of DDT per square foot is recommended as most desirable.

During the current season reports have been received from many places in the United States that DDT is not providing satisfactory control of house flies. In many cases those reporting have stated that the same methods and materials employed with complete success during 1946 and 1947 proved unsatisfactory during 1948. Investigation of some of these reports has indicated that better control would likely have resulted if rigid sanitation had been practiced and if a higher percentage of the potential resting places for flies around the installations had been treated. Nevertheless, in some of these situations a higher degree of fly control should have resulted.

Extensive investigations are now under way at the Bureau laboratories at Orlando, Florida, and at Kerrville, Texas, in efforts to explain such failures. Most effort is being devoted to studying the relative efficiency of various types of DDT preparations and to determining whether house flies are developing a tolerance to
the action of DDT. Investigations have not progressed to a stage where an explanation of the major factor responsible for the failures can be offered. However, data obtained to date show that strains of house flies from certain local areas in Florida, where DDT has been used for several years, require much longer contact with DDT treatments to give mortalities comparable with those among flies which have not been previously exposed to DDT. These observations confirm earlier studies which showed that house flies under laboratory conditions can become resistant to DDT and other insecticides (Lindquist and Madden 13, Wilson and Gahan 17). Barber and Schmitt (1) have recently published data which show that a strain of wild flies collected in New York State show a marked resistance to DDT. Reports of the occurrence of DDT-resistant flies in Europe have also been published.

The development of such resistance to certain insecticides has been previously demonstrated for other insects, and there is no reason to discount available evidence that DDT-resistant strains of house flies have developed.

Because of the possibility that substitute materials might be needed for house fly control, a brief review will be given of available information regarding the effectiveness of the several new insecticides as residual sprays. These data were obtained largely by the Orlando laboratory of this Bureau in connection with its work on insects of medical importance to the armed services.

Methoxychlor is one of the more promising residual treatments for house flies and approaches DDT in lasting effects. In comparative tests in the laboratory with some of the other insecticides, deposits of technical benzene hexachloride, chlordane, and chlorinated camphene applied at the rate of 200 mg. per square foot of surface area caused high kill of flies for 9, 28, and 24 weeks, respectively. DDT in the same tests employing the same length of exposure remained effective for more than 36 weeks, even when it was applied at the rate of 50 mg. per square foot. In a few preliminary field tests chlordane and methoxychlor provided satisfactory control of house flies where DDT proved unsatisfactory, but the duration of the treatments has not been determined.

Horse flies and deer flies. A large number of species of horse flies (Tabanus spp.) and deer flies (Chrysops spp.) affect livestock. Aside from their vicious attack on animals, they are involved in the transmission of certain diseases. At present little is known about the life history and habits of most of the species and no satisfactory methods of control can be recommended.

Some studies have been conducted to determine the value of the new insecticides for protecting animals from attack by horse flies and deer flies. Some investigators have reported fairly satisfactory control with some of the materials, whereas others have reported negative results. Such differences are probably due in part to the variation among species in their reaction to the different materials.

In Texas tests on cattle have been conducted against Tabanus abactor Philip with DDT, methoxychlor, chlordane, TDE, and benzene hexachloride. None of the insecticides applied at concentrations as high as 2 per cent prevented engorgement, but 2 days after treatment most of the flies were killed after feeding on animals treated with DDT, the methoxy analog of DDT, and chlordane. DDT and methoxychlor show most promise, because some of the flies died when they took blood meals 5 days after the animals were treated. Tests have also been conducted with
piperonyl butoxide-pyrethrum insecticides. This treatment repels or kills the flies for varying periods. In some cases protection has been as low as 5 to 6 hours and in others at least partial protection has resulted for several days. Before recommendations are made, further studies with various dosages of the different insecticides are needed against some of the more important species of tabanids. However, there are some indications that fairly satisfactory control of horse flies may result in some instances following treatment of animals with some of the insecticides. Even though the flies may not be killed for more than 2 or 3 days after the animals are treated, the existing fly population in a given area may be depleted sufficiently to effect a reasonable degree of control.

**Screw-worm.** Proper ranch-management practices, which reduce the number of wounds on animals during the fly season, close observations at regular intervals of all livestock in infested areas and prompt and regular treatment of all wounds are the only effective means of avoiding heavy losses by the screw-worm (*Callitroga americana* (C. and P.). Two remedies developed by the Bureau of Entomology and Plant Quarantine, known as smear 62 and EQ smear 82, are recommended. The former is made up of the following ingredients (all parts by weight): Diphenylamine 35, benzene (benzol) 35, turkey red oil (pH 10 to 7) 10, lampblack 20. EQ smear 82 consists of diphenylamine 35, benzene 32, Triton X-300 (sodium salt of an alkylated aryl polyether sulfate) 2; n-butyl alcohol 10, lampblack 21. Smear 82 formula has no particular advantages over smear 62, but was recommended primarily as a substitute at a time when turkey red oil was in short supply. Other screw-worm preparations containing diphenylamine as the principal active ingredient are also on the market, but little information is available relative to their effectiveness.

Many stockmen have reported fewer screw-worm infestations among their stock since they began using DDT for controlling external parasites. Available data indicate that the treatment of the animals with DDT will not prevent infestations of wounds. However, various livestock parasites which are controlled by DDT are predisposing causes of screw-worm infestations and the use of this and other insecticides will reduce such infestations. Several species of ticks, notably the Gulf Coast tick and the horn fly cause a high percentage of the infestations.

**Fleece worms.** Preliminary investigations indicate that several of the new insecticides are promising for the control of fleece worms (*Phormia regina* (Meig.) and other secondary blow flies) attacking sheep. However, none of them have been developed for practical use.

**Sheep tick.** The sheep tick (*Melophagus ovinus* (L.)) is highly susceptible to most of the new insecticides. Rotenone dips are also highly effective for controlling this insect. From the standpoint of cost and efficiency rotenone is considered the most economical sheep tick treatment. A concentration as low as 8 ounces of the finely ground derris or cube root (rotenone 5 per cent) in 100 gallons of water is recommended. However, DDT has been employed successfully for controlling sheep ticks (Rude and Parish 16, Kemper et al. 11), when used as a 0.2 per cent dip. Recent tests conducted by the Corvallis, Oregon, laboratory indicate that benzene hexachloride (technical) and chlordane are particularly effective against this insect. Dips containing as low as 0.1 per cent of the insecticides resulted in complete control.
among sheep with long fleece. Chlorinated camphene was also highly effective but considerably slower in action. All three materials proved more effective than DDT. TDE and methoxychlor were somewhat less effective than DDT.

Spraying for sheep tick control is becoming popular among sheep owners; however, it is more difficult to eliminate sheep ticks with sprays than with dips. The amount of spray, length of the fleece, and type of material all influence the degree of control. At present insufficient data are available for the Bureau to suggest materials, methods, and concentrations that are most effective for sprays. Excellent control is indicated possible, however, with properly applied sprays, especially those containing chlordane and benzene hexachloride.

TOXICITY OF INSECTICIDES TO LIVESTOCK

Some of the major factors which must be considered in appraising the potential hazards of the new insecticides are (1) their effect on the host, (2) potential hazards to consumer of products from treated animals, (3) their influence on the quality and palatability of the animal products and (4) their effect on persons handling the insecticide.

Since at least six prominent new insecticides are likely to be offered for use on livestock, it is understandable that many questions regarding the toxicology of these materials remain unanswered. The problems become much more complex when it is realized that the different insecticides might be used singly or in combination and that they are formulated in several ways, involving the use of many different types of emulsifiers, solvents, dusts, or other ingredients. A mixture of insecticides might cause toxic reactions different from those of the individual materials and certain emulsifiers or solvents might increase the toxicity of a given compound.

Following is a brief résumé of some of the recent information obtained on the toxicity of insecticides. Some of the data have been reported by Bushland et al. (6) and Carter et al. (7), but much of the recent information has not yet been published. Thus far investigations have been limited largely to acute and subacute toxicity. Little is known about possible chronic toxicity to animals when the materials are applied repeatedly over a period of several years.

**DDT**

It is well established that DDT in itself is of a rather low order of toxicity to animals and that it will not harm animals when employed with reasonable precaution. The wettable-powder preparations in particular can be used at high concentrations without producing acute toxic effects on the animal. When DDT is employed as a solution or an emulsion, there may be some danger because of the increased toxic action of DDT when in solution and because of the possible toxicity of the solvents and emulsifying agents. However, DDT emulsions properly formulated and mixed have been applied to millions of animals without apparent harm.

One of the major concerns in connection with the use of DDT on livestock is the possible hazard to consumers of meat and milk from treated animals. Howell et al. (9) demonstrated that DDT applied to dairy cattle was secreted in the milk. Carter et al. (7) showed that the amount of DDT in the milk of cows treated by the recommended procedure for horn fly control averaged about 0.6 part per million during the
fly season. This amount gradually decreased when the treatments were discontinued. Whether such small amounts of DDT constitute a potential hazard is a question which toxicologists are attempting to determine. It is known also that animals heavily treated with DDT under experimental conditions will absorb and store considerable amounts of DDT in the fatty tissues. However, few data are available on the amounts stored when animals are treated in practical insect-control operations.

**Methoxychlor**

No adverse effects on livestock have been noted in connection with the use of methoxychlor, a close relative of DDT, even when the insecticides have been applied repeatedly at concentrations as high as 2 per cent. The Food and Drug Administration has found that the acute toxicity to laboratory animals of this material is of a much lower order that for DDT. It requires on an average, more than 6,000 mg./kg. to cause death of most laboratory animals. Methoxychlor seems not to be secreted in significant amounts in the milk. This insecticide is therefore of particular interest for controlling certain insects on dairy cattle and its use on dairy cattle should be encouraged as it becomes more generally available. Although somewhat more costly than DDT, it is equally as effective for controlling lice and only slightly less effective against horn flies. Preliminary tests indicate also that it will aid in protecting the animals from stable flies. Methoxychlor should be applied in the same way and employing the same concentrations of insecticide recommended for DDT.

**TDE**

This insecticide is an analog of DDT, but is of a lower order of toxicity to animals than is DDT, but somewhat more toxic than methoxychlor. No adverse effects on livestock have been noted when applied repeatedly at concentrations up to 2 per cent. It is secreted in milk of dairy animals when used for horn fly control but Carter et al. (7) report a slightly lower average than that of DDT on the basis of tests conducted in 1947. Tests conducted in 1948 indicate that the average amounts are about the same for the two insecticides (unpublished data).

**Benzene hexachloride**

Benzene hexachloride has been employed extensively in the United States and other parts of the world for controlling insects, ticks and mites on livestock. Thus far only a few reports of toxic effects on livestock have been reported following treatment with this material. Information obtained by the Kerrville laboratory indicates that the insecticide can be safely applied to older cattle, sheep, goats and swine at concentrations likely to be employed for controlling such pests as ticks and lice. Repeated treatments with up to 1.5 per cent of technical benzene hexachloride failed to produce toxic symptoms in such animals. However, recent tests show that calves less than 2 months of age are far more susceptible to benzene hexachloride than are the older animals. Toxic symptoms have been produced when such calves were thoroughly saturated with a wettable-powder spray containing 0.5 per cent of technical benzene hexachloride (0.05 per cent of gamma isomer). The relative
susceptibility of calves of different ages has not been determined. Until more is known regarding the toxicity of this material, it should be used on an experimental basis only. When it is applied to young animals, the concentration should not exceed 0.25 per cent of the technical grade or 0.025 per cent of the gamma isomer.

When excessive amounts of the insecticide have been applied, some odor and taste have been detected in the flesh of cattle and swine. However, off-flavors or odors have not been detected when animals were treated with the amounts and frequency likely to be employed in controlling livestock pests.

Chlorinated camphene

From the standpoint of cost and efficiency chlorinated camphene is one of the most promising of the new insecticides for controlling livestock pests. Preliminary investigations indicated that it could be applied repeatedly to farm animals at concentrations up to 1.5 per cent without producing acute toxic reactions. However, following its use as dips by stockmen in Texas, deaths among cattle, principally calves, were reported. Special investigations to determine the cause of such deaths were undertaken by the Kerrville laboratory, in cooperation with William Cooper Nephews Co., Inc. and Hercules Powder Company. Young calves less than 3 months old were found to be more susceptible to this insecticide than yearlings and older cattle. Toxic symptoms were evident among some young calves that had been thoroughly sprayed (simulated dipping) with 1.0- and 1.5-per cent concentrations of the insecticide. Emulsions and wettable powders showed no great difference in toxicity, although the latter was indicated to be less toxic. No acute toxic effects were noted when a concentration of 0.75 per cent was applied to calves, although large numbers of animals have not been treated. The concentration of this insecticide required for satisfactory control of the more resistant parasites, such as ticks, ranges from 0.5 to 0.75 per cent.

It is possible that chlorinated camphene can be developed for certain uses as a livestock-pest insecticide when it is properly formulated and carefully applied. However, with the types of formulations investigated there is only a narrow margin of safety between the maximum concentration needed for controlling parasites such as ticks and the acute toxic dose for calves. No tests have been conducted to determine whether chronic toxicity develops when sublethal concentrations are applied repeatedly over a period of several years.

Chlordane

Chlordane has been employed to some extent for controlling livestock pests. No injury to animals has been reported following its use at concentrations of about 0.25 per cent, although it has killed cattle, sheep, and goats when applied in greater amounts and more frequently than would be needed for controlling various parasites.

When cattle were thoroughly sprayed at 2-week intervals with a wettable-powder suspension containing 2 per cent of chlordane, some of them were killed after the fourth treatment and those surviving showed evidence of harmful effects. In other tests sheep, goats and cattle were killed with a 1.5-per cent emulsion and with wettable-powder sprays applied four times at 4-day intervals. The toxicity of chlordane varied in different tests. A breakdown of the formulated preparations might be a factor explaining such variations.
It is possible that chlordane can be used with safety at the concentrations needed for controlling certain pests. However, further tests with repeated applications employing various concentrations and different age animals should be conducted before maximum concentrations which will prove safe can be determined.

*Pyrethrum with piperonyl butoxide*

During recent years materials have been developed which greatly enhance the insecticidal action of pyrethrum. Perhaps the best known of these materials is piperonyl butoxide. This material with pyrethrum is being offered to livestock growers for controlling certain parasites such as flies and lice. There are no indications that toxic effects will be produced when this type of insecticide is applied to livestock with ordinary precautions, therefore the use of this insecticide on livestock should be encouraged, particularly for controlling pests on dairy cattle.

**Suggestions for Further Research and Control of Livestock Pests**

Livestock growers have become increasingly aware of the losses caused by external parasites and they are anxious and willing to employ effective control methods. The widespread use of DDT for controlling the horn fly on cattle is an example of the enthusiasm shown by farmers and ranchers for a new method of protecting their animals from insect attack.

Information is accumulating slowly which indicates that external parasites of livestock take a heavier toll of the stockman’s profits than was formerly believed. Weight-gain studies conducted in Kansas in 1945 (Laake 18) showed that controlling high populations of the horn fly increased the daily gain by one-half pound per head of beef animals. Recent studies in Illinois by Bruce et al. (5) have shown that cattle subjected to moderate infestations of the horn fly and stable fly produced approximately 10 per cent less milk than did treated herds. Similar information is needed for these and other external parasites to determine precisely how important various livestock pests are. Such knowledge would serve as a guide to stockmen in developing sound livestock-management practices. It would also aid research workers, extension service personnel, veterinarians and others who are responsible for recommending new management practices.

The most urgent research problem in the animal-parasite field is the toxicity of insecticides to animals and man. Certain materials are employed on livestock today which might have an acute or a chronic effect on the health of animals. Toxicologists are also concerned about the potential hazard to man resulting from consumption of meat and milk which might contain significant amounts of insecticide. On the other hand, some of the highly effective insecticides may be safer to employ than others now in use, but they are not being recommended because of lack of information relative to their toxicity.

Toxicological investigations of the kind needed cannot be conducted with limited funds and man power, and several years’ observations may be needed, especially for chronic studies. Such studies must take into account the specific insecticide and various types of solvents, emulsifiers, and other adjuvants. An appraisal of their toxicity should be made on different classes and age groups of animals. New chemicals for use in controlling livestock pests will surely be forthcoming. If we are to determine their merits or their limitations within a reasonable period of time,
studies on their toxicity will have to be given high priority. Necessary toxicity studies should be conducted before materials are employed in livestock pest control and not after they are in use, as is taking place today.

No satisfactory methods of controlling several important livestock pests are known. Perhaps the greatest need at present is a method of protecting animals from attack by horse flies and deer flies. Satisfactory or improved methods are needed also for controlling a number of other parasites, including screw-worms, stable flies, cattle grubs, sheep bots, and various ticks.

On the other hand, excellent methods are available for controlling lice on sheep, goats, swine and cattle, and horn flies and sheep ticks. The writer believes that stockmen are not taking full advantage of the progress that has been made in controlling these insects. There is every indication that the insects mentioned could be completely eliminated from animals in large areas or regions with little expense and effort. Carefully controlled demonstration areas should be first organized to determine whether eradication is possible and feasible, but there is every indication that two properly timed dippings of all animals with the proper insecticide or combination of insecticides now available should eliminate the several parasites mentioned. On the basis of recent reports from several investigators, certain mange and scab mites attacking these animals might also be eliminated at the same time.

Aside from losses in profits to the livestock industry resulting from continued attack by these arthropods, the uncoordinated control efforts of individual stock owners as now practiced will mean in the end far greater cost in material and handling of animals. Furthermore, the uncoordinated control procedures and continued use of insecticides might increase chances of chronic toxicity hazards to man and animals. Such practices might also result in the development of strains of parasites more and more resistant to the chemical agent now employed for their control, as now appears to be the case with house flies that are resistant to DDT.

LITERATURE CITATIONS


INTERNAL PARASITES

The accepted drugs for use against internal parasites of farm animals and their methods of use, have been adequately described in previous reports. In the present report, therefore, it is necessary only to make brief reference to a few new facts concerning these treatments which have come to light during the past year or so. These relate particularly to (1) the use of the free-choice method of administering phenothiazine to sheep; (2) to the rate and method of administering sodium fluoride to swine; and (3) to the use of lead arsenate as a taeniacide for ruminants.

Phenothiazine for Removal of Worms from Sheep

Two aspects of the free-choice administration to sheep of phenothiazine in loose salt or mineral mixtures are worthy of note. One is that the procedure cannot be interrupted or discontinued without risk of severe parasitism in flocks that have been on this regimen. The other is its apparent controlling influence on certain species of parasites against which the drug is not therapeutically effective.

Sheep raisers, quite reasonably, are motivated to practice parasite control because of losses caused by parasites in their flocks. In a few instances, there has been a disinclination to pursue carefully the program of self-medication after a flock has shown no ill effects from parasitism for a few years. From the experimental standpoint, moreover, there was no evidence than an indefinite continuation of phenothiazine-salt prophylaxis was either desirable or necessary, provided adequate medication was given to new animals before their addition to the flock. A trial interruption of the regimen, made by the Zoological Division of the U. S. Bureau of Animal Industry, on a flock of grade sheep which had been maintained on a 1–10 phenothiazine-salt mixture for five years, with excellent control of internal parasites, resulted in rapid increase of parasites as determined by fecal egg count, followed by sudden deaths of a few adult sheep from acute haemonchosis. The results were ascribed to the persistence of low-grade, but potentially injurious, residual infections and the absence of a well-marked immunity in the animals that had benefited from the parasite-control measure. In this instance, further losses were checked by giving therapeutic doses and reverting to the free-choice regimen, but only after it was found that therapeutic doses of phenothiazine were essential to achieve success when the program was resumed. It is concluded, therefore, that sheep raisers should guard against carelessness from a feeling of security when there are no further losses from parasites.

Regarding the efficacy of the regimen under discussion, it has sometimes been felt by experimenters and sheep raisers alike that the scheme of prophylaxis may
exercise some control over parasites such as intestinal wireworms (*Nematodirus*), tapeworms, cooperias, and possibly some others, against which phenothiazine is not known to exhibit any significant anthelmintic effect. It is of note that some recent studies seem to substantiate this view, more particularly with reference to the influence of the regimen in controlling *Nematodirus* and tapeworms. Since there is some evidence, also of comparatively recent date, that these species may be more injurious than hitherto supposed, observations of the kind mentioned seem to enhance the value of the free-choice ingestion of phenothiazine in salt as a measure for the control of sheep parasites.

**Sodium Fluoride for Removal of Roundworms From Pigs**

The administration of sodium fluoride in dry, ground feed at a concentration of 1 per cent for a period of one day has proved to be a safe, effective and economical measure for removing large roundworms from swine. Continued trials with this treatment, however, suggest that concentrations of 0.75 per cent may approximate more nearly the optimum dosage. The problem is especially complicated because dosage depends as much upon the amount of medicated feed consumed as upon the concentration of the chemical in the feed. At the 1 per cent level, medicated feeds are sufficiently unpalatable to prevent excessive consumption of the mixture and also sufficiently irritating to cause reflex vomition in the occasional instances of overindulgence. At concentrations as low as 0.5 per cent, these natural safeguards to intoxication seem to be largely lost with some associated loss in anthelmintic efficacy. As far as has been determined, however, administration at the 0.75 per cent level appears to preserve these safeguards as well as the high efficacy of the treatment. The problem requires further study, however, before definite recommendations can be made, although cautious use of the 0.75 per cent dose rate should be encouraged. Treatment for the removal of roundworms may be given shortly after weaning. Pigs may be treated again after an interval of about 2 months.

**Lead Arsenate for Removal of Tapeworms from Ruminants**

Spray-grade lead arsenate (acid form) has come into field use as a treatment for the removal of tapeworms (*Moniezia* spp.) from sheep, goats and cattle. The chemical has been employed in doses from one-half gram for lambs and kids to 2 grams for mature cattle. The experience, so far as known, has been entirely favorable. Moreover, the literature records the experimental treatment of over 4,000 animals, mostly lambs and kids and the results show that the treatments were safe, effective and beneficial to the animals. Analyses, although still meager, suggest that the amounts of lead and arsenic occurring in the tissues of treated animals are too small to be of consequence from the standpoint of human consumption. More information is needed on this point and likewise on the optimum doses of the chemical, and of contraindication to its use. Notwithstanding these gaps in our information, there appears to be no reason to discourage the use of the lead arsenate treatment, provided it is not given to animals within 4 to 6 weeks of the time that they are destined for slaughter, since some interval is desirable to allow for the maximum possible elimination of lead and arsenic from the tissues.
EXTERNAL PARASITES

Benzene Hexachloride Dips for Treatment of Sheep Scabies

According to information available in the Bureau of Animal Industry, based on reports received up to June 1948, sheep scabies is still present in 14 States, the flocks involved numbering approximately 300, with a total of somewhat less than 15,000 head. The States involved are in the South, East, and Midwest. Although the disease is no longer of great economic importance, there is still a need in practically every State for extreme vigilance to prevent the introduction and/or spread of sheep scabies. Even in States where the disease has been absent for years, Federal and State inspectors are still available for preventing the introduction of scabby sheep, and arresting the spread of scabies if it should gain entrance.

As is well known, sheep scabies is treated by dipping affected and exposed flocks in medicated solutions. Dips commonly used and permitted in official dippings of sheep for scabies are (1) lime-and-sulphur, and (2) nicotine solutions. At least two dippings, 10 to 12 days apart, in warm dip are required for the eradication of the disease from a flock.

Recently, the Federal Bureau of Animal Industry and other agencies have experimented with a new dip prepared by adding to cold water a chemical known as hexachlorocyclohexane, and commonly known in this country as benzene hexachloride or BHC. This chemical was first synthesized in Great Britain in 1828 but remained a chemical curiosity until the war years. Among its many other parasiticidal uses, BHC has shown an amazing specificity in killing the sheep scab mite (Psoroptes) even in very low dilution.

BHC is available for field use as a powder which usually consists of (1) 50 per cent of technical BHC containing generally 12 per cent of the gamma isomer—the active fraction of the compound—and (2) 50 per cent of inert diluents, wetting agents and fillers. The gamma isomer content of such powder as a whole is, therefore, 6 per cent. Some commercial powders contain only 5 per cent and others 10 or more per cent of the gamma isomer. For practical purposes, the 5 per cent gamma isomer product may be used in place of the comparable 6 per cent product. When the 10 per cent product is used only about half as much is needed in place of the 5 or 6 per cent product. The experimental work conducted by the Federal Bureau of Animal Industry with BHC as an acaricide on sheep involved for the most part the commercial product containing 6 per cent gamma isomer. From the standpoint of scientific interest, it is noted in this report that dipping scabby sheep only once in a dip containing one pound of the wettable BHC named per 100 gallons of water was sufficient to destroy all mites; however, some mites were still alive 36 hours after dipping. The percentage of the active ingredient (gamma isomer) in this low concentration dip was 0.0075 per cent. By doubling the strength of the dip, namely, adding 2 pounds of the commercial powder to every 100 gallons of water, all mites were destroyed in about two hours. Increasing the strength of the dip to 4 and even 8 pounds of the acaricidal powder per 100 gallons of water, did not appreciably accelerate the destruction of the mites.

For practical purposes of eradication of sheep scabies with BHC dips, 8 pounds of the wettable powder (containing 5 to 6 per cent gamma isomer) per 100 gallons of
water appears to be adequate. This concentration has been found in field trials to destroy all mites on shorn and unshorn ewes, bucks, and lambs, and to resolve the lesions.

Only one dipping in unheated dip proved adequate to destroy the most severe infestations with scab mites on sheep encountered in Louisiana and Virginia. The BHC dip destroyed not only scab mites but also true ticks, keds or so-called sheep ticks, and lice. BHC appears, therefore, to be of marked value as an all around treatment for the destruction of external parasites on sheep.

**New Treatment for Hog Mange**

Sarcoptic mange is quite prevalent in hogs in this country, being especially common in the Corn-Belt area where the swine population is greatest. In the past various medicaments such as petroleum oils, lime-and-sulphur dip, coal-tar creosote dip, and arsenical dip have been used to control mange in swine. Among the devices used for applying acaricidal substances to hogs are self-oilers of various kinds, medicated wallows, spraying, and dipping. All past efforts have been directed to the control of the disease rather than to eradication.

During the year information has become available on the acaricidal efficacy of two parasiticides for hog mange, namely, BHC and chlordane. By preparing sprays of wettable BHC already referred to in the section on sheep scabies, hog mange was completely eradicated in several herds by workers of the Federal Bureau of Animal Industry. The lowest concentration successfully tested contained $1\frac{1}{2}$ pounds of the powder for 10 gallons of water, the percentage of gamma isomer in the spray being 0.13. No information is available on the sarcopticidal efficacy of lower concentrations.

The rapidity of the destruction of the mites varied with the strength of the spray used, the concentration made requiring 6 hours to kill the mites. The commercial BHC used produced no visible discomfort or other injury to the swine and the musty odor of the chemical on the hogs was dissipated after about two days, but persisted for about two weeks in the shelters where the animals had been sprayed.

Recently a report has come to light on the value of chlordane as a treatment for sarcoptic swine mange. About 1,000 head were sprayed with 0.25 per cent emulsion of this chemical. The conclusion, in the words of the author of the report is as follows: “The tests indicate that one application of a 0.25 per cent chlordane solution when thoroughly applied will completely clean up sarcoptic mange.” Inasmuch as the toxicity of chlordane is still under investigation, this treatment must be regarded as still in the experimental stage. The reference to chlordane in this report should not be construed as a recommendation for its use.
COMMITTEE ON LEGISLATION

WILL J. MILLER, Topeka, Kansas, Chairman; T. O. BRANDENBURG, Bismarck, North Dakota; W. J. BUTLER, Helena, Montana; G. H. GOOD, Cheyenne, Wyoming; R. A. HENDERSHOTT, Trenton, New Jersey; C. E. KORD, Nashville, Tennessee; B. T. SIMMS, Washington, D. C.; FERD MOLLIN, Denver, Colorado; JOE MONTAGUE, Fort Worth, Texas.

It is recommended that the committee on legislation for the coming year give consideration to the following suggestions:

1. That a bill be introduced into Congress to provide for the building of an animal-tight fence along the border between the United States and Mexico.

2. That a bill also be introduced to appropriate sufficient money to provide adequate patrol of such border.

3. That a bill be introduced into Congress to provide the authority for the U. S. Secretary of Agriculture to promulgate health requirements for all animals and birds in interstate commerce by any form of transportation.

4. That our association continue to work for legislation which would make it possible for the Department of Agriculture to cooperate with the various states in the control of infectious diseases of domestic animals.

5. To recommend legislation which would give the Department of Agriculture control over the sale and distribution of biological products containing live disease producing organisms, such as swine erysipelas vaccine, ovine ecthyma, laryngotracheitis, fowl pox, hog cholera, Newcastle virus vaccine, anthrax, products made from Brucella organisms, tuberculin, mallein, and such diagnostic agents as enter into the control of these diseases.

REPORT OF THE AUDITING COMMITTEE

C. P. BISHOP, Harrisburg, Pennsylvania, Chairman; H. G. GEYER, Columbus, Ohio; T. C. GREEN, Charleston, West Virginia.

Your committee has carefully examined the books and records of the Secretary-Treasurer and finds them to be correct, as presented October 13th, 1948.

We believe the Secretary-Treasurer should be commended for the excellent manner in which the finances of the Association have been handled.
In 1939 the author learned about a steam cleaning unit used in the animal hospital of Dr. M. A. Northrup (1) in San Francisco. The cleaning job done was unique because it was the only way Dr. Northrup was able to free his hospital of ticks. Spraying and even painting failed to kill the ticks deeply imbedded in the wainscoting. His high pressure Jenny delivered hot water in steam with an incorporated detergent and successfully destroyed all ticks, besides doing a completely satisfactory cleaning job on irregular, worn, wood surfaces.

A similar unit was purchased for the San Diego Zoo and was used successfully in cleaning stucco and cement surfaces fouled with feces in monkey cages, cement surfaces in drinking cups and swimming and wading pools for bears, small mammals, birds and seals, fouled with algae and imbedded organic matter. We have now had seven years experience with steam vapour spray cleaners used on a variety of surfaces, including wood, concrete and composition animal quarters, cow, horse and sheep barns, swine pens, rabbit hutches and metal small animal and bird cages in a manufacturing plant.

The experience has been so entirely successful that it was suggested that a paper be prepared describing the use of high pressure steam vapour spray cleaners.

We must first agree that environmental cleanliness is an essential part of disease and parasite control and that disinfection—the freeing of the immediate environment where animals are kept of infectious and parasitic agents—is an essential disease-preventive measure in good farm management. If we accept these premises, we must then consider how the job can be done most effectively at lowest cost.

In a recent communication, E. C. McCulloch states (2), “when equipment has been cleaned, sanitation probably has been accomplished—that is to say, I consider a thorough job of cleaning to be 98% of the process of disinfection.” What is a “thorough job of cleaning”? Mallman and Chandler (3), and others, have shown the inability of our best disinfectants to kill pathogens, bacteria and viruses imbedded in fecal material. In one experiment, 1:500 bichloride of mercury, 5% tincture of iodine, 2% formalin, 1% creolin, chlorine in a concentration of 1 pound chlorinated lime in 4 gallons of water, failed to sterilize suspended chicken manure in 30 minutes.

Johns (4) showed, by a dried skim milk slide technique, the inability of quaternary

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Plate 1.—A typical high pressure steam vapor spray cleaning unit

Plate 2.—Showing detail; oil burner for flash boiler, water and detergent injector pump and panel for adjusting detergent concentration, water volume, and pressure
CLEANING AND DISINFECTION ON FARM

ammonium compounds like roccal and strong hypochlorite solutions to penetrate the milk film and destroy the imbedded microorganisms. Mallman and Churchill (5) showed that concrete walls in food storage units, seeded with molds and bacteria, had a population of 28,000,000 organisms per 2 square inches of surface. After washing with trisodium phosphate, the population was reduced to 380,000; when followed by a water rinse, 53,000; and when then vigorously scrubbed with a cationic disinfectant, the population was 0. It would seem that disinfection of unclean surfaces has little or no value and the foregoing data stresses the importance of thorough preliminary cleaning.

In a cleaning program, therefore, it is first essential to completely remove manually all manure and physically perceptible dirt. Obviously, the equipment and environment will still have too much organic matter remaining to permit an effective disinfection job after broom, hoe, and shovel cleaning. Hand scrubbing the area at this stage is laborious and for the most part unsuccessful, because inaccessible areas remain as danger spots. Water with suitable incorporated wetting agents, under high pressure, will reach all areas. It is also important to use hot water. The literature abounds (6) with authoritative data demonstrating the increase in effectiveness of detergents and disinfectants as the temperature is increased. If the disinfecting job can be accomplished together with the cleaning job, one step is eliminated and the labor cost is reduced.

What combination detergent and disinfectant should we use? The quaternary ammonium compounds have been studied in detail by McCulloch (7) and others and while they have a place in hospital-laboratory and food-industry sanitary practice, they have too limited use, are not fool-proof and are too costly for farm disinfection. The cresols and other coal tar preparations are smelly. It would seem that, for greatest detergent and disinfection effectiveness and greatest economy, the alkalies should be used. Obviously, lye is the best, most effective and most economical, but not the safest for the operator. The orthosilicates, sodium phosphates and sodium metasilicates are readily available and inexpensive. Especially compounded preparations, consisting of caustic soda or other alkali as a base, are available at two to three times the cost of lye, but may, in the long run, be the safest and most effective agents to use. McCulloch (8), however, writes, "momentarily heating a contaminated surface to 75° C . . . with a solution of one of the newer anionic detergents such as Oronite, D-40, or naccanol . . . or similar product sold to the package trade . . . Dreft, Swerl, and Tide . . . will give reasonable assurance that all (non-spore bearing) pathogens will be killed. These can be used alone in a solution of about 1 pound of the detergent to approximately 40 gallons of water, or used in combination with some of the alkalies. Trisodium phosphate is one of our best alkaline cleansers and is not as damaging to painted surfaces as are the stronger alkalies. However, cold solutions of trisodium phosphate do not kill the ordinary pathogenic bacteria such as occur in maternity stalls and in calf pens. Very hot solutions of trisodium phosphate would, however, be effective bactericides. Sodium metasilicates or orthosilicates, which are quite cheap when purchased in 100-pound lots, are somewhat stronger alkalies than trisodium phosphate and are considerably better germicides. Used hot, these do an excellent job of cleaning and are only slightly damaging to painted surfaces. Of course, the very best disinfectant, insofar
as efficiency and cheapness is concerned, is ordinary caustic soda or lye. One 13-ounce can of lye to 15 gallons of water, or one pound of lye to 20 gallons of water,
Plate 5.—Illustrating overhead cleaning operation

Plate 6.—Effectively removes organic matter from stall planking, wire partitions, drinking cups, and mangers
is a very effective bactericide which is also a reasonably good cleaner. It does possess the disadvantage of injuring paint, although, in common with other alkalies, it actually is beneficial to concrete.

"After a good thorough job of cleaning with a hot solution of either the new anionic detergents, or the alkalies, or a combination of the two, I see no necessity for following with any other disinfectant. I am positive these compounds will kill any organism that the quaternary ammonium compounds would kill, as the quaternary ammonium compounds admittedly are not effective against spores. Hypochlorites, used sufficiently strong might kill spores but I am not too enthusiastic over their use, particularly in view of the fact that they corrode metals. The cresols, if used sufficiently strong, are excellent bactericides, but I am prejudiced against their odors".

We have shown that,
1. We should remove gross filth;
2. We should use water under pressure to get into every recess to carry out organic matter;
3. We should use the commonly available alkalies or anionic detergents;
   a. for ready availability,
   b. economy,
   c. effectiveness,
   d. active under all conditions,
   e. leave no residue,
   f. are odorless,
   g. are not injurious to livestock;
4. We should use hot solution because, at high temperature, the common detergents are bactericidal.

The so-called steam jenny vapour spray units, available through several manufacturers¹, (1) deliver a stream of water at over 100 pounds pressure; (2) deliver water at 60°-70°C. to the area being cleaned (over 100°C. as the water leaves the nozzle); and (3) incorporates the detergent and disinfectant in the water stream in any desired concentration. Such units are available with gasoline driven engines or electric motors operating at 110 volts for pump and flash boiler—burner power. A continuous source of water can be fed into the unit through a hose, or can be carried in a tank reservoir. The volume of water delivered is small and adjustable, which makes for water economy.

These units make excellent fire fighting equipment and can be used for a variety of cleaning operations.

We have successfully aided many disease control programs and have made buildings contaminated with strangles streptococci, paratyphoid and many other bacterial and viral infections, again safe to house livestock. It would seem desirable to encourage the use of this type of cleaning unit on the farm.

BIBLIOGRAPHY


THOUGHTS ON MORBIDITY AND MORTALITY REPORTING

C. E. WICKTOR, D.V.M.

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Morbidity and mortality statistics of animals have become a burning necessity. The time has arrived for the veterinary profession to become cognizant of the necessity for complete reporting of both morbidity and mortality of livestock under its jurisdiction. Such a system should be inaugurated and managed by those in the profession who are responsible for the control and eradication of livestock diseases so they can control what shall constitute reportable diseases. If such reporting is instituted by some other, outside agency, stress may be placed on those diseases which are of special interest to them and thereby may not be as beneficial to veterinary science and the livestock industry.

The needs for inaugurating a reporting system for morbidity and mortality on a nation-wide basis are many. A few of our weak points under present conditions are:

1. We base our knowledge of total losses from a given disease on estimates arrived at through various and sundry channels.
2. We are hazy, in many instances, as to what species of animals are affected by a given disease.
3. The area in which a disease is indigenous is, for the most part, known only by the local veterinarians and livestock men.
4. New areas of infection become old before proper authorities become acquainted with their presence.
5. Diseases strange to this country may not be reported immediately.

Complete knowledge of the foregoing is essential if we are to properly and quickly control or eradicate livestock diseases. This can be done only if a proper reporting system is in force.

The methods to be used in reporting and collecting statistics relative to morbidity and mortality have been widely discussed at meetings and via questionnaires. It appears that our coverage, at least for some time, cannot and should not be compared with human reports. The reason for not making such comparison is that most states, if not all, require a certificate from a physician stating the cause of death. This is out of the question when applied to animal deaths.

I believe the veterinary profession is in a much better position at the present time to inaugurate a morbidity and mortality report than ever before. This is due to the fact that our younger veterinarians and graduates coming out of school have been impressed with the necessity of the profession working as a unit instead of as "lone wolves"; veterinary associations are more active, which also tends to knit the individuals together for the good of all; and, last but not least, the "Great White Father" has asserted that a tax on income is forthcoming resulting in better bookkeeping methods.

The various agencies requiring reporting of infectious diseases in Los Angeles County at the present time are of interest.

The California State Department of Agriculture considers the following diseases reportable: glanders, anthrax, hog cholera, sheep scab, cattle scab, equine encephalo-
myelitis, infectious equine anemia, dourine, erysipelas, trichomoniasis, aphthous fever, Texas fever, vesicular exanthema, vesicular stomatitis, and other animal diseases specified by the department.

The Los Angeles County Live Stock Department requires the reporting of all infectious diseases of livestock.

The Los Angeles County Health Department requires reporting of tuberculosis, glanders, anthrax, rabies, actinomycosis, cysticercosis, trichinosis, tularemia, coccidiosis, and equine encephalomyelitis.

I presume this is but an example of what is occurring in other sections of the country. A veterinarian will not even attempt to satisfy the law requirements in such instances, which again shows the need for central reporting agencies which have uniform requirements.

Changing the late Will Rogers' vernacular term slightly, I only know about our difficulties in Los Angeles County as applied to morbidity and mortality reporting. We have found that the average, practicing veterinarian is anxious to shift at least part of the responsibility of these outbreaks to a regulatory body, providing he can get immediate action and no attempt is made to push him out of the picture.

Practicing veterinarians make all their reports to our office via telephone unless otherwise agreed upon. We attempt to make an appointment with the veterinarian that day on the premises involved. We have found this prompt action very gratifying to both the veterinarian and his client as they know we have a real interest in their problem.

The veterinarian from this department obtains all history possible, including morbidity and mortality. He conducts ante mortem and post mortem examinations, if suitable animals or carcasses are available and makes a complete autopsy record. If the lesions present are not sufficient for a positive diagnosis, specimens are submitted to the laboratory.

Periodic contacts are made with the infected premises, as often as seems desirable, until the disease has subsided.

When the case is complete, we have as records the autopsy reports which include morbidity and mortality, the laboratory report and the case history as it appears in the department veterinarian's monthly report.

I believe we have as complete a picture of infectious disease outbreaks as we are able to procure; however, hundreds of miscellaneous deaths remain unaccounted for with the exception of those deaths that occur in which the practicing veterinarian does not feel sure of his diagnosis and requests an autopsy by this department.

It can be conservatively estimated that 90 per cent of the dead stock in Los Angeles County are disposed of through four rendering plants in the Los Angeles City area. If a complete morbidity and mortality accounting were to be made, it would require the services of two veterinarians, on a six-day-week, at the rendering plants. This would incur an expenditure of at least $10,000 per annum, which appears rather high especially since our coverage of infectious diseases is as fairly complete as heretofore stated.

We can readily see that but a few counties in this nation are as fortunately situated, nevertheless a morbidity and mortality report on a nation-wide scale should be inaugurated, utilizing as many well equipped units as possible in the program.

The general organization and functioning of such a project on a national basis is
a tremendous task. The Committee on Morbidity and Mortality Statistics of this association cannot hand you a functioning organization for the collection of such statistics other than gather data as to procedure and act in an advisory capacity. The project is so large that it requires the cooperation of livestock organizations, United States Bureau of Animal Industry, the regulatory officials of each state, the American Veterinary Medical Association, state veterinary associations, and local veterinary associations.

It seems plausible that we should have standard nomenclature in order that we may all understand each other. The question as to who should compile and edit such a manual is another thought. Most likely this will fall under the jurisdiction of the American Veterinary Medical Association in order that more individuals interested may have their say before the first edition goes to press.

A manual on diagnostic procedure is valuable particularly as far as laboratories are concerned. However, those of us who are in close contact with the practitioner can see it will be of little immediate value. The average large animal practitioner relies on his clinical observations and an occasional autopsy for his diagnosis. We find that throughout the country a large percentage of diseases reported by practitioners are diagnosed by those means.

I do not believe we should put off the inaugurating of a good mortality report for several years due to the lack of manuals of standard nomenclature and diagnostic procedure.

Assuming that this association is serious regarding a morbidity and mortality report, I propose the following procedure.

First, we should confine our activities, for the present, to a mortality report, as veterinarians are accustomed to some requirements covering this matter.

Second, the various state officials should concur in compiling a list of reportable diseases for the purpose of uniformity.

Third, this list should include, among other diseases, those which are transmissible to man.

Fourth, each state regulatory official should be given the power to set up his own system of accumulating such reports.

Fifth, state officials should prepare and distribute printed forms to all licensed veterinarians and laboratories for weekly reporting. This report should be returned to state officials properly filled out even though no reportable diseases occurred within that week. Forms used by laboratories may be more inclusive, that is, diseases not readily diagnosed clinically. Forms submitted for reporting diseases may also contain items covering morbidity, if desired, which is true at the present time of the California reports.

Sixth, intensive and continued publicity should be circulated to veterinarians and others regarding reporting of those diseases.

Seventh, all veterinary publications should be contacted for space in furthering publicity.

If the publicity is intensified and methods of reporting are not burdensome, I believe we can eventually work out a fairly decent mortality report. But publicity and more publicity is necessary as we have found in Los Angeles County when we were collecting data on the prevalence of certain diseases.
MORBIDITY AND MORTALITY

I believe state officials should, beside the foregoing, pick a strategic county within their state and work up a complete mortality and morbidity report on a more elaborate scale and make use of veterinarians, farm advisors, farm bureaus, and other active agents within that county, chiefly on an experimental basis. By doing this, we will be able to correct the deficiencies and make such changes as are necessary with a minimum of confusion. If we start such a project on a state or nation-wide basis at once, necessary changes may create such confusion that the whole project may collapse.

Such a project also would assist us in more accurately determining losses from specific diseases which may be of especial interest.

The United States Bureau of Animal Industry should be the national reporting agency because it is the national agency responsible for the control and eradication of livestock diseases. As to how often the state officials should make their report to the Bureau of Animal Industry is a matter that should be settled between the interested parties.

The national report distribution, I believe, could be limited to the state officials, veterinary colleges, veterinary research establishments, and leading veterinary journals in this country and to the latter only if the material were to be published in their journals along with such other publicity as the Bureau of Animal Industry and state officials would require.

The cost of accumulating these records should not be much more than the ordinary, haphazard methods in use in most states today. I sincerely believe that our failure to-date is due to the lack of publicity. For instance, if we expect the practicing veterinarian to be so interested in reporting infectious diseases that he will go to the trouble of making inquiry as to what and to whom to report, we are doomed to failure.

When a veterinarian gets his license to practice veterinary medicine, he should be given a complete picture of what is expected of him. It might be a good idea, when reportable diseases are standardized, to make this a constant question on the State Board Examinations. By doing this, you may be assured that veterinary college instruction will place special emphasis on reporting infectious diseases and also on the diseases which are reportable.

Education and publicity by repetition are the essentials in getting diseases reported from the initial source.

As a closing thought, it seems we should include dogs and cats in this report because of diseases existing in these animals which are transmissible to both man and other animals. The correlation may be of immense value and interest. While they are not legally included as domestic animals, because the term is generally applied and confined to the food producing species, they are certainly important members of the farm flock and family group.

SUMMARY

1. State regulatory officials to agree on reportable diseases and include diseases transmissible to man.

2. State regulatory officials to set up a system of reporting in their states most suitable to their area and conditions.
3. State regulatory officials to make reports to United States Bureau of Animal Industry at such times as are agreeable to both.

4. United States Bureau of Animal Industry to be the national reporting agency.

5. Every effort used to first establish a mortality report and when functioning properly to add a morbidity report.

6. Publicity and more publicity be given veterinarians concerning their duty in this matter, stressing the benefits to be derived therefrom and the value to the livestock industry of these data as a means of disease prevention and control.
THE COMMITTEE ON NOMENCLATURE OF THE A.V.M.A.
Its Function and Activities
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More and more the tabulations of numerical facts on birth, morbidity and mortality among domestic animal populations—veterinary vital statistics—is receiving the notice of persons interested in the problems of disease. Many profess an assurance that adequate and accurate veterinary vital statistics will help to focus attention to the problems which require further investigation and research and that they can be a means for evaluating the successes or failures of the corrective, preventive and control measures that are being pursued. Veterinary vital statistics that merely show the number of animals born, the number that were sick and the number that died in some specified period of time—a calendar year for example—would have some value. The value of the statistic can be increased tremendously if each of the chief or principle categories—birth, morbidity, mortality—is expanded to include certain qualifying information. For example, the value of a statistic on birth is increased materially if a record of the sex is included. It is increased still further if it is known that the birth was viable or still-born. If still-born, did the birth occur at term or did it occur premature. Likewise, in the case of the statistic on death, if the age of the animal at the time of its demise is recorded, then the value of it is increased markedly. The matter of knowing when these vital phenomena occur, i.e., the month or the season, adds much to their significance. Other examples might be given but these will illustrate some of the important items pertinent to a useful statistic.

However important the items just mentioned might be, nevertheless the data that most persons interested in veterinary vital statistics would derive the greatest benefit from, would be the statistics that show which diseases and disorders are responsible for the sickness and death of animals. In other words, how many bovine animals suffered from bloat, or from vesicular stomatitis, or from mastitis, etc., etc., and how many died from them. Here again, many other examples might be given.

Qualifying statistics on morbidity and mortality leads to the phase of the vital statistics problem for which we, as the committee on nomenclature of diseases of animals, have a particular interest.

In 1938, the A.V.M.A. created a special Committee on Nomenclature of Diseases and Vital Statistics. These subjects have much in common and could be developed more or less simultaneously. However, in 1943 they were separated to become the functions of two distinct committees, one on nomenclature and one on vital statistics. Thus, if a service on veterinary vital statistics is to include tabulations on the diseases which are responsible for morbidity and mortality states, then the names or terms used to designate those states are of considerable importance.

The Committee, early in the course of its deliberations, decided that only those diseases and disorders known to occur in animals in North America be included in
the report and that the names or terms listed be those used in North America to designate them. In fact, this committee is strongly inclined to the idea that the names used to designate diseases that are of long standing and are generally accepted, be respected and that only such changes be made as may be required to meet the needs of the present. No attempt will be made to conjure new names for the diseases nor do we contemplate the preparation of a set of rules and regulations for deriving a name for a disease or disorder. We recognize, however, that this is a matter that should at some time receive the attention of a qualified committee.

The activities of the Committee on Nomenclature for the past few years has centered around the development of a schema or system of classifying, codifying and cataloging the recognized diseases. From time to time one or another of the committee members would come forth with a plan of procedure which, to a greater or lesser extent, would go through a series of modifications and revisions with the view of setting upon one that will meet the required conditions and still be workable. The schema which was finally adopted is one patterned after the Standard Nomenclature of Disease that is indorsed by the American Medical Association and is now in use in many medical clinics and hospitals. It will be necessary to modify it in places in accordance with our needs. The schema or method of classification is based on two primary factors (a) the portion of the body concerned with disease and (b) the cause of the disease. An example of the schema was printed in the Journal of the American Veterinary Medical Association 1946, 109: 427.

At present we are engaged in the job of collecting and assembling the names and terms of the diseases and disorders. Much has already been done on this part of the undertaking but there is still much more to be done. The classification which has been adopted just about requires that the entire job be completed before any part of it can be available for publication. It appears that the compilation will be quite voluminous.

The Committee is aware that this organization (United States Livestock Sanitary Association); the American Veterinary Medical Association and the Section on Agriculture of the National Research Council have created and aided committees to collect and assemble veterinary vital statistics. We would encourage every effort that is directed toward this problem and give support to any movement designed to probe the possibilities of creating an agency whose function would be that of collecting, assembling and distributing information of this kind.
To remain alive in highly competitive world markets with skyrocketing direct labor costs, American industry today is placing great stress upon lowering product unit cost. To accomplish this, top management has instituted time and motion studies, job evaluation, and work simplification courses for industrial supervisory personnel, so that labor and product losses can be avoided to permit the manufacturer to get the most product per dollar spent. Briefly stated the following directives have been proposed. The supervisor must be able to recognize the problem or situation which needs correction. He must then (1) get the facts, which includes reviewing the record, learning the rules and customs that apply, having conversations with the individuals concerned, and getting opinions and feelings. Then he must (2) weigh and decide. Specifically, he must fit the facts together and consider their bearing on each other. What possible actions can he take? He must check the practices and policies which apply; he must consider the objective, and the effect on the over-all program on individuals, groups, and on production. He must not jump at conclusions. When the decision has been reached he must (3) take action. He must decide whether or not he will handle the problem himself, whether he needs help, or whether the problem should be referred to someone else. He must watch the timing of the action, and above all, not “pass the buck”. When the corrective program is installed he must (4) check results. He must follow up the changes in output and study the attitudes and relationship of those involved. He must then decide: “Did the action help production?”

We recognize that American agriculture is a gigantic industrial enterprise. The small plant owners—the farmers and stockmen—contribute as subsidiaries or suppliers. One of the problems in animal production which causes excessively high unit cost and great waste is disease. The above directives for the industrial supervisor can and should be directly applied by those who are responsible for disease control in livestock production.

Is the livestock industry being efficiently operated? Are there unnecessary losses and inefficiency in production? A preliminary sampling survey (An Experiment in the Collection of Morbidity and Mortality Data on Farm Animals, by George W. Snedecer Proc. 51st Annual Meeting of the United States Livestock Sanitary Association, 1947: 218) in part bears out the assumption that there are tremendous losses due to disease.

Money will have to be spent to correct these losses. Is the legislative branch of our government, the budget committee of top management, justified in making the expenditure? The stockman—the supervisor and all those interested in the business—must show the need. The immediate concern of this committee is that we do not have the facts concerning mortality and morbidity, or the cause of death,
cause of disease, and dollar losses for farm animals, which is the first step in securing the facts leading to the solution of the problem.

For many years most of us have recognized the shortcomings of the methods used for assembling mortality reports of domestic animals, and the comparative inaccuracies of final assembled data. Four years ago this Association set up a “Committee on Morbidity and Mortality” in an effort to do something constructive toward improving the techniques employed. An initial poll of those engaged in the control of livestock disease confirms the findings of others (Report of Committee on Miscellaneous Transmissible Diseases, Proc. U. S. Livestock San. A., 1945: 161). There are no legitimate mortality reports, or a source of such material, and no one has given any real thought to morbidity. The appointed Committee realized that they would have to start with a standard manual, listing animal disease names which would be internationally accepted. A committee of the American Veterinary Medical Association, known as the “Committee on Nomenclature,” have been working on such a draft for years, but their efforts are just now maturing. Last year we conducted a poll (Report of Committee on Morbidity and Mortality Statistics, Proc. U. S. Livestock San. A., 1947: 228), and the consensus was that the U.S.D.A. should prepare a “Manual on Nomenclature”. The outcome of a meeting held this summer in the office of Dr. B. T. Simms, Chief of the U. S. B.A.I., attended by Dr. H. Schoening, Chief of the Pathological Division, a representative of the Committee on Nomenclature of the A.V.M.A. and two representatives of this committee, quickly indicated that neither funds nor personnel were available to permit the U.S.B.A.I. to take formal part in the preparation of such a manual, or for that matter to go beyond their present activities, in the collection, publishing and distribution of mortality or morbidity data. Many people, however, in both government circles, agriculture and industry, continue to give us the go-ahead sign, and ask us to assume a “stir ’em up”, “acquaint the legislators”, “do something” attitude. We have approached Dr. Kernkamp, Chairman of the Committee on Nomenclature of the American Veterinary Medical Association, who enthusiastically promises that his Committee will present something concrete this year.

There are those who believe industry can be counted on to make a grant-in-aid to cover prime printing costs of a ‘Manual on Nomenclature’ to be published and distributed by the American Veterinary Medical Association.

Our Committee members agree that, even in a sampling program, an accurate diagnosis would have to be made once in a while, and the methods used to arrive at that diagnosis should be the same in Sacramento as in Bismarck. In accordance with the 1947 poll findings we approached the Pathological Division of the U.S.B.A.I. to learn whether or not they would participate in setting up “Standard Methods of Diagnosis” which could be revised every five or ten years, printed at the Government Printing Office, and sold to those engaged in diagnosing animal diseases. Dr. Simms, Chief of the Bureau of Animal Industry, indicated again that, because of lack of funds, it would be necessary to have such material prepared, published, and distributed by an organization outside the Department of Agriculture. Our Committee has approached an internationally recognized pathologist and bacteriologist to act as Editor-in-Chief of a “Manual on Standard Methods of Diagnosis”, which would receive official endorsement and be published by a print-
ing house and sold in the usual manner. These two manuals dealing with disease (1) nomenclature and (2) diagnosis are essential to the initiation of a program of collecting and assembling morbidity and mortality data.

We must have the facts. We need them now. We need them so that the necessary expenditures can be made to correct waste and permit the production of more and better meat, wool, eggs, and dairy products, on a smaller land area, at lower cost. We have petitioned the active participation of the following individuals and organizations by presenting the facts concerning the problem of collecting, assembling, publishing, and distributing morbidity and mortality data:

**Senate Agricultural Committee**

- Senator Arthur Capper, Kansas, Chairman
- Senator Harlan J. Bushfield, South Dakota
- Senator Milton R. Young, North Dakota
- Senator James P. Kem, Missouri
- Senator Allen J. Ellender, Louisiana
- Senator Tom Stewart, Tennessee
- Senator Claude Pepper, Florida
- Senator George D. Aiken, Vermont
- Senator George A. Wilson, Iowa
- Senator Edward J. Thye, Minnesota
- Senator Elmer, Thomas, Oklahoma
- Senator Scott W. Lucas, Illinois
- Senator Clyde R. Hoey, North Carolina

**House Agriculture Committee**

- Rep. Clif. R. Hope, Kansas, Chairman
- Rep. George W. Gillie, Indiana
- Rep. William S. Hill, Colorado
- Rep. Hadwen C. Fuller, New York
- Rep. W. R. Poage, Texas
- Rep. Walter K. Granger, Utah
- Rep. John L. McMillan, South Carolina
- Rep. Thomas G. Abernethy, Mississippi
- Rep. E. L. Bartlett, Alaska
- Rep. Reid F. Murray, Wisconsin
- Rep. Chas. S. Hoeven, Iowa
- Rep. Chester H. Gross, Pennsylvania
- Rep. Abe McGregor Goff, Idaho
- Rep. Wat Arnold, Missouri
- Rep. John W. Flannagan, Jr., Virginia
- Rep. Stephen Pace, Georgia
- Rep. Georgia M. Grant, Alabama
- Rep. E. C. Gathings, Arkansas
- Rep. Eugene Worley, Texas
- Rep. Preston E. Peden, Oklahoma
- Rep. A. Fernos-Isern, Puerto Rico

American Medical Association, Dr. Morris Fishbein, Editor of Journal
American Veterinary Medical Association, J. G. Hardenbergh, Secretary
Hooper Foundation, Professor Karl F. Meyer, Director
Ministry of Agriculture and Fisheries, Surrey, England, Sir Daniel Cabot
Ministry of Agriculture and Fisheries, Surrey, England, Prof. T. Dalling, Dir.
New York Farm Bureau Federation, Mr. Edward S. Foster
Office of Surgeon General, U. S. Public Service
Veterinary Public Health Section, U. S. Public Health Service, Dr. James H. Steele, Chief
Veterinary Research Institute, Onderstepoort, Pretoria, South Africa, Dr. P. J. duToit
American Dairy Cattle Club
American Farm Bureau Federation
American Foundation for Animal Health
American Meat Institute
American National Livestock Association
American Poultry Association
Animal Health Institute
Institute of American Poultry Industries
International Baby Chick Association
National Grange
National Livestock Loss Prevention Board

Armour & Company
Cadahy Packing Company
King & Co.
McNeil & Libby
Morrell & Company
Wilson & Company

Abbott Laboratories
American Scientific Laboratories, Inc.
Anchor Serum Company
Ashe Lockhart, Inc.
Beebe Laboratories, Inc.
Ciba Pharmaceutical Products, Inc.
Colorado Springs Vaccine Laboratories, Inc.
Columbus Vaccine Company
Corn States Serum Company
Crockett Laboratories Company
Cutter Laboratories
Denver Serum Company
Fidelity Laboratories, Inc.
Fort Dodge Laboratories, Inc.
O. M. Franklin Serum Company
Gland-O-Lac Company
Globe Laboratories Company
Jensen-Salsbery Laboratories, Inc.
Johnson Laboratories
Klumsiere Biologic Laboratories
Lederle Laboratories Division, American Cyanamid Company
National Drug Company
National Vaccine and Serum Company
Norden Laboratories
Parke-Davis
Peters Serum Company Laboratories
Pitman Moore Company
I. D. Russell Company Laboratories
Dr. Salsbury's Laboratories
Sharp and Dohme, Inc.
E. R. Squibb and Sons
United States Standard Products Company
Upjohn Company
Mr. President: This Committee presents the following resolution and hopes that direct action will be taken by the Executive Committee:

WHEREAS, this Committee has been actively engaged in publicizing the need for morbidity and mortality data of farm animals for four years without tangible results; and,

WHEREAS, sufficient data have been gathered to initiate a Congressional investigation of the problem; therefore, be it

RESOLVED, that the secretary be instructed to petition the Secretary of Agriculture and Committees on Agriculture of the House and Senate for a formal hearing to be entered into by the President and Secretary of this Association, together with the members of this Committee, on the problem of establishing a Division of Vital Statistics for farm animals. Mr. President: I move that this report be submitted to the Executive Committee for approval so that action may be taken on this resolution.
Swine erysipelas was first recognized in the United States in 1921 through the isolation of the specific organism from diamond-skin lesions of a hog by Creech of the Bureau of Animal Industry. The condition termed “diamond-skin” disease had been seen in swine in the United States for many years. This was similar to the urticarial form of swine erysipelas described in European countries. However, swine erysipelas was not considered to be present in this country prior to the isolation of the organism by Creech.

Following the work of Creech, a number of other scientists isolated the organism from lesions in the joints, and from other parts of the bodies of swine. It was then definitely known that the disease, at least in the chronic form, was present in certain parts of the United States in 1930. The disease was later recognized as an acute herd infection in South Dakota, Nebraska, and other States of the Corn Belt.

Since the disease appeared to be increasing in prevalence and virulence, control of the malady was a problem causing considerable concern. Anti-swine-erysipelas serum was available in this country and was extensively used in efforts to control the infection. While the use of serum produced favorable results when used in early stages of the disease, its protection was only temporary and erysipelas reappeared in many herds after the effects of the serum were dissipated. Consideration was given to the use of the live culture and serum method of immunization which had been practiced in European countries for many years with considerable success. However, the matter was approached with caution since that method had never been employed in the United States and much information was needed before it could be recommended for use under conditions existing in this country.

It was therefore decided to inaugurate a comprehensive field experimental study on the efficacy of the culture serum method of immunization in the control of swine erysipelas. Two methods were set up: (1) One simultaneous injection of culture

1 Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture, Lincoln, Nebraska.
2 Pathological Division, Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture, Washington, D. C.
3 Interstate Inspection Division, Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture, Lincoln, Nebraska.
4 Formerly of the Pathological Division, now with Office of Experiment Stations, Agricultural Research Administration, U. S. Department of Agriculture, Washington, D. C.
and serum; (2) one injection of culture and serum followed by a second injection of culture only, using double the original dose, administered from 10 to 14 days later.

COLLECTION OF DATA

Considerable thought was given to the collection of data and methods of evaluating the results of this extensive field study. Two factors were given prior consideration: First, was it safe, since a virulent live organism was to be used; second, how much immunity could be expected.

The project was started in Nebraska on a small scale in 1938 by a group composed of Dr. L. Van Es of the experiment station of the University, State Veterinarian Dr. J.S. Anderson, certain practitioners in the State, and officials of the Pathological and Interstate Inspection Divisions of the United States Bureau of Animal Industry, both in Nebraska and in Washington, D. C.

The culture was first prepared by Dr. Van Es in his laboratory at Lincoln and was distributed through the State veterinarian's office to a few practitioners in areas of the State where the disease was prevalent.

Each veterinarian participating in the project was required to obtain an authorization from the State veterinarian to use the product in a certain herd. When this was granted, forms giving minute details on this herd, such as the number of animals vaccinated, condition of the herd, serial number, and producer of the serum and culture used, were submitted by the veterinarian. The forms were filed with the State veterinarian and the Bureau inspector in charge of the project and at a later date a follow-up report on the result was made by the veterinarian.

The results of vaccination during the first 2 years were quite encouraging and the use of the culture was extended to many veterinarians in infected areas. By 1940 it was not possible for Dr. Van Es to continue the preparation of the culture and at that time the Bureau established a branch laboratory of the Pathological Division at Lincoln, Nebraska, where the preparation of the culture was continued on a much more intensive scale.

The use of culture and serum received such favorable support from the practitioners and livestock owners in Nebraska that other States wished to enter the experimental program. It was then extended to Iowa, Illinois, and South Dakota, and later to 13 other States under a memorandum of understanding between the U. S. Bureau of Animal Industry and the State livestock sanitary authorities. The requests for culture reached such proportions that the small laboratory at Lincoln was not able to meet the demand.

By 1942 the project had shown much promise and in order to continue, arrangements were made whereby the culture was produced by commercial houses and sold to veterinarians in those States having a memorandum of understanding with the Bureau relative to this experimental field project.

There was excellent cooperation between the State livestock sanitary officials, the Bureau, and the practicing veterinarians. From the inception of the project starting with the activities of Dr. Van Es, Nebraska State officials have been exceptionally active in the project. The disease at the start of the project was widespread in Nebraska and opportunities for careful study of the project were particularly
good in that State. Much of the critical information on the project was obtained there. Dr. J. R. Snyder who succeeded Dr. J. S. Anderson as State veterinarian has played an active part in furthering the objectives of the project.

The culture is a virulent strain of *Erysipellothrix rhusiopathiae* produced by the various commercial houses. The serum used is the regular anti-swine-erysipelas serum prepared from horses. The Bureau has licensed biological laboratories to produce both of these products and with their cooperation has maintained a satisfactory standard of potency.

Frequent checks were made on the virulence of culture produced by the laboratories as well as on the potency of the serum. It was found necessary to reduce the expiration date of the culture from 60 to 40 days. Veterinarians were instructed in the use and also the care of the culture and serum to insure that these products were kept under favorable conditions until the time of their injection into the swine.

Both the State and the Bureau had representatives in the field at all times checking on the results of the project. They conferred with veterinarians who had reported trouble either before or after vaccination and cooperated with the practitioners in the field study of this method of immunization including the observation of the vaccinated herds, clinical diagnosis of the disease, post mortem examination, and collection of specimens for laboratory diagnosis. In addition, the Bureau representatives made very careful detailed studies on a number of farms where, over a period of years, vaccination was not practiced, as well as on farms where vaccination was practiced.

### Table 1.—Comparative incidence of swine erysipelas in vaccinated and non-vaccinated swine in the same areas

<table>
<thead>
<tr>
<th>STATUS OF HERDS</th>
<th>NO. HERDS</th>
<th>NO. HOGS IN HERDS</th>
<th>% DEVELOPED ERYSIPelas</th>
<th>% DIED</th>
<th>RATE OF DEATH LOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccinated for 5 to 8 years</td>
<td>173</td>
<td>119,362</td>
<td>1.02</td>
<td>0.104</td>
<td>1 in 955</td>
</tr>
<tr>
<td>Not vaccinated for 5 years</td>
<td>174</td>
<td>61,986</td>
<td>11.62</td>
<td>2.99</td>
<td>1 in 33</td>
</tr>
</tbody>
</table>

**EFFECTS OF VACCINATION**

The results of the study on the comparative incidence of swine erysipelas in vaccinated and non-vaccinated swine, in the same areas, are given in Table No. 1. This shows that all swine on 173 farms, a total of 119,362, were vaccinated for a period of 5 to 8 years. Of those animals, 1.02 per cent developed erysipelas after vaccination and of these .104 per cent died. This result indicates that the normal expectancy of death losses in vaccinated herds is one animal in 955. On 174 additional farms in the same area, 61,986 swine were not vaccinated for 5 years. Of these, 11.62 per cent developed erysipelas and 2.99 per cent died from erysipelas. In these the death rate was one in 33.

The project has been in effect now for 10 years and more than 12 million swine have been vaccinated by the culture-serum method. During that period much in-
formation has been accumulated. Seventeen States have entered the program in the following order:

<table>
<thead>
<tr>
<th>State</th>
<th>Herds</th>
<th>Swine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nebraska</td>
<td>98,447</td>
<td>5,713,706</td>
</tr>
<tr>
<td>Iowa</td>
<td>62,664</td>
<td>4,960,857</td>
</tr>
<tr>
<td>South Dakota</td>
<td>7,039</td>
<td>492,263</td>
</tr>
<tr>
<td>Missouri</td>
<td>3,960</td>
<td>263,131</td>
</tr>
<tr>
<td>Illinois</td>
<td>10,613</td>
<td>756,678</td>
</tr>
<tr>
<td>Kentucky</td>
<td>100</td>
<td>6,121</td>
</tr>
<tr>
<td>North Dakota</td>
<td>192</td>
<td>9,215</td>
</tr>
<tr>
<td>Oregon</td>
<td>28</td>
<td>1,337</td>
</tr>
<tr>
<td>Nevada</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Idaho</td>
<td>79</td>
<td>6,225</td>
</tr>
<tr>
<td>Washington</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tennessee</td>
<td>440</td>
<td>16,811</td>
</tr>
<tr>
<td>Georgia</td>
<td>43</td>
<td>3,150</td>
</tr>
<tr>
<td>Florida</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>New York</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Colorado</td>
<td>3</td>
<td>361</td>
</tr>
<tr>
<td>Utah</td>
<td>2</td>
<td>109</td>
</tr>
<tr>
<td>Grand Total</td>
<td>183,610</td>
<td>12,229,964</td>
</tr>
</tbody>
</table>

In some States only a few herds have been vaccinated, which fact does not indicate the extent of the disease. These were particularly troublesome herds and ones on which it was desired to use culture and serum to control the disease.

At one experiment station where erysipelas was a problem, highly successful results were reported from vaccination. Previous to vaccination, boars from this herd sold and placed on infected farms usually developed erysipelas, whereas after being vaccinated, they resisted such exposure. They now sell at premium prices.

An analysis of the data collected shows the following results:

**SECOND INJECTION OF CULTURE**

In regard to the two methods of vaccination, reliable data collected in Nebraska for one year show that an additional injection of culture only has no advantage over one simultaneous injection of culture and serum.

This conclusion is based upon the following results: In 23,364 herds receiving only the initial dose of culture and serum, 1.55 per cent later developed erysipelas. On the other hand, in 9,421 herds receiving both the initial dose of culture and serum and an additional double dose of culture alone at 10 to 14 days, 2.32 per cent later developed erysipelas.

**SAFETY OF THE VACCINE**

The results of the experimental project in the field were studied very carefully from the standpoint of the safety of the vaccine. Since a virulent culture of the organism is used in combination with serum, the question as to the dangers of the
vaccination method producing the disease or seeding down the farms with the organism from vaccinated swine was given careful study. In a small percentage of cases, it appeared that the administration of the culture and serum resulted in the production of the disease. The number of such cases has been extremely small and the exact cause of the appearance of the disease in a few herds following vaccination has not been satisfactorily explained. They may have been due to faulty techniques such as the improper dose of serum or, as was known to occur early in the experiment, the use of serum of low potency. The fact that the live culture is used in this method of vaccination makes its use one that should be carefully supervised and it has been the practice in the project to use the simultaneous vaccination only on farms or in those areas where the disease was prevalent. It is not considered advisable in the light of our present knowledge to extend the method to areas where the disease does not exist or where it is not a threat. It is felt that this method of vaccination should not be used indiscriminately but should be under the close supervision of the State livestock sanitary officials. It should also be remembered that the culture vaccine is a virulent organism which is pathogenic for man and its careless use or use by untrained personnel may result in human infections. Such cases have been reported in this country.

The information that has accrued from the field with regard to the safety of the method of vaccination indicates:

1. The vaccine is safe to use.
2. Vaccinated animals do not seed down the premises nor do they transmit the disease to non-vaccinated animals.
3. No harmful results follow the vaccination of pregnant sows.
4. No bad effects follow the simultaneous use of hog cholera serum and virus and erysipelas culture and serum.
5. Hog cholera can be produced at the time of vaccination against erysipelas if the equipment is contaminated with the hog cholera virus. It is therefore especially important to have all vaccination equipment brought to the farm free from virus contamination.

**IMMUNITY**

In regard to immunity, it is difficult to demonstrate it experimentally since swine cannot regularly be infected artificially with the organism. However, the data collected have been evaluated from the field standpoint and the evidence indicates clearly that definite immunization in swine can be produced by this method. This has been demonstrated by a comparative study of vaccinated and non-vaccinated herds in areas where erysipelas is a problem.

Chart No. 1 shows the comparative incidence of erysipelas on 200 farms. Group No. 1 represents 100 farms on which all swine were vaccinated for 5 years. Group No. 2 represents 100 farms on which none of the swine were vaccinated for 5 years. It will be noted that in the vaccinated group 100 per cent of the farms were infected with erysipelas before vaccination was started. After the first year of vaccination the incidence of erysipelas was reduced to 11 per cent and remained at a low level for the entire 5 year period. However, in the non-vaccinated group, during the first year records were kept the incidence of infection was 38 per cent but increased to 67 per cent the 5th year.
CONTROL OF SWINE ERYSPIELAS

<table>
<thead>
<tr>
<th>Group 1 Before Vaccination</th>
<th>1st Yr.</th>
<th>2nd Yr.</th>
<th>3rd Yr.</th>
<th>4th Yr.</th>
<th>5th Yr.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>10%</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
</tr>
</tbody>
</table>

| Group 2 Not Vaccinated     | 0       | 10%     | 20%     | 30%     | 40%     |

| Group 1 After Vaccination  | 0       | 0%      | 0%      | 0%      | 0%      |

**Chart No. 1.** Comparative percentage of 200 farms infected with swine erysipelas

Group 1, 100 farms—Swine vaccinated. Group 2, 100 farms—Swine not vaccinated.

**Chart No. 2.** Incidence of swine erysipelas on 25 Nebraska farms

Before and after vaccination

Furthermore, that immunity can be established is vividly pictured in the following case history. On one badly infected farm, for 12 years swine were produced without being vaccinated and each successive pig crop was damaged from erysipelas. In 1939, six vaccinated pigs were placed on this farm in contact with 40 unvaccinated pigs of the same age. A severe attack of acute erysipelas developed in the
untreated animals, whereas all six of the vaccinated pigs remained healthy until marketed. The figures on the longevity of immunization indicate that there may be some waning after 6 or 8 months.

Chart No. 2 gives additional evidence that immunity was established. This chart shows the incidence of swine erysipelas on 25 Nebraska farms before and after vaccination. It also shows that from 1938 to 1940 none of the swine on those farms were vaccinated and the incidence of erysipelas increased from 60 to 80 per cent. However, on these same farms 12 herds were vaccinated in 1941 and 24 in 1942 and the incidence of erysipelas decreased to 8 per cent.

**DIAGNOSIS OF SWINE ERYSIPELAS**

In evaluating culture and serum vaccination a correct diagnosis is essential. This is sometimes a difficult task because erysipelas manifests itself in various forms. However, through years of study, careful field observations, and the liberal use of the laboratory, it is believed that a high degree of efficiency in the recognition of the disease has been accomplished.

There are several pathological conditions which somewhat simulate swine erysipelas and which may confuse the diagnostician. In numerous instances, where veterinarians in all sincerity diagnosed post-vaccinal erysipelas, upon closer investigation it was found that the disease was due not to erysipelas but to other causes, such as infection from castration, fractured femurs, navel ill with arthritis, necrophorus infection with complications, photosensitization with skin peeling, deficiencies retarding growth, and other abnormal skin conditions.

**WHEN TO USE CULTURE AND SERUM**

The dosage of the serum used was for pigs up to 50 lbs., 5 cc.; 50 to 100 lbs., 10 cc.; 100 to 150 lbs., 15 cc.; over 150 lbs., 20 cc. The dosage of the culture was ½ cc. to each 5 cc. of serum used.

The program may be started at any time regardless of the age or size of the swine. Since pigs may become infected very early in life, the best results are produced by protecting them before the appearance of symptoms.

If given a choice, perhaps the best procedure is to vaccinate the gilts soon after they have been selected for breeding purposes. Then after the gilts have farrowed vaccinate the sucklings only, before they are 2 weeks of age.

If there is evidence of acute infection in the herd, it is safe to use culture and serum on the entire group.

If chronic erysipelas is present the number affected varies, as the entire group or only a few may be attacked. Chronicity usually responds more favorably to culture and serum than to serum alone. Sometimes the results are surprisingly good, although in some cases the damage already inflicted upon the herd is beyond repair and nothing can be accomplished by treatment. In many herds chronic erysipelas develops progressively and vaccination at the opportune time often checks further development of the infection. The history obtained and the clinical effects of the disease on a chronically infected herd should be a guide in predicting the final results of the treatment.
From these factors, it is apparent that there is nothing to lose but much may be gained in almost all infected herds by giving the culture a trial.

From this analysis the following conclusions have been reached:
1. The use of live culture is considered a safe procedure.
2. The culture-serum method is applicable to the type of infection in this country.
3. Immunity of sufficient degree and duration can be established to protect the great majority of all healthy swine properly vaccinated against erysipelas during the period of time they are on the farm.
Obviously the main objective in a broad brucellosis program involving all susceptible species must be the eradication of reservoirs of infection. Under existing conditions this is an ambitious program and one in which the attainment of the objective is still in the indefinite future. Nevertheless, by using available methods, progress is being made.

These available methods are, first, the exercising of strict hygienic measures through the use of the blood test on a herd basis in preventing the spread of infection. The term "herd basis" is used because negative animals exposed to infection should be considered positive until proved otherwise. This is a fundamental consideration and applies to all species susceptible to brucellosis. Secondly, the use of immunizing agents to protect susceptible individuals and thus limit the spread of infection in an infected herd, and also to protect clean herds subject to exposure. The latter method is applicable at present only in the bovine species. For reasons that will be referred to later in this paper, the method is not used in swine.

Although this group is interested chiefly in the subject as it affects the economical production of livestock, it cannot neglect the serious public health aspect of the disease. Since no evidence is available that would lead us to believe brucellosis can be readily transmitted directly from man to man, it is apparent that the control of human brucellosis depends on the eradication of reservoirs of infection. The importance of the veterinarian in public health has been established, and since the principal reservoirs of infection are in domestic animals, the problem becomes a livestock sanitary undertaking.

The three species of Brucella are fairly specific with respect to virulence for their hosts. Brucella melitensis, the principal host of which is the goat, has the widest range of species virulence and includes all species susceptible to the genus. Brucella suis is second, affecting swine, man and, to a lesser extent, cattle. Brucella abortus has the lowest range of hosts for which it is virulent; it affects cattle and man. This same order, as far as can be determined, applies with respect to pathogenicity for man.

Antigenically, the species vary little; immunologically they can be differentiated by agglutinin absorption. The use of Br. suis antigen in the test on swine has no advantage over Br. abortus antigen. The routine agglutination test will not identify the species although as a rule, it can be assumed that a positive titer in swine means Br. suis and in cattle Br. abortus. Nevertheless, cross infections can occur without acute symptoms becoming apparent, although a transitory blood titer may develop and the individual shed the organism in secretions and excretions.

1 The investigations on Swine Brucellosis at the California Agricultural Experiment Station are cooperative with the United States Bureau of Animal Industry.
This is likely to occur where cattle and swine are maintained in contact with each other. The former may become a carrier of \textit{Br. suis}. The reverse is less likely to prevail although \textit{Br. abortus} may produce a transitory low titer in swine.

With this introduction, we have attempted to emphasize the importance of integrating the work on the various hosts susceptible to \textit{Brucella}. Specifically this paper will discuss the eradication of the disease in swine, with particular reference to the program in California.

The importance of swine brucellosis has only become emphasized during comparatively recent years. A study of production records has shown the marked effect of brucellosis on the economical production of pork. It has been conservatively estimated by Cameron (1) on the basis of investigation in one large herd from two to three pigs per liter is the cost of maintaining swine brucellosis in a herd and that this cost may be much greater during an acute outbreak of abortion. It is also becoming apparent that swine brucellosis constitutes a serious threat to public health, and that the \textit{Brucella suis} species is perhaps more pathogenic for man than \textit{abortus}. Economically the eradication of the disease in swine differs from the problem in dairy cattle. First, we have the value of the infected sow or gilt disposed of for pork. In the great majority of instances, except where valuable blood lines are concerned, the animal realizes her true market value and a replacement can be purchased at little or no loss. A financial loss usually results when a dairy cow is sold for beef. Secondly, there is the replacement problem. The sow or gilt replaces herself six times in the year, whereas the dairy heifer or cow reproduces her kind once in two years. For these reasons, therefore, a test and slaughter program is a sound approach to the problem in swine.

Before going into details of the program, let us dispose of the question of vaccinating swine against brucellosis. In view of our knowledge of the disease in this species, there is little doubt but that vaccination with a live strain of \textit{Brucella suis} would be at least as effective as calfhood vaccination with strain 19, \textit{Br. abortus}. A \textit{Brucella suis} vaccine, being live, would be too dangerous a product from the standpoint of public health to place on the market. \textit{Brucella abortus}, strain 19, on the other hand, will not immunize swine against \textit{Brucella suis}. The work of Crawford and Manthei (2) has definitely proven this fact. Research is, of course, continuing in an effort to effectively immunize swine, but nothing is in sight at present that would supersede a test-slaughter program.

This discussion on the eradication of the disease in swine is based largely on the experiences of Cameron (3) at the California Agricultural Experiment Station and supplemented by the work in other parts of the country, especially McNutt (4) and Hutchins (5). The statement may be made, and possibly justified, that a program suitable for California may not be adaptable to other parts of the country. California is a relatively isolated state as far as breeding swine are concerned. The state imports much of its pork. It imports, however, relatively few breeding swine. Swine herds are fairly well isolated, are usually conducted as a unit and not intermingled with dairy cattle. Under these conditions, therefore, where the movement of breeding swine is almost entirely intrastate, eradication on an area basis, designating the state as the area, has been the objective.

Swine brucellosis is perpetuated within the industry by the public and private
sale of breeding stock and the exhibiting of such stock at fairs and expositions. The sale of boars, and bred gilts, regardless of the brucellosis status of the herd of origin, is too common a custom. Curbing of these practices and the eradication of infection from herds interested chiefly in the sale of brood stock constitutes the most important phase of control. True, the infection gets into other herds, such as those interested only in marketing pork. There it is confined within the herd and tends to eliminate itself by immunization if new infection is not introduced. The introduction of infection into these herds by occasional boar or gilt replacement may result in an acute storm of abortion especially if the herd has been free from infection for several years.

The California State Department of Agriculture certifies herds that are free from swine brucellosis as evidenced by two consecutive negative tests not less than thirty days apart. Re-certification results from an annual retest. Blood sampling for these official tests is conducted by a veterinarian selected by the owner. The blood is tested in the State laboratory. The herd test is negative when no animals show a titer of 1:50. It has been our experience that in dealing with the test on a herd basis that such a titer may be tolerated. If we place the positive titer lower, we may run into a so-called non-specific titer in one or two animals. If these titers, however, are due to invasion by *Brucella suis*, higher titers will be reflected in a significant number of animals.

The Experiment Station as part of its swine brucellosis project in cooperation with the U. S. Bureau of Animal Industry has undertaken, on a demonstration basis, the eradication of brucellosis from several herds located in various areas throughout the state. The plan has been first, to blood test the brood stock. If reactors are found, the entire unit is considered positive. In other words, we do not place reliance on the test as it applies to an individual animal. The agglutination test has its limitations, but if it is interpreted on a herd basis, these limitations become insignificant. We consider positive those animals that react to the blood test and also those that are negative to the test but have been exposed to the reactors. It is the failure to consider this exposed negative group in terms of probable infection that has led to the failure of test and slaughter programs involving the slaughter of reactors and doing nothing about the exposed pigs.

Our next step depends upon several factors that may be peculiar to each herd. If only a few reactors are found, we may recommend immediate slaughter and retest. It is possible that the spread of infection was not active in the herd and the elimination of the reactors may be all that is necessary to control the disease. This type of herd, however, is the exception. As a rule, when we find infection in a herd, at least 50 per cent of the animals are affected. If so, it is not feasible to immediately slaughter the breeding stock until replacements have been made available. Possibly replacements may be purchased immediately if they can be obtained from brucellosis-free herds and can be placed in clean quarters. In order to avoid loss of production such replacements should be bred gilts, and these are the most dangerous type to purchase from the standpoint of introducing infection. In this respect they resemble the infected pregnant dairy heifer. The method which has been received favorably by the breeders of purebred swine is based on the raising of their own negative replacements with the gradual eradication of the positive
SWINE BRUCELLOSIS

unit as those replacements become available for breeding. It has been shown by numerous workers that young pigs being weaned from positive sows are for the most part non-infected and will remain so if segregated from the positive unit at weaning. Even if they are infected at weaning, they are not in a position to spread infection, and the marked tendency, as in the bovine species, is to overcome infection. The young pigs should be segregated from the positive unit and at no time brought into contact with the latter. They should be blood tested at the time when selection is made for those individuals that are to be retained for breeding purposes. Only those gilts and boars negative in the 1:25 dilution should be kept for breeding purposes. These animals should again be retested before being bred. The transitory presence of infection in young unbred gilts is not a serious factor since it is the bred infected animal that becomes a source of infection, through potential abortion, to susceptible stock.

The positive unit should be culled as early as possible. Attempts have been made to salvage non-reacting animals from the positive unit at the time of disposal, particularly where valuable blood lines are involved. In view of the limitations of the blood test with respect to the individual animal, this is a somewhat dangerous procedure, and it is recommended that such individuals still be segregated from the non-infected unit. There is always the temptation to get just another litter from the infected unit before disposing of it. If an animal is not exposed to re-infection, there is a tendency for the blood titer to recede. This is much more apparent in swine than in cattle. The significance of the receding titer in the individual is not clear, possibly it is latent infection, harmless in sows having acquired an immunity, but explosive in the presence of susceptible gilts.

The foregoing plan of establishing a non-infected unit with replacements from the infected unit has proved successful. It has even stopped the active spread of infection in the positive unit. This is due to the break in the chain of infection which normally is from the recently infected aborting gilt to the chronically infected sow, back to succeeding crop of susceptible gilt. All of this occurs in the so-called dry lot where bred sows and recently bred gilts are intermingled. Therein lies the difference between the herd selling brood stock and the herd producing pork. The former is constantly adding susceptible gilts raised apart from the sows until bred, at which time they are exposed to infection. The pork producing herd on the other hand, only occasionally adds new breeding stock, a procedure that allows for self-immunization of the herd.

At this time it might be well to consider the importance of the boar as a spreader of the disease. While the aborting sow and gilt is the most dangerous source of infection, we must always consider the reacting boar as a spreader of infection, probably more so than the bull as far as cattle are concerned. Brucellosis in a boar may produce sterility through localization of the organism in the testicles. The boar is still able to breed sows or gilts and will spread infection in this way. It is, therefore, quite essential that only non-infected boars be used in the clean unit.

We have confined our efforts in California to the pure-bred herds whose main objective is the sale of boars and bred gilts. It is our opinion that this constitutes a major source of infection for herds interested only in pork production. One
breed sale in which boars and bred gilts are sold required a negative blood test on animals submitted for sale. This in itself is not the answer to the question. We have already referred to the limitations of the blood test on the individual; a negative exposed gilt from an infected herd is just as dangerous as the reactor. Nevertheless, it is a step in the right direction and has made the breeder conscious of the danger to his swine herd. Similar requirements are in force for certain fairs where breeding stock are exhibited. A number of herds have become infected through exhibiting breeding stock at fairs and then bringing them back into the herd. It is hoped that when we have sufficient herds certified in the state, that we will be able to make certification a prerequisite for submitting animals to public sale and for exhibition at fairs and expositions.

Brief mention should be made of the possibility of propagating those strains of swine that apparently are resistant to Brucellosis. This possibility has been strongly suggested by the work of Cameron, Hughes and Gregory (6). It is also supported by field observations in herds where the disease is being eradicated. The progeny from repeatedly non-reacting stock in an infected herd will frequently prove resistant to infection. Since other factors, such as conformation, may be involved in the selection, the adaptation of the procedure to the field is a long-term project. Nevertheless, we recommend that this be taken into consideration when the non-infected unit is being established. Where possible, progeny from non-reacting sows should be selected for future brood stock.

In summary it is our opinion that swine brucellosis is a serious problem from the standpoint of public health, to the economic production of pork, as well as to the broad brucellosis problem. We also are of the opinion that the eradication of swine brucellosis does not present as difficult a project as does the disease in dairy cattle. A test and slaughter program is financially sound in swine, provided it is adapted to an area basis. Cattle may serve as a host for Brucella suis, but swine will not serve as a host for Brucella abortus. The only other host harboring a species (Brucella melitensis) that may infect swine, is the goat. As yet, brucellosis in goats with the exception of an area in the Southwest is not a serious problem in the United States. A well concerted program of test and slaughter on an area basis supported by quarantine measures would eradicate swine brucellosis in much the same manner as bovine tuberculosis.

REFERENCES
According to government estimates about 8 million sows produced nearly 51.5 million living pigs between December 1, 1947 and June 1, 1948. This figure is about 3% below the number of pigs farrowed one year earlier. Although the number of living pigs farrowed was less than a year ago, it was accomplished with 8% fewer brood sows. In fact, the number of living pigs per litter (6.44) has been exceeded only once during the 25 years of official pig crop reporting. As veterinarians and swine breeders know, large litters of livable pigs almost always mean thrifty pigs that will make rapid and economical gains from the limited supplies of feed likely to be available. The official report credits favorable weather for the relatively good pig crop, but we believe that this is overlooking one item of great importance.

More than a year ago, the American Feed Manufacturers Association and the A.V.M.A. jointly sponsored a conference on baby pig losses, and this was followed by other conferences under the same joint sponsorship. These conferences were attended by men who knew what was happening to the pig crop, but necessarily did not know why all the losses did occur. As result of these conferences a group of recommendations from a Committee on Management and Nutrition, and another group of recommendations from a companion Committee on Diseases and Ailments of Suckling Pigs were prepared by these committees. We believe these reports, on account of wide circulation, deserve a part of the credit for the increased livability of the present year baby pig crop.

Swine nutrition needs further investigation and can only be accomplished by extended research studies. A great deal of investigation has been done with the problem centering on the growing pig. The crux of the problem appears to be centered on the baby pig through the nursing period. We all know that entirely too many pigs die during the first 8 weeks of their life. We seem to do fairly well rearing them after they are weaned.

Hog cholera is still considered to be the number one disease of swine and in some areas of the Midwest, swine erysipelis is also a serious menace. Proper vaccination against these diseases are satisfactory methods of prevention as a whole even though there are too many unexplainable "breaks" following vaccination against hog cholera. It is hoped that in the not too distant future a method of prophylactic procedure will be developed which will eliminate the use of a living organism. Progress along this line is being made.

Research discoveries may be forthcoming, but will do no good unless livestock owners put them to use. The importance of balanced rations, scientific management practices and disease prevention should be the policy of every practicing veterinarian who deals with swine breeders—and this applies equally well to us all.
Extensive research at the Hormel Institute at Austin, Minnesota is in progress on the cause of baby pig losses. The problem is being approached from a fundamental basis and at the present time it appears that progress is being made. Results of these studies are being published from time to time. We all know that other causes have been presented by others. Time alone will decide whether this is the answer or a partial explanation of the losses of baby pigs that occur during the first few days or weeks of the baby pig's life.

The Biological Institute of Sao Paulo, Brazil has investigated the use of crystal violet vaccine against hog cholera by the intradermic route of introduction into the vaccinate. The incubation period of the virulent blood was reduced from 14 to 7 days. The site of vaccination was the border of the ear. One cc. of vaccine was administered and always gave complete protection against a challenge of 2 cc. of hog cholera virus. Ten to 15 days are required for the appearance of immunity. A second vaccine, administered in 0.5 cc. dose, intradermally, also provided complete protection against a challenge dose of 2 cc. of hog cholera virus.

Porcine Virus Encephalomyelitis has been recognized thus far, only in Europe. We should be aware of the existence of such a disease. Synonyms used for the disease are infectious pig paralysis, Teschen disease, Bohemian pest, and encephalomyelitis enzootica suum. Well controlled experiments have demonstrated almost incontrovertibly that a separate and distinct virus is the cause of this disease. Some doubt exists, in the minds of a few veterinarians that an unknown filterable virus is involved. Some feel, for example, that infectious pig paralysis is the result of an aberrant manifestation of swine influenza, hog cholera, Aujeszky's disease (pseudorabies); although there is no experimental evidence to support these opinions.

Hutyra et al. are of the opinion that the virus is distributed by the blood stream throughout the body including the central nervous system, although they may mean this to apply to Aujeszky's disease which they describe simultaneously.

The disease usually breaks out two to three weeks after known or suspected exposure, adding new animals to a farm or feeding diseased carcasses, etc. It begins with a slight rise of temperature 104 to 105° or it may sharply rise to 106° and higher. This is followed by a stage of irritability and then the paralytic process is ushered in gradually. The hind legs show the greatest and most frequent involvement. Complete paralysis may develop. Gross autopsy findings are not marked.

Microscopically the lesions are essentially those of poliomyelitis and polioencephalitis characterized by advanced degenerative changes in the nerve cells, perivascular infiltration and glial proliferation. Mention is made of the striking similarities between human poliomyelitis and infectious pig paralysis. The authors feel that the similarity is projected beyond a pure coincidence.
THE MILK AND CREAM RING TEST FOR BRUCELLOSIS 1

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A study of the results of the bovine brucellosis control program on the area plan in Minnesota indicates a regional difference in the amount of infection disclosed after a lapse of three to six years between county tests. In the northern section of contiguous counties under the area plan, very little infection has been disclosed on county wide tests even after a six year interval. Such results have not been attained, however, in the border counties, i.e. those counties adjacent to the counties not on the area control plan.

The theory has been advanced that the infection is in proportion to the movement of cattle in the interval between tests, or activity of sales barns operating in this border area. This condition appears to have a decided influence. A difference is also apparent between predominantly "buying" versus "selling" counties.

An analysis of test results covering the eight-year period from 1939 to 1947 indicates that in border counties tested annually the infection remained very low. After a lapse of two years there was a slight increase in the percentage of infection and after three years of appreciable increase. A further study revealed that of the order of only 20% of the infection disclosed was in previously infected herds. Thus by far the larger percentage of infection found was in previously clean herds.

Dr. Aa. Jepsen, Head of the Department of Bacteriology, Royal Veterinary College, Copenhagen, during his visit to our laboratories in June of 1947, discussed with us the role of the milk ring test in the brucellosis control program in Denmark. Because of lack of personnel the past several years to adequately service our counties on the area plan, the thought occurred to us that the ring test might be a valuable adjunct in our Bang’s Disease control program in these counties. It was considered that the milk or cream test on composite or herd samples applied on an annual or semi-annual basis in such counties, might prove to be an effective and inexpensive means of locating infected herds and a valuable aid in keeping the disease at quite low levels in the intervals between the reaccreditation blood tests. The ring test might also provide a means of extending the period between county wide blood tests. It was with this idea in mind that a study of the ring test was undertaken in Minnesota as a cooperative project between the State Livestock Sanitary Board, the

1 Paper No. 2432 Scientific Journal Series, Minnesota Agricultural Experiment Station.
2 These studies were made possible by a grant from the Bureau of Animal Industry, United States Department of Agriculture.
Bureau of Animal Industry represented by Dr. Fred Driver and his staff and the University of Minnesota.

Before presenting the preliminary data we have collected thus far, it is desirable to briefly review the development of the ring test, the preparation of the antigen, the method of conducting the test and summarize the extensive studies on the use of the test reported largely from Denmark.

As has been known for many years the milk from cows with brucellosis contains agglutinins or antibodies which are found in milk in concentration usually between one-fifth to one-tenth the concentration in the blood. A number of workers have studied the tube agglutination test on milk whey from pooled or herd samples of milk with the objective in mind of finding a satisfactory method of locating infected herds. Because of the cumbersomeness of the method and the lack of sensitivity of the test this procedure has not been used extensively.

Fleishhauer in 1937 and Fleishhauer and Hermann in 1938 of Germany reported the development of a stained Brucella antigen with sufficient sensitivity to detect the presence of milk from one infected animal when it was mixed with the milk from 5 to 10 negative cows. This test was designated the Abortus Bang Ring test ("ABR" test). The high sensitivity of the test which permits the detection of infected herds by applying the test to pooled milk samples collected from the milk cans delivered to the creameries or dairy plants has created considerable interest in the European countries.

Since the original reports in 1937 and 1938, a number of reports have appeared from Sweden and particularly from Denmark on improved methods of preparing the antigen, details on methods of conducting the test with quite extensive data of field studies on the efficiency of the test in locating infected herds. The ring test is used extensively in Denmark at present as a rapid and inexpensive method of locating centers of infection and is an official part or adjunct to the blood test in their brucellosis control program.

The stained antigen used for the ring test is similar to the standard plate antigen prepared in this country by the Bureau of Animal Industry, U.S.D.A. for the plate or rapid serum agglutination tests. The chief difference is that the bacterial cells are stained a deep blue-violet color with a dye (hematoxylin) in order that the agglutination reaction may be observed in whole milk. The concentration of the cells is approximately half that of the standard plate antigen to provide some increase in sensitivity.

The actual mechanism of the test is not entirely clear but would appear to be as follows: The protein layer around the cream droplets carries antibodies or specific agglutinins in proportion to the concentration of the antibodies in the milk whey. When the stained antigen is added the antigen is agglutinated with the cream droplets included in the agglutinated particles or aggregates. The cream then carries the stained cells to the top to give a deep blue cream line or ring with a white skim milk layer if the reaction is strongly positive. If no agglutination occurs the cream ring or line formed is white with the stained antigen remaining in the skim milk layer. (See Figure I, which illustrates three milk samples tested in duplicate to show a negative test on the left and several variations of strongly positive reactions on the right.)
That the aggregation of cream droplets occurs in strongly positive tests is indicated by the much more rapid formation of the cream ring than usually occurs in negative samples. The test of course depends upon the presence of cream. Usually the samples are placed in the incubator at 37°C. for 40–50 minutes before reading. This period of time is generally sufficient for a good cream ring to form on the negative samples. In our field tests we have used room temperatures with readings at about 75 to 90 minutes. The optimum time and temperature for the test needs further study.

The ring test would be of quite limited use in many areas of this country if it were not possible to use it on other than whole milk. In Europe nearly all dairy production involves the marketing of whole milk. In this country an appreciable portion is marketed by the producers as cream. As it is the cream present in the whole milk which is the essential part of the actual mechanism of the test itself it seemed to us that it would be possible to modify the test so that we might apply it to cream samples collected at creameries. This would provide a means of a much more complete coverage of the dairy herds in a given area.

Through a series of “trial and error” studies on the use of the test on cream it has been possible to develop a method which seems to give fairly satisfactory results. This modification of the test is given under the outline of test procedures.

The method of preparing the stained antigen is, with several slight modifications, that given to us by Dr. Aa. Jepsen of Denmark on his visit to our laboratories. The steps in preparing the antigen, the technique of the test on milk, with the modification of the test for cream is as follows:

Fig. 1. Duplicate tests. Reading left to right. 1 and 2 negative. 3, 4, 5 and 6 positive.
1. Prepare a suspension of washed Brucella abortus antigen from a smooth culture. The suspension must be stable at pH 4.

We have used the standard *Br. abortus* B.A.I. stock tube (about 4% cells) or plate antigen (about 8% cells by volume) and have found the preparations satisfactory.

We centrifuge the stock B.A.I. antigen in weighed centrifuge tubes and wash once with saline by centrifugation. Reweigh after decanting to obtain the weight of the bacterial paste. Stir the paste thoroughly with a stirring rod with the addition of a few drops at a time of physiological saline to obtain a smooth, thick creamy suspension of cells in a small volume of saline. This method of suspending the paste results in good dispersion of the bacterial cells. This suspension is ready to add to the staining solution.

2. Preparation of staining solution.

   Reagent I
   a) Dissolve 9 grams of ammonium aluminum sulfate in 100 ml. of distilled water (near saturation). Add 30 ml. glycerine.

   Reagent II
   b) Dissolve 1 gram of hematoxylin (Merck) in 2 ml. of alcohol (95%) by heating to 50°C. After solution add distilled water to 100 ml.
   c) Mix all of reagents I and II and to this mixture add 0.17 gram of sodium iodate dissolved in 2 ml. of distilled water. After allowing 15 minutes at room temperature for oxidation to take place, the mixture is diluted 1:4 to 1:6 with saturated ammonium aluminium sulfate (approximately 10%). The degree of dilution here determines the depth of staining of the cells. In our experience diluting to about 1:4.5 or 1:5 seems to give best results. After letting the diluted stain stand for 12 to 20 hours at room temperature, filter through a small filter to remove insoluble substances.

3. Staining:

Add the bacterial suspension to the dye solution at the rate of 10 grams of the paste to about 1200 to 1400 ml. of the diluted stain. Heat the suspension in a boiling water bath with gentle mixing until the mixture reaches 65°C. Hold at this temperature for 3 to 5 minutes and cool in flowing water. Centrifuge the suspension at 2600 to 2800 r.p.m. to collect the cells. Decant and wash about 3 times by suspending and centrifuging with 0.3 per cent NaCl solution acidified to pH 4 with HCl. The pH of the wash fluid seems important. If washed too much, the cells begin to lose appreciable dye. Some stain will always be found in the wash fluid. The stained cells may be suspended in glycerine containing 0.5% phenol. Saline containing 0.5% phenol may also be used but the Danish workers use glycerine for better preservation. We prefer a 50-50 mixture of physiological saline and glycerine containing 0.5% phenol as such antigen mixes more readily.

The Danish workers recommend suspending the stained paste by grinding in a mortar with glycerine. We find a thorough stirring of the paste with a rod and then the addition of a few drops at a time of the glycerine-saline mixture while
stirring gives the rapid and satisfactory results. After a creamy suspension is obtained, the remainder of the diluting fluid may be added and the suspension completed by vigorous shaking for a moment. The final bacterial cell concentration should be about 4% by volume (centrifuge method with Fitch-Hopkins vaccine tube) and the pH 4.0 to 4.3 by the glass electrode method.

TEST PROCEDURES

1. Milk
   a) Mix the milk sample thoroughly but gently to resuspend the cream. Transfer sufficient milk to a small test tube to result in a column of milk approximately 1\(\frac{1}{2}\) inch in depth. This results in the desired thickness of cream ring on standing for easy reading. For the test tubes used in our studies (100 x 10 mm. inside dimensions), this requires approximately 2 ml. of milk. One may pour the milk from the collecting tube into the tube used for the test and estimate the 2 ml. This seems sufficiently accurate and avoids the use of a large number of pipettes.

   b) Add 2 drops of the stained antigen (1 drop per ml. milk) and mix thoroughly by gently inverting the tube a number of times and in such a manner as to thoroughly wash the antigen down the wall of the tube. If darkly stained areas are noted in the top layer after standing a few minutes, the mixing has not been adequate. Avoid shaking to prevent foam which interferes with reading the tests. Mix the specimen within a minute after adding the antigen.

   c) Incubate the test samples at 37°C. for 45-50 minutes or leave stand at ordinary room temperature for 75-90 minutes. The time and temperature of incubation must be such as to avoid significant acid production in poor quality milk specimens as appreciable acidity and bacterial growth decolorizes the stained cells. If the milk samples are of poor quality and acidity is frequently encountered, add 1 or 2 drops of saturated sodium bicarbonate to the small test tubes before pouring in the milk. The question of time and temperature of incubation needs further investigation.

   d) Reading the tests

   The designations of various gradations of the reactions which we use are purely arbitrary. We will not know the significance of each grade until a great many tests have been made and correlated with the herd blood tests. However, we present our designations so that anyone may follow them if they wish and provide a means of comparison of data. They are as follows:

   Negative = Cream line or ring, white or only a slightly "muddy" color—skim milk fraction contains the stained cells to give a blue-violet color.

   + = Cream ring approaching or equal to the color of the skim milk fraction.

   ++ = Cream ring color slightly greater than the skim milk fraction.

   +++ = Cream ring significantly deeper blue than the skim milk fraction, but the latter still contains appreciable stained cells of the antigen.
+++= Cream ring a very dark blue and the skim milk fraction nearly white.

As we do not measure the milk and antigen accurately for each test, we do not read the test on the basis of the absolute color of the cream ring, but on the ratio of the cream ring color to that of the skim milk layer.

2. Cream

Preliminary comparisons of the cream and whole milk tests on samples from the same specimens or sources indicate the cream test as we use it may be a little less sensitive than the test applied to milk. Therefore, we may need to modify the cream test to bring the results in line with that on milk samples. The cream test is as follows:

a) Add 2 drops of saturated sodium bicarbonate to a small test tube (100 x 10 mm. inside dimensions). If desired an equivalent amount of the sodium bicarbonate may be added to the stock saline used in the next step. The sodium bicarbonate is used to neutralize the acid which may be present in some cream specimens.

b) With pipette add 1 ml. of physiological saline.

c) With dropper (2.5 mm. outside tip diameter) add 12 drops of cream and then 1 drop of stained antigen. Mix within one minute, incubate and read as for milk.

If the dropper is thoroughly rinsed in water at 45-55°C., it may be used for successive samples. For those cream samples which show marked acidity and bacterial growth two or three additional drops of saturated sodium bicarbonate may be added to the tube at the time the cream is measured.

The brief review of the extensive studies on the ring test reported herein is taken largely from the reports of Norell and Olson of Sweden (1943) and Winther and Hansen (1943), Bruhn (1944 and 1948), Seit and Jorgensen (1944), and Christiansen (1948) of Denmark.

In almost all of the studies the milk samples were collected from each can of milk from a producer as the milk was delivered to the creamery or dairy plant. This method permitted less dilution of the infected milk in that each can of milk represented possibly not more than 6 or 8 cows of a herd. Also collection of specimens from each can of milk though involving much more work reduces the chances of contamination from another producer’s milk as would be the case if the sample was taken from the weighing tank. The ring test results on each herd was compared with the blood test conducted within a period of a month or two before or after the milk tests.

The diagnosis of infection within a herd was based on the presence of one or more animals showing a blood titer of complete agglutination in the 1:20 dilution or higher. On the surface this would appear to be appreciably different than the application of the blood test in this country. However, from a personal communication from Dr. Aa. Jepson of the Royal Veterinary College in Copenhagen concerning the density of the antigen used in Denmark it would appear that complete agglutination in the 1:20 dilution with their antigen would roughly correspond to complete agglutination at 1:50 with the standard tube antigen used in this country.
Their antigen is approximately 2.5 times more concentrated and therefore significantly less sensitive than the standard antigen we use. Even with the differences in the antigens it would appear that the interpretation of the agglutination test in Denmark is somewhat more stringent than in this country.

Table 1 presents a summary of some of the more extensive field studies in Denmark. The herd infection rates in the three groups studied varied from 14.7 to 18.6 per cent. As may be noted from the table not only is the agreement of the two tests quite good but also the efficiency of the milk test in locating or detecting infected herds is high. The results of these studies and others not reviewed here serve as a basis for the official adoption of the ring test as an aid in the brucellosis control program in Denmark. Not only does the test serve as an inexpensive and rapid method of locating centers of infection so that herd owners may initiate a control program in their herds, but also serves as an aid in the accreditation of brucellosis free herds. A herd is accredited if it successfully passes three ring tests 3–6 months apart followed by a negative blood test. This method materially reduces the expense and work involved in accrediting a herd in that it eliminates the several additional negative blood tests normally required for accreditation.

On investigation of an appreciable number of the infected herds missed by the ring test i.e. blood positive and milk negative, or in some instances questionable, it was found that the milk test was really not in error in over two-thirds of such herds. The one or two infected animals in such herds were not in production at the time of the ring test, i.e. either heifers or dry cows. The majority of the herds in this category no doubt would be detected on subsequent ring tests when most of the animals responsible for the "misses" would be in production. In some instances the only infected animal in the herd was a bull.

In the groups of herds showing negative or in some instances questionable blood tests but positive ring tests, it is not at all clear that the ring test is actually in error in a number of instances. In the studies reported by Seit and Jorgensen there were a number of instances in which the pooled-milk tests were positive but on which the last blood tests were negative. In a number of such herds there were found animals which earlier had given positive blood tests (so called ceased-reactors or self-cleaned cows). They selected 134 cows in this category from a number of

Table 1.—Summary of Field Studies on the Ring Test in Denmark

<table>
<thead>
<tr>
<th>Reference</th>
<th>No. Herds Tested</th>
<th>Agreement</th>
<th>Disagreement</th>
<th>Per Cent Efficiency in Locating Inf. Herds</th>
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<tr>
<td></td>
<td></td>
<td>Milk –</td>
<td>Milk +</td>
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<tr>
<td>Seit and Jorgensen, 1944</td>
<td>3,262</td>
<td>2,768</td>
<td>465</td>
<td>96.2</td>
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<tr>
<td>Christiansen, 1948</td>
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<td>2,435</td>
<td>479</td>
<td>94.7</td>
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<td>5,112</td>
<td>721</td>
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</tr>
<tr>
<td>Total</td>
<td>12,605</td>
<td>10,315</td>
<td>1,665</td>
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</table>
herds for further investigation. They conducted simultaneous blood tests and ring tests on milk from individual quarters. All but seven animals of this group gave negative or partial agglutination up to the 1:20 dilution. Table 2 summarizes the results of this study. The seven animals with complete agglutination at 1:20 or higher are excluded from the table as being reactors according to their interpretation of the blood test.

In regard to the interpretation of the above study we should like to quote the following free translation from the report by Seit and Jorgenson: "Among the so-called self-cleaned cows (ceased reactors) is found a considerable per cent (42.9) which in spite of the fact that the blood reaction has fallen below the titer accepted as the reaction limit, still shed Brucella agglutinins in the milk which are detectable with the ring test. This must be interpreted as an indication that Brucella infection is still present in such cows. The positive reaction to the ring test applied to milk from individual quarters further suggests that the infection is localized in the udder; also that the agglutinins are formed in the individual quarters."

**Table 2.—Summary of Blood and Ring Tests on "Ceased Reactors" or "Self-Cleaned Cows" (by Seit and Jorgenson)**

<table>
<thead>
<tr>
<th>NO. COWS STUDIED</th>
<th>POSITIVE RING TEST</th>
<th>BLOOD TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One Quarter</td>
<td>Two Quarters</td>
</tr>
<tr>
<td>127</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

In certain problem herds from which it is difficult to eradicate brucellosis or which show reinfection from time to time, the ring test applied on an individual quarter basis might offer a means of locating ceased reactors or possible carriers that may be present. This phase of the ring test is certainly worthy of further study.

Seit and Jorgenson also report that a considerable part—a little over 30 per cent—of the herds giving positive ring tests but negative blood tests are really not infected. The apparent positive ring test is merely due to faulty marking of the specimens in the creamery.

To what extent errors in this direction are involved in our own study we do not know. We do know that it is a problem for the "hustle and rush" in a large creamery is certainly conducive to errors in the proper identification of milk or cream samples. However, such errors no doubt will be reduced as more experience is gained.

In some of the creameries or dairy plants, Seit and Jorgenson collected specimens from the weighing tank for comparison with milk can sample collection used in the majority of the dairy plants. Weighing tank samples gave less accurate results because of the danger of further dilution particularly in large herds and possible contamination of milk weighed subsequently due to inadequate drainage of the milk from the tank. Our own studies confirm this observation.

Several studies have been made on simultaneous blood and milk tests on an individual animal basis. One such study was reported by Bruhn which is summarized in table 3.
TEST FOR BRUCELLOSIS

As mentioned earlier the antigen used in Denmark is probably significantly less sensitive than that used in this country and that they consider complete agglutination at 1:20 or higher dilutions as indicating an infected animal.

As indicated by table 3 the ring test detected 97 animals or 80 per cent of the 121 animals positive to the agglutination test. There was an “overrun” of 26 positive ring tests in which the blood titers were below the diagnostic level. The ring test failed in 5 instances in which the blood titers were high i.e. 1:100 or higher. Further investigations of the ring test on these high titered animals revealed the lack of cream rising ability in that the milk from these animals when mixed with known negative pooled milk resulted in positive ring tests. This condition tends to explain why the ring test is more reliable on pooled milk than on individual samples.

Christiansen reported a study of simultaneous ring and blood tests on a group of nearly 4,000 cows in which the infection rate was 19 per cent. He found agreement between the two tests in 84.3 per cent, partial disagreement in 4.1 per cent and total disagreement in 11.6 per cent of the tests. The efficiency of detecting the infected animals with the ring test was 87 per cent of the 745 animals with positive blood tests. However, there were an additional 376 animals which gave a positive ring test and a negative blood test. This represents approximately 50 per cent “overrun.” Thus it would appear that the ring test on individual animals is of a more limited value until much more information becomes available.

Of 621 animals which gave partial or total disagreement between the two tests, 65.5 per cent were “normal” milkers, 11.5 per cent were “new milkers” (recently freshened), 22.5 per cent were “strippers” or nearly dry and 1.2 per cent gave evidence of mastitis. Thus cows in early or late lactation may contribute more than their share to the errors but they are not responsible for the major portion of the discrepancies. The first milk or colostrum in a high percentage of cases yields false positive tests. The high concentration of proteins in the milk whey immediately after calving or when nearly dry as well as in instances of mastitis appears to be responsible for false positive reactions in such animals.

The studies in Minnesota which we are in a position to report thus far are of a limited nature. To date ring tests have been made or are in progress in 17 counties under the area control plan. The work reported at this time is restricted to the counties in which the county wide blood tests have been completed and the data summarised.

In the early work (that reported herein) no special effort was made to collect a
high percentage of the cream or milk samples available in the counties. Usually only readily available samples which might be obtained on several visits to the creameries were collected. Not all creameries or cream buying stations were contacted. In the area of the state under study, the average herd size is small and the time of the year happened to be such that the production was at its lowest which meant that many owners were not marketing milk or cream.

For the collection of cream samples 4 to 6 ml. specimens were obtained from the sample vials collected by the creamery operator from each patron for butterfat determination or the specimen was obtained at the time the "butterfat" sample was collected from each can. The regular blood collecting tubes or vials were used for collecting cream samples. Two drops of a 1:12 dilution of formalin was added to each vial used for collection to aid in preserving the cream.

After collection of the major portion of samples at a creamery empty vials were left with the creamery operator to collect samples from those patrons missed. These samples were placed in the cooler until they might be "picked up" a day or two later.

In collecting milk samples we rather deliberately disregarded the warning of the Danish workers and collected milk samples from the weighing tank to determine if possible the extent of errors by this method in our earlier work. Most of the samples for the studies reported in this paper were collected in this manner. In view of the small herds in the area involved the additional dilution factor did not seem important.

At present we are collecting a small amount (about 3 ml.) from each 2 or 3 cans of milk from a patron for a composite sample. In most instances this requires not more than 3 such samples per herd.

It would seem that the efficiency of the ring test in locating infected herds would vary with such factors as the average herd size, the percentage of dry or non-producing animals, whether milk samples are collected from individual cans of milk or a composite from several cans or whether the specimens are milk or cream. In the instance of cream, the sample tested represents all the producing animals in a herd.

Formalin is added to the collecting vials as for cream. The ring tests were made 1 to 6 weeks preceding or in the early part of the county wide blood tests. This permits a fairly accurate comparison of the two tests.

Table 4 presents a summary of available comparisons of the two tests to date. Sufficient tests have not been made to permit an accurate comparison of the accuracy of the milk tests separately from the cream tests and therefore they are included as one group.

In the group of slightly over 6000 herds studied the herd infection rate was 4.74 per cent. In a number of the counties it had been 4 to 6 years since the last complete blood test.

In general the results confirm those reported from Denmark. In the one county (St. Louis) in which there was a large overrun of herds with positive milk or cream tests and blood negative, by far the larger portion of the tests were on milk. The reverse was true for the other counties in that the majority of the tests were on cream.
A large percentage of the overrun in St. Louis county is believed to be due to the manner of collection and the condition of the milk at the time of collection. The work in this county was done at a time of extreme weather conditions of temperatures of 10-30° below zero which with bad roads resulted in a considerable portion of the milk reaching the plant partially frozen. In view of the collection of the specimens from the weighing tank the accumulation of "iced" milk on the screens over the weighing tanks resulted in contamination of the succeeding patron's milk. Also some preliminary study of the effect of freezing milk on the ring test suggests that freezing alters the physical state of the milk sufficiently to give appreciable numbers of + and ++ reactions to the ring test. The results in St. Louis county serve as a good illustration of how and when not to conduct the ring test.

Up to the present no special emphasis has been directed towards reducing the "overrun" i.e. false positive ring tests. This category is somewhat analogous to

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>NO. HERDS TESTED</th>
<th>AGREEMENT</th>
<th>DISAGREEMENT</th>
<th>PER CENT EFFICIENCY IN LOCATING INF. HERDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Blood Mor C</td>
<td>Blood + Mor C</td>
<td>Per cent Agreem't</td>
</tr>
<tr>
<td>Koochiching</td>
<td>228</td>
<td>210</td>
<td>11</td>
<td>96.0</td>
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<tr>
<td>Itasca</td>
<td>584</td>
<td>573</td>
<td>4</td>
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</tr>
<tr>
<td>St. Louis</td>
<td>2,704</td>
<td>2,502</td>
<td>61</td>
<td>94.7</td>
</tr>
<tr>
<td>Lake</td>
<td>49</td>
<td>48</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Watonwan</td>
<td>828</td>
<td>748</td>
<td>56</td>
<td>97.8</td>
</tr>
<tr>
<td>Wilkin</td>
<td>669</td>
<td>558</td>
<td>69</td>
<td>94.8</td>
</tr>
<tr>
<td>Hubbard</td>
<td>1,054</td>
<td>1,014</td>
<td>15</td>
<td>98.5</td>
</tr>
<tr>
<td>Total</td>
<td>6,116</td>
<td>5,653</td>
<td>217</td>
<td>96.5</td>
</tr>
</tbody>
</table>

"suspect" herds on the blood test i.e. herds with all animals negative except one showing a suspicious or doubtful titer. It is common in retesting our area counties to find between one-half to two-thirds as many "suspect" herds as reactor herds with the blood test. A very high percentage of such "suspect" herds are classified as negative on subsequent blood tests.

With more experience in conducting as well as interpreting the tests it is hoped that it will be possible to keep the per cent of false positives to a satisfactory level. As long as 60-70 per cent of the positive ring tests are correct as indicated by the follow-up with the blood test on individual animals in such herds the application of the ring test as an aid in the control program probably would be satisfactory. At present in a number of our counties under the area plan it is necessary to blood test anywhere from 20 to nearly 100 herds to find the one infected herd we are searching for.

In one county (Watonwan) the nine herds with false positive ring tests were investigated with the following information of some possible significance regarding
the marked sensitivity of the test: One herd practiced vaccination; one had been holding reactors; one had been infected and frequently disclosed "suspects" and one herd had frequently disclosed "suspects."

Of the total of 73 failures to detect infected herds by the ring test, in 41 herds the reactors present (usually one only) were non-producers i.e. heifers or dry cows. Thus 56 per cent of the apparent failures were not bona fide in that the test had no chance to detect such infection. This represents an important natural limitation of the ring test. A subsequent test 6 months later would no doubt disclose a majority of these herds. In several instances the reactor was nearly dry which gave rise to quite high dilution with negative milk or cream.

In this study we have had the very best of cooperation from the creamery managers and operators which has expedited the work greatly. In some instances the creamery managers asked for a list of the herds which were positive to the test. When informed that the majority of herd owners do not desire such information to become public and that some of the tests may be false positives they readily understand why it is not desirable at least under present conditions to have such information.

One of the most encouraging points regarding the work and somewhat a surprise to some of us is the quite universal and enthusiastic response of the herd owners to the general idea of the ring test. Judging from remarks commonly made this would appear to be due to the apprehension of dairymen in the area counties regarding the status of their herds in the years between the reaccreditation blood tests. They would welcome more frequent checking of their herds and the earliest possible disclosure of any infection present so they may cope with it more promptly. They also comment on the desirability of early disclosures of centers of infection to reduce the spread to neighboring herds. When informed that the ring test might be made once or twice a year the reply frequently heard is "why not do it every month just like the methylene blue test for quality milk control."

At the request of breeder's organizations and dairymen in one of our counties under the area control program—a county which was not due for a reaccreditation blood test for a year and a half—a program was initiated involving the ring test followed by the blood test on the herds positive to the ring test. It is planned to repeat this procedure every 6 months until the next county-wide blood test to determine the efficacy of the ring test as an aid in holding the infection rate at a low level. The response of the herd owners showing positive ring tests in regard to submitting the herds to blood tests has been excellent. We have been careful to inform the herd owner that the ring test is very sensitive and may give a false positive test. He is informed therefore that he should not be disappointed if his herd is found to be negative to the blood test.

In the more recent studies, special emphasis is being placed on as complete a collection as possible of milk or cream samples in a county to determine the degree of coverage of herds which is feasible. For this purpose collections are made as complete as possible for each creamery irrespective of the county in which the patrons reside. By checking the list of samples collected against the patron list of the creamery a quite satisfactory coverage can be obtained. It is the general experience that a number of collections over a period of approximately one week is required to get satisfactory results.
TEST FOR BRUCELLOSIS

By testing the samples in a central laboratory either a trailer or portable laboratory arranged in a county court house or city hall, our experience to date suggests that a staff of four veterinarians may average about 1000 to 1200 herds per week. On the basis of our limited experience it is estimated that the cost of locating centers of infection by the ring test and providing a blood test on such herds is approximately 10–15 per cent that required in using the blood test alone, in counties with herd infection rates below 5 per cent. In such a comparison one must keep in mind however, that the use of the ring test in locating centers of infection is not as thorough as the blood test applied to all herds.

SUMMARY

The preliminary studies on the ring test for the diagnosis of brucellosis, as applied to herd milk and cream samples collected at creameries, confirms the reports from Denmark regarding the accuracy and efficiency of the test in detecting infected herds. A comparison of the milk and cream ring test with the blood test on slightly over 6000 herds gave an efficiency of 75 per cent for the ring test in locating infected herds. This compares favorably with an average of 82 per cent efficiency for the ring test obtained in similar studies in Denmark.

The rapid and inexpensive nature of the ring test in locating centers of infection would seem to render it a valuable adjunct or aid in the brucellosis control program in the predominantly dairy areas of this country.

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WHAT IS KNOWN ABOUT BRUCELLOSIS

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FOREWORD

On September 22–23, 1947, a group of men interested in the control of brucellosis, and especially in regulations governing the interstate shipment of cattle, met in Washington to discuss their problems. The group included owners of livestock, veterinarians, research workers, physicians and sanitary officials and the extension service. Their deliberations convinced them that the solution of the problem of interstate regulations does not lie in uniformity alone, because the conditions in the individual states vary so widely. It was clear, as well, that many livestock owners wanted, and were entitled to receive, a concise statement of established facts regarding brucellosis itself, because fundamentally, each infectious disease lays down its own laws and exacts its own penalties from those who infringe. Dr. Jean V. Knapp, President of the United States Livestock Sanitary Association and Dr. B. T. Simms, Chief of the United States Bureau of Animal Industry were asked to name a special committee to prepare such a statement, and this committee, with substantial aid from the U.S. Bureau of Animal Industry, from progressive elements of the agricultural press, and from other interested sources, here presents its report.

Inconveniences to some individuals and groups always attend sanitary regulations of any kind, but it is the unnecessary inconveniences, or those thought to be unnecessary, that create most of the friction. It is confidently expected that this report, aside from being a helpful and available reference, will, by stating basic facts regarding brucellosis, operate to eliminate unnecessary restrictions, and provide a rational basis for those that are merely thought to be unnecessary.

The selection of material for this report has not been easy nor can its presentation be free from imperfections and legitimate criticism. To serve its purpose the report must keep to the main highway, it must be accurate and it must be read. Consequently, entangling detail, and even references, which often take on a formidable aspect, have been omitted. In order to make each topic reasonably complete within itself some repetition has been retained in the text.
Finally, with the *purpose* of the report its guiding motive, the committee has included a brief statement regarding control. This may invite some criticism because the report was intended to be essentially a statement of *fact* rather than of *policy*. This departure was decided on so as to include a brief statement regarding four optional plans (A, B, C and D) for control of brucellosis within the states. These plans have been approved by the U. S. Livestock Sanitary Association and already have been adopted, without modifications or with minor ones, by forty-two of the states as the basis of a memorandum of understanding between the individual states and the Bureau of Animal Industry in the control of brucellosis. Thus, the individual breeder in any of those states, following his first informative test, may choose the plan best suited to his needs, and his herd will assume official status in accordance with the plan selected.

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I. DEFINITION

A. Brucellosis is a specific infectious disease of animals and man caused by microorganisms or bacteria of the genus Brucella. The three known types of this genus are: (a) *Brucella abortus*—most commonly causing disease in cattle; (b) *Brucella suis*—most commonly causing disease in swine; (c) *Brucella melitensis*—most commonly causing disease in goats.

B. In cattle the disease is also known as Bang’s disease and contagious abortion; in swine as contagious abortion. In man brucellosis is known as undulant fever or sometimes when caused by *Brucella melitensis*, as Malta or Mediterranean fever.
II. HISTORY

A. Brucellosis is an insidious disease of animals and man which must have been prevalent in cattle, goats and swine centuries ago, inasmuch as a similar disease now known in man also as undulant fever was described in early histories. In 1861 an accurate description of the disease in man was reported and designated as Mediterranean or gastric intermittent fever. The disease in man was given the descriptive name undulant fever in 1897.

B. History reveals that among the military and naval forces quartered on the Isle of Malta undulant fever had been for years a major cause of disability. For this reason, in 1904 the British Government established a commission headed by Sir Robert Bruce to find, if possible, the source of the disease and recommend measures for its prevention. Associated with Dr. Bruce were many noted scientists of that day. This group of workers labored for two years with little success, eliminating such possible sources of infection as insects, air, sewage, water and dust. However, the search was continued and needing a readily available supply of laboratory animals for experimental purposes it was decided that milch goats might serve that purpose. Goats were then, as now, the chief source of the milk supply for the Island.

C. Before attempting to infect the goats, it was considered advisable to examine their blood for specific agglutinins and to the great surprise of all of the investigators the goats reacted to the agglutination test. Blood cultures from some of these animals were positive and the source of brucellosis stood revealed. During these experiments it was also demonstrated that the milk from the udder of the infected goats contained specific agglutinins and that the detection of these was a reliable diagnostic measure.

D. One of the first cases in man, supposed to be brucellosis, originating in the United States was reported in 1905 and inasmuch as the patient had never used goat’s milk, it is quite possible that the causative organism in this particular case was the *Brucella abortus* or *Brucella suis* strain. It was also in 1905 that a representative of the United States Bureau of Animal Industry was sent to Malta to purchase milch goats. Sixty-one female and four male goats were purchased. On their way to the United States the milk from the goats was consumed by the crew of the ship, The St. Andrew. Several men became sick from 18 to 24 days after leaving Malta. Observations suggested a clinical diagnosis of brucellosis.

E. In 1897 Bernard Bang and Stribolt isolated a microorganism, now known as *Brucella abortus*, from an aborting heifer.

F. In 1911 the disease in man was reported as prevalent in southwestern Texas and came from infected goat’s milk. Evidence was also obtained that the disease had been present in Texas for many years.

G. In 1914 J. Traum identified a microorganism, now known as *Brucella suis* the cause of brucellosis in swine.

H. In 1918 Dr. Alice Evans of the United States Bureau of Animal Industry reported the results of her comparative study of *Brucella abortus* (bovine) and *Brucella melitensis* (caprine). Her conclusion was that only with great difficulty was she able to distinguish between the two. This discovery led to the belief that the bovine type as well as the caprine type was pathogenic for man. Several
attempts were made prior to 1918 to connect *Brucella abortus* with brucellosis in man, but apparently it was not clear to the investigators just what to look for. Now we know that brucellosis in animals is directly responsible for the disease in man. Consequently, and with the preponderance of evidence that undulant fever was prevalent in man centuries ago, it must follow that some of our domestic animals have been subject to brucellosis down through the years.

III. SPECIES OF ANIMALS INFECTED

A. Brucellosis is the name now used to designate infections in animals and man caused by any member of the genus *Brucella*. Brucellosis in man is also known as undulant fever.

B. Many animal species serve as reservoirs of infection, especially cows, pigs, goats, and to a lesser degree sheep and horses.

C. *Brucella abortus* is commonly found in cattle, *Brucella suis* in swine, and *Brucella melitensis* in goats, but each type sometimes infects other animals, and all three cause disease in man.

D. *Brucella abortus* occasionally produces abortion in sheep. It has been found in the uterine content of an aborting mare, but apparently the organism does not play an important role in abortions in either of these species.

E. Swine, dogs, cats and fowl are very resistant to experimental exposure to *Brucella abortus*, but the organism has been recovered occasionally from individual animals of each of these species where there has been close association with infected cattle.

F. It is known that *Brucella abortus*, the bovine type, has little or no virulence for swine. *Brucella suis* is readily transmitted among swine or from swine to man. *Brucella suis* also occasionally infects cows and is eliminated in the milk of these animals; this creates the possibility that swine may become infected from such cows’ milk, but it is not likely that this often takes place.

IV. IMPORTANCE OF THE DISEASE TO THE LIVESTOCK INDUSTRY

A. Experienced cattle breeders know that brucellosis causes severe losses, but it is doubtful whether many fully realize the heavy toll they regularly pay to the disease. The losses in calves, felt most keenly by breeders of purebred cattle, are apparent to all. But the losses caused by temporary and permanent sterility, the decreased milk yield, the breaks in the ranks of valuable purebred families, and the lower sale value of infected cattle sometimes escape accurate appraisal because these factors are not spectacular in nature. Brucellosis makes its attack from many directions.

B. Probably about 5 per cent of the cattle in the United States have brucellosis. How do infected cattle differ from those free from the disease and kept under identical conditions? Records kept for some years on several thousand cattle in many representative herds give reasonably accurate estimates. Clean cattle, recent reactors (those that have been reacting less than two years) and chronic reactors (those that have been reacting more than two years) have been compared. The basis of comparison has been the number of normal calves produced. Cows that have produced an average of one normal calf each 12 months have been given
100 per cent; the others have been graded in proportion as they have failed to reach this ideal. For example, a cow that required two years to produce one calf has been given 50 per cent; one that produced two calves in three years has been given 66.6 per cent.

C. Cows that remained free from brucellosis during the entire period of observation average 87 per cent; the recently infected group averaged 54 per cent; the chronic reactors averaged 76 per cent. If one realizes that these figures do not include the cows sold for beef because they were rendered permanently sterile or otherwise incapacitated by the disease, and that the proportionate loss of milk production in the infected groups probably closely paralleled the loss in calves, he can estimate the extent of the devastation wrought by brucellosis.

D. Further evidence of the losses to the industry is revealed by data in another report which indicates that brucellosis reduced the milk production in infected cows about 22 per cent and the calf crop about 40 per cent. This report further states that brucellosis-free cattle calve every 11.5 months, infected cattle calve on an average of every 20 months and one out of every five cows aborting will become sterile. The disease with the breeding trouble, sterility and mastitis it produces, increase the needed replacements by about 30 per cent. These reports, taken collectively with others, are a reasonably accurate basis for estimating the losses.

E. At the present time there are about 26,000,000 milk cows in the United States; based on current Federal-State cooperative test results approximately 5 per cent, or one and one-third million of these are affected with brucellosis. On the basis of national averages these one and one-third million dairy cows, had they not been infected, would have produced about six and one-third billion pounds of milk each year. However, because of a conservatively estimated 20 per cent loss in milk production which results from the disease, this figure is reduced by one and one-quarter billion pounds—an annual loss of slightly over $50,000,000.

F. In addition to milk losses, the reduction in calf crops must be considered. For infected dairy cattle, even the lowest estimate of annual losses we have encountered (15 per cent) would be nearly 200,000 calves, having a current value for veal of approximately $5,000,000. This figure does not take into consideration the additional value of about one-fourth of these lost calves which normally would be saved each year as replacements.

G. We must recognize also the cost of replacing dairy cows affected with brucellosis. The number of such replacements made each year is estimated at 2 per cent of the 26 million dairy cattle in the United States or about 500,000 animals. Giving full consideration to the difference between salvage and purchase values the loss would approximate $32,000,000.

H. Thus from the standpoint of replacements and milk and calf losses, we have accounted for a total annual loss to the dairy industry alone of about $87,000,000 resulting from bovine brucellosis.

I. Since the degree of infection in beef and dairy animals is much the same, calculations of losses and calves for both groups can be handled in a similar manner. For obvious reasons milk losses in strictly beef animals cannot be reasonably estimated and have been omitted entirely.

J. On the same 15 per cent abortion-sterility loss figure used in computing calf
losses for dairy cows, and an estimated sixteen and one-third million beef cattle over two years of age in the United States, brucellosis in this group of animals accounts for a probable annual loss of 125,000 calves. These calves would have a potential value of three and one-quarter million dollars.

K. Because of the different beef cattle feeding and breeding practices followed in various sections of the country, no attempt has been made to estimate additional values that rightfully belong to a significant number of these calves.

L. As already pointed out, any figure for losses caused by brucellosis in cattle must, of necessity, be a broad estimation. Thus, in arriving at a final estimate of around $90,000,000 for the yearly losses suffered by the cattle industry because of brucellosis, every effort has been made to lean heavily toward the conservative side. It will be noted that a number of important elements have not been considered at all due to a lack of suitable data upon which satisfactory determinations could be made. No reliable data are available to form a basis for accurate estimates of the heavy economic losses to the swine industry; however, it would seem that the economic loss to the livestock industry caused by brucellosis can be conservatively estimated to be more than $100,000,000 yearly.

M. No estimates are available of the economic losses due to brucellosis in man.

V. PUBLIC HEALTH ASPECTS OF BRUCELLOSIS

A. There is no doubt as to the existence of a disease of man, commonly known as undulant fever or brucellosis, which is caused by Brucella organisms of animal origin.

B. Scientific evidence indicates that rarely, if ever, does one human contract brucellosis from another human. It appears, therefore, that in the light of present knowledge the prevention and control of brucellosis in man is directly dependent upon its control and eradication in domestic animals. A major effort needs to be directed to bring the disease under control in animals which may act as reservoirs of infection and as a means of transmission to man.

C. There is overwhelming evidence that brucellosis in man occurred in the United States and other countries for many years prior to its diagnosis. Since 1905, when the first reasonably authentic case of human brucellosis originating in the United States was reported, the number of reported cases has increased to around 7,000 annually. Most students of public health reports think that the data do not fully indicate the incidence of human brucellosis. It is known that the disease is being recognized at a higher rate each year.

D. The diagnosis presents one of the most difficult aspects of the problem of human brucellosis. Standard diagnostic procedures and techniques are not yet used in many public health laboratories and this fact contributes to the inadequacy of data on the incidence of the disease.

E. Brucellosis in the people of the United States involves most heavily the young adult males. Children less than 14 years of age rarely contract the disease and above that age the proportion of reported cases in males as compared to females is about four to one.

F. A wide variation in the incidence in occupational groups has also been shown. A comparatively high rate occurs in men on the farm and in packing house workers,
which emphasizes the incidence in occupations where direct contact with *Brucella* infected livestock and fresh livestock products exists. Many veterinarians and laboratory workers acquire brucellosis in the course of their professional work, but their numbers are not significant because they are numerically a small professional class.

G. As mentioned earlier, brucellosis is primarily a disease of cattle, swine and goats; however, horses, dogs and other species may become infected. The relative importance to human health of these animal sources cannot be measured statistically, but in the United States cattle and swine are chiefly incriminated. It was previously assumed that human brucellosis was acquired primarily, if not solely, by ingestion of infected raw dairy products. It has been established by experimental work and epidemiological studies that the infection can be acquired through the skin especially when abraded, and conjunctiva of the eye; hence major sources of human infection are represented by raw dairy products and any infective animal discharges, either ingested or otherwise acquired through direct contact.

H. It is commonly considered that man is most susceptible to *Brucella melitensis* (goat type), slightly less to *Brucella suis* (swine type), and somewhat less susceptible to *Brucella abortus* (cattle type). The intensity and violence of the symptoms produced in man are in the order given above, dependent on the type of the *Brucella* organisms causing the disease. In man the opportunity for exposure to the three types of *Brucella* frequently is in the reverse order. It is well known that brucellosis in man, regardless of the type and source of infection, frequently results in a serious debilitating, incapacitating illness of long duration with an occasional death.

VI. DISTRIBUTION

A. Brucellosis is world-wide in distribution.

B. Bovine brucellosis occurs in all areas where cattle are maintained. It is common in all the United States except in areas where an intensive program of eradication is in operation. It is most common in areas where large herds are maintained and where there is frequent transfer or importation of cattle. It is less common in areas where herds are small and self-contained and where additions are only rarely made.

C. Swine brucellosis occurs throughout the United States wherever hogs are raised. It is most common in corn-hog belt states in the Middle West. Purebred herds where individual animals are kept for a period of years are most commonly infected.

D. Brucellosis of goats in the United States is confined principally to south-western states.

E. Brucellosis in man is increasingly common, or at least it is more frequently diagnosed in most states.

VII. CHANNELS OF ENTRANCE AND LOCALIZATION OF THE ORGANISMS IN THE ANIMAL BODY

A. The infection of cattle, sheep and goats occurs readily through the mouth. The organisms gain entrance to the blood stream or lymph channels and become
PROVEN FACTS REGARDING BRUCELLOSIS

Localized temporarily in the various lymph nodes. In young animals, not yet sexually mature, the disease seldom goes beyond this stage and the organisms are gradually eliminated from the body.

B. In pregnant animals, however, the organisms reach the uterus, fetal membranes and even enter the body of the fetus. The recovery of the organism from the alimentary tract and lungs of aborted fetuses suggests that the organism had been taken into the fetus by swallowing of the amniotic fluid rather than through the blood stream.

C. The organism often induces inflammation of the placenta and cotyledons interfering somewhat with the circulation of the fetus, the final result being the death and premature expulsion of the fetus, or abortion.

D. The organisms also invade the ovaries, udder, lymph glands, and occasionally the bones and joints. In the bull the testicles and accessory reproductive organs are sometimes infected, the inflammation produced often causing sterility.

E. It has been shown experimentally that cattle can easily be infected through the mucous membrane of the eye and this may be an important avenue of infection.

F. The skin should not be overlooked as a channel of invasion, as the organisms enter through abrasions and probably also through the normal skin.

G. A rather high percentage of infected cattle develop infection of the udder. The disease usually maintains itself in the cattle from one gestation period to the next. Such cattle are usually carriers for life. The disease may be transferred to the uterus in succeeding pregnancies, even though normal calving occurs. Instances have been reported in which Brucella abortus has been recovered from abscesses in the lungs, liver or spleen.

H. When calves are fed infected milk the organism can be found in the lymph glands of the digestive canal. Within a few weeks after the feeding of infected milk is discontinued the organism usually disappears.

I. Until sexual maturity is reached the genital organs seldom become infected. Calfohood infection, therefore, seldom results in permanent infection.

J. Suckling pigs receive exposure through the milk of the infected dam, and the blood stream is usually the first site in which the organism may be found. The average blood stream infection in young pigs lasts from one to six weeks but has persisted in some instances for as long as eight months. After weaning infection may be contracted through contact with the older infected animals in the herd or contaminated environment.

K. Sows may contract the disease through feed or water contaminated with uterine discharges, urine, or droppings of infected animals; but probably the chief source of infection in the sow is mating with an infected boar. The Brucella organisms that gain entrance to the reproductive tract of the sow at the time of mating become established in the uterus and spread to other parts of the body. In sows of breeding age and older, the organism, after gaining entrance to the body, may be found for various periods in the blood stream; it may localize in lymph nodes, especially those of the head, the spleen, liver, uterus, mammary glands, or in the spinal column and infrequently in the joints of the feet.

L. In boars the organism tends to lodge most frequently in the testicles, seminal vesicles and other accessory sex glands; it may also be present in the blood stream,
various lymph nodes, liver and kidney. Bone involvement, especially of the spine, is not uncommon.

VIII. CHANNELS OF ELIMINATION FROM THE BODY

A. Brucellosis in cattle is primarily a disease of the uterus, placenta and mammary glands.

B. The *Brucella* organisms leave the body of the infected cow in the fetal membrane and in the vaginal discharges for a few days before calving and for about one month afterward. Many cows also eliminate the organisms in the milk in varying numbers during the lactation period.

C. An infected cow may calve in what appears to be a normal way and yet eliminate many *Brucella* organisms in the fetal membranes and discharges. Recently-infected cows will eliminate the organisms during the calving period in about 85 per cent of the cases, but as the disease becomes chronic the organisms are shed in about 16 per cent of the calvings. Not all infected cows abort.

D. Calves that are fed milk from infected cows often shed the organisms temporarily because all of them are not killed in the digestive tract and some appear in the feces. After calves are weaned and fed exclusively on non-infected milk, shedding *Brucella* organisms in the feces almost always ends in less than thirty (30) days.

E. For many years the bull was thought to be the chief offender in the spread of brucellosis in cattle. Later investigations showed that bulls become infected with *Brucella abortus*, and even though the bull plays only a minor role in the spread of infection through service, when the infection becomes localized in the testicles the organisms are sometimes eliminated in the seminal fluid. Under such circumstances the bull is a spreader of the disease.

F. A non-infected bull which has served a non-infected cow immediately after serving an infected one does not usually transfer the infection. This is because the infected cow in most cases, does not spread the organism from the genital tract longer than thirty (30) days beyond the date of calving and ordinarily the cow is not bred until two or three months after the date of calving.

G. *Brucella suis* may be present in the feces of swine if *Brucella* are present in the intestinal tract, either through localized infection in the intestines or drainage from the infected liver through the gall duct. Likewise, the urine of some may contain the organisms if there is kidney infection or localization in the urinary bladder. Infection of the uterus of swine is often accompanied by a scanty, thin discharge which empties through the vagina. In sows the organism is expelled in the milk if the udder is infected. In boars with infection in the genital tract the organisms are expelled in the seminal fluid. This seminal fluid may not only affect the sow that is bred but may also contaminate the soil, feed or water.

IX. RESISTANCE OF THE ORGANISM OUTSIDE THE ANIMAL BODY

A. *Brucella* organisms are rather sensitive to sunlight and are readily killed by the common disinfectants and by standard pasteurization.

B. They are believed to live only a short time in pastures and barnyards, unless they become covered with manure or other protective material.
C. The resistance of the bacillus to certain natural influences has been reported as follows: It lived (1) four and one-half hours exposed to direct sunlight; (2) five days when dried in burlap sacking and kept in an ordinary room; (3) thirty days when dried in burlap sacking and kept in an unheated cellar; (4) thirty-seven days when dried slowly in soil; (5) four days in bovine urine; (6) one hundred and twenty days in bovine feces dried very slowly in a dark cupboard; (7) in an aborted fetus during cool weather 75 days.

X. NATURAL COURSE OF THE DISEASE

A. Brucellosis tends generally to be chronic in all species, but ranges according to species, individual and Brucella type (bovine, porcine, caprine) from a mild and transient febrile attack to severe, recurrent fever with localizations, general symptoms and sometimes septicaemia, terminating in death.

B. Man. The course is most severe when the disease is caused by the caprine type, less severe when caused by the suis type and least severe when caused by the bovine type. Apparent recovery is the rule, but regardless of the type involved prolonged incapacity is frequent, death the exception. Abortions in women are infrequent.

C. Cattle. (Bovine type predominates) The young (less than 1 year old) as a rule do not acquire permanent infection or show visible symptoms. In bulls with localizations in the testicles, permanent infection tending toward sterility is the rule. In sexually mature cows the disease may follow one of four courses depending on individual susceptibility.

1. Slight and transient agglutination reaction, (suspicious reactions) the only manifestation (frequent).

2. Chronic course, as a rule with months or years in which there is positive blood agglutination with symptoms (abortion, retained placenta, metritis) and actual shedding of the Brucella organisms, followed by complete recovery, (relatively infrequent).

3. Chronic course with outward appearance of recovery (symptoms subside) but with permanent blood agglutination and continued intermittent shedding of Brucella organisms, (most frequent).

4. Semi-acute form involving permanent blood agglutination, shedding of Brucella organisms and symptoms, (chronic metritis, arthritis, low condition, low milk production) that destroy the economic value of the animal in a relatively short time, (frequent).

D. Horses. (Bovine type predominates) Chronic general course with occasional acute arthritis (which tends to subside), fistulous withers and poll-evil the chief chronic manifestations. Abortion not a prominent symptom in mares.

E. Goats. (Caprine type predominates) Chronic course, follows the same general pattern as does the bovine type in cattle.

F. Other animals. Economically less important. Not considered here.

XI. PERIOD OF INCUBATION

A. The period of incubation is the interval of time between the entrance of infection into the animal body and the appearance of manifestations of disease.
In brucellosis, evidence of disease in farm animals is usually either a positive reaction to the agglutination blood test, the act of abortion, or some other symptom such as retention of the placenta.

B. Unfortunately, the period of incubation in brucellosis in animals is quite variable. This is one of the troublesome characteristics met in handling the disease. The minimum incubation period, when abortion is the first symptom observed, is about 30 days. Some cows abort before developing a positive reaction to the test, but much more frequently they show a positive reaction to the test before aborting. Some infected cows never abort.

C. Infected animals usually develop a positive reaction to the test 30 to 60 days after infection enters the body. Some infected animals, however, do not develop a positive reaction to the test until several months have elapsed following the entrance of the infection into the body.

XII. SYMPTOMS

No characteristic symptoms set brucellosis apart from other diseases that cause abortion. Abortion, death and expulsion of the premature fetus, is the most prominent symptom. It attains special significance when it occurs repeatedly in the same herd. When cows are exposed experimentally so that the exact day on which the organisms enter the body is known, abortions take place at any time from the thirtieth day on, more commonly from two to four months. Reaction to the blood test usually appears between the third and eighth week following the date of infection but it is sometimes delayed beyond this period.

B. Generally it is impossible to distinguish between the changes that precede normal parturition and those that precede abortions or premature births caused by brucellosis. When abortions or premature births occur relatively early in the gestation period they are less suggestive of *Brucella* infection. Retained placenta occurs much more frequently in animals infected with brucellosis than it does in those that are free from infection, but even among the latter it is common. Cows with brucellosis often lose condition; there is a strong tendency toward temporary or permanent sterility; and the bacilli frequently invade the joints, especially the knee and stifle. One cannot depend on the symptoms to identify the disease positively, though they are often a valuable guide in determining the probabilities.

C. In swine the most common symptom of brucellosis is abortion or the birth of weak pigs. This usually occurs after an infected sire has been added to the herd. In some instances, in non-infected herds where the susceptibility to infection is high, all sows bred to a recently-purchased infected boar have aborted. Abortion often occurs so early in pregnancy that it is overlooked and the sow thought not to have conceived. When the natural resistance is relatively high pigs may be carried full term but be so weak that only a small number will survive. Sows that have aborted once will usually farrow normal litters thereafter with no uterine infection. However, a few sows, in succeeding pregnancies, will bear apparently normal litters but the uterus will excrete a discharge containing large numbers of *Brucella suis*. Thus, sows successfully bred following abortion usually bear normal litters even though infection persists.
D. Sterility is often a manifestation of infection with *Brucella suis*. A persistent but scanty discharge from the uterus may follow abortion as a result of metritis, or inflammation of the mucous membranes of the uterus. Sows so affected cannot be bred successfully and are either temporarily or permanently sterile, depending on the persistence of the uterine infection.

E. The testicles of boars, when infected, become swollen. One or both may be involved. Usually such infections are chronic. Adhesions in the scrotum have been observed in young pigs at the time of castration, which may be an indication of infection with *Brucella suis*.

F. Bone involvement in chronic swine brucellosis is not uncommon. In one survey of 62 experimentally infected hogs 13, or 20.9 per cent, showed lesions in the spine (spondylitis) from which *Brucella suis* was recovered. When lesions are not extensive a staggering gait or posterior paralysis is manifested. On rare occasions, the joints, especially those in the legs, become involved; such conditions are also found in other diseases such as swine erysipelas and tuberculosis are not a sure indication of brucellosis.

G. Although lesions consisting of abscesses in the liver, spleen, tendon sheaths and under the skin have been reported, such lesions are very rare. For instance, in liver infection, the lesions are usually so small that they are barely discernible to the naked eye.

H. Symptoms and lesions are extremely variable in individual animals. In fact the disease may persist in some herds in such a mild form that its presence is unsuspected.

XIII. TISSUE CHANGES

A. One of the most interesting and somewhat unusual features of brucellosis is the fact that it produces quite different manifestations in the several species of animals which it invades, including man. For example, the disease commonly causes abortion in cows and sows but rarely in mares or women. Likewise the tissue changes caused by *Brucella* infections are extremely variable in its several different hosts.

B. In cattle there may be no visible gross tissue changes on post mortem examination. In other cases changes occur including the following: placentitis (inflammation and sometimes necrosis of the placenta or after birth); metritis (inflammation of the uterus or womb); hygromas of the knee (swelling filled with fluid); and orchitis (inflammation of the testicle).

C. In swine the above changes have been observed but with the following addition: spondylitis (inflammation and necrosis of the vertebrae), and abscess formation in many other parts of the body.

D. In horses the disease is commonly manifested by pus formation in the conditions commonly known as “fistula of the withers”, “poll-evil” and arthritis (inflammation of the joints).

E. In man the changes are dependent on the tissue invaded by the bacteria with many types having been observed and reported. Localizations occur in the spleen bone, joints, ovaries, testicles and other tissues.
XIV. DIAGNOSIS

A. It is impossible to recognize brucellosis in animals accurately by looking at them or even by knowing whether or not they have aborted. The act of abortion is not conclusive evidence of this disease, many *Brucella* infected cows do not abort.

B. The blood agglutination test is the most reliable and practical single method of diagnosing brucellosis in farm animals. In the blood stream of brucellosis diseased animals there is a substance known as agglutinin. When blood serum containing this agglutinin is brought in contact with a suspension of *Brucella* organisms (called antigen or test fluid) it causes the organisms to clump and settle out of suspension. This constitutes a positive reaction to the test, known as agglutination. There are two methods of conducting an agglutination test; the tube method, which requires 48 hours incubation; and the plate or rapid method in which results are available after about ten minutes. Either method (tube or plate) is remarkably accurate when properly conducted. There are only minor discrepancies in the results obtained in using both methods on the same samples. Such discrepancies occur in both directions and are minor, being confined to tests of animals with indecisive or suspicious reactions which constitute a relatively small percentage of animals tested.

C. The blood agglutination test is not 100% accurate; neither is any other human endeavor. It has been shown to be as accurate for the diagnosis of brucellosis in cattle as in any other biological test. It is sufficiently accurate in cattle to form a dependable basis for the control and eradication of this disease.

D. The blood agglutination test is much less accurate in swine, goats and man than in cattle. In swine it is sufficiently accurate to make a diagnosis on a herd basis but does not suffice to pass judgment on individual swine showing a negative reaction.

E. It should be kept in mind that the blood agglutination test is not a means of searching for *Brucella* organisms in the blood stream. Under natural conditions, a positive reaction to the blood agglutination test means that the animal either is or recently has been infected. A very small percentage of positive reacting cows overcome the reaction later and become negative to the test. They are sufficiently numerous so that many cattle owners have heard about them, which frequently has resulted in confusion in their minds, causing doubts as to the value and accuracy of the blood agglutination test. There are not enough of such cows to be of much economic importance to the cattle industry.

F. Calves vaccinated with strain 19 usually react to the test for several months after vaccination and then cease to react. A few continue indefinitely to show a positive reaction to the test.

G. Young calves nursing infected mothers frequently show positive reactions to the test. These reactions are the result of absorption of agglutinins from the colostrum or milk of the dam and are not evidence of active disease in the calf. These positive reactions cease in due time after the calves stop consuming milk containing *Brucella* agglutinins.

H. Isolation of *Brucella* organisms from the body of an animal or its discharges (milk, etc.), or from the aborted calf or foetal membranes or fluids, is another
method of diagnosing this disease. Finding the organisms constitutes incontestible
evidence of the disease. Such procedures are too expensive for routine work; also,
negative results from such examinations are never conclusive evidence of freedom
from the disease.

I. The diagnosis of brucellosis in man is less certain and more difficult than in
farm animals. The physician must employ all means available, including history
and symptoms, combined with several different laboratory tests and examinations.
It is important to recognize that brucellosis in man produces different manifesta-
tions from those observed in farm animals. At best, the diagnosis of human brucel-
osis is difficult and troublesome, particularly in the chronic types.

XV. METHOD OF SPREAD

A. Brucellosis finds its way into a herd by several ways such as:
1. The purchase of brucellosis infected cattle or brucellosis negative animals that
have been exposed to the infection prior to introduction. New-born calves from
infected herds represent a special danger.
2. Contact over single line fences or through contact with infected cattle on ad-
joining farms.
3. Exposure at shows, fairs, through visitors who may carelessly bring the in-
fection in on their shoes.
4. Outside breeding.
5. Cattle trucks that are not properly cleaned after transporting diseased animals.
6. Livestock auctions and sales rings where clean and infected livestock are sold.
7. Occasionally by aborted calves dragged from farm to farm by dogs, foxes,
and other carnivorous animals.

B. The unbred heifer rarely spreads Brucella organisms from the genital tract
or udder. The organisms leave the body of the infected cow in two ways: First,
in the fetal membranes and in the vaginal discharges for a few days before calving
time and for about a month afterward: Secondly, in the milk, either continuously
or intermittently. An infected cow may calve in what appears to be a perfectly
normal way, and at the same time may eliminate millions of Brucella organisms
in the fetal membranes and discharges. Almost all recently infected cows elim-
inate the organisms during the calving period, but as the disease becomes chronic
the danger, though still present, is less constant. Infected cows have been held
under observation for years without showing any spread, then, during a later calv-
ing period a large number of Brucella have been discharged. Thus the infected cow,
regardless of whether she actually aborts or shows any outward symptom of brucel-
osis, may, at any time, become highly dangerous to her associates. The organ-
isms are eliminated in the milk in comparatively small numbers, but usually milk
is not handled so as to spread the bacilli in the barn.

C. Calves that take milk from infected cows often become temporary spreaders
of Brucella because all the organisms are not killed in the digestive tract, hence
the organisms appear in the feces. This spread ceases soon after calves are weaned,
almost always in less than 30 days. Strange to say, most calves resist brucellosis;
however there is an occasional exception. Most calves of infected cows react
temporarily to the blood test during the nursing period, but soon after they are
weaned the reaction disappears and unless the animals are again exposed as they approach breeding age, or afterward, they remain as clean animals throughout life.

D. Clean cows raised as calves on milk from infected cows are now in hundreds of herds all over the country. The principal precaution to be taken with calves that are taking milk from infected cows is to be sure they do not, during the nursing period and for a month afterward, come in contact with noninfected cattle old enough to be susceptible to brucellosis. Premature and apparently normal calves born of infected mothers are often covered with exudate that is teeming with Brucella.

E. Formerly the bull was assumed to be the chief agent in the spread of brucellosis, but careful work has disproved this assumption. Many bulls acquire brucellosis but only a small percentage of these actually become spreaders of the organisms. When the infection localizes in the testicles or adjacent parts of the genital tract Brucella organisms are eliminated in the seminal fluid and the animal becomes a dangerous spreader.

F. Often the question is asked whether a noninfected bull in serving an infected cow, and immediately after covering a clean one, thus transfers brucellosis from the one to the other. Occasionally this may occur, but usually it does not because the infected cow has in most cases ceased to shed Brucella organisms from the genital tract in less than thirty days from the date of calving, and in ordinary breeding practice the cow is not bred until about three months following the date of calving; therefore, the bull, as a rule does not transfer the infection because it has disappeared from the genital discharges of the infected cow before she is bred. There are a few exceptions to this rule.

G. Frequently one hears a breeder ask: “How can I free my own herd from brucellosis when my neighbors are doing nothing? Will not their herds be a constant menace to mine?” Usually they are not a serious menace if fences are good and if the herds actually are kept apart. Despite occasional exceptions it is a general rule that brucellosis is carried from one herd to another by an infected animal that has mingled with both herds. As someone has so aptly said: “It is bought and paid for.”

XVI. TREATMENT AND ALLEGED CURES

A. There is no known cure for brucellosis in domestic animals. The erratic course of the disease in herds and in individual animals leads to misinterpretation of results obtained from any treatment that may be used. Occasionally animals recover spontaneously over a long period of time. Many animals discontinue showing active symptoms but usually are still diseased and are dangerous sources of infection to other animals and man.

Many drugs and proprietary remedies have been used and some of them, temporarily, have gained widespread endorsement. None has been found to be of value based on critical experimental study. Some of these so-called remedies are as follows: Carbolic acid, methylene blue, Bowan’s abortion remedy, Dr. Robert’s Abortion Cure, Brown sugar, and various mineral mixtures. Correction of mineral deficiency is still believed by some to prevent and cure brucellosis. Extensive experimentation has disproved this theory. Wheat Germ Oil or vitamin E, though
widely advertised as a cure for brucellosis there is no good experimental evidence to substantiate the claims.

**XVII. NATURAL SUSCEPTIBILITY AND RESISTANCE**

A. *Man.* There is a definite tendency toward natural resistance. The resistance is high before the age of puberty. Susceptibility increases under exposure to the bovine, porcine and caprine types in the order named. Males are more frequently infected than females chiefly because they are more frequently exposed (handling infected animals). The relatively infrequent infection of children, the low incidence of brucellosis in exposed adults and the distinct tendency toward recovery in both children and adults are cardinal points indicating the pronounced tendency toward natural resistance in man. Constant and severe exposure, especially to the caprine type, tends to break down this resistance. There appears moreover to be a marked individual variation in susceptibility.

B. *Cattle.* (Bovine type predominates) Animals less than one year old are generally resistant. The tendency of exposed adults, especially females, is to acquire permanent infection with the outward symptoms gradually subsiding as resistance is built up. Mild and transient attacks, complete recoveries, and severe attacks in which the symptoms persist, collectively constitute many exceptions to the general rule. Pregnant females are especially susceptible.

C. *Herd resistance,* but not complete immunity, gradually builds up under severe and prolonged exposure and modifies favorably, but does not eliminate, the tendency of the individual toward permanent chronic infection. In small herds the disease is frequently self-limiting; in others it travels by "calms and storms" some years apart. In the larger herds it tends to remain indefinitely, taking its toll year after year. Basic and important points are: (1) This resistance is slow in building. (2) It is pronounced but not complete under natural conditions. (3) Under natural conditions it is acquired at enormous economic loss. (4) It is a partial indicator of the legitimate expectations of the degree of resistance created by artificial immunization and especially of the time required to build up this resistance.

D. *Horses* (Bovine type predominates) There is a general tendency toward pronounced natural resistance, (brucellosis does not spread rapidly through a band of horses). Many individuals contract permanent infection, indicating low resistance.

E. *Swine* (Porcine type predominates). Natural resistance not well understood because of rapid turnover in swine herds. Transmission tends to be uncertain and slow as compared to brucellosis in cattle, indicating considerable natural resistance. Exceptions to the slow transmission sometimes occur. Recovery is not unusual.

F. *Other Animals.* Omitted here. Known to be more resistant than the species already included. Economically less important.

**XVIII. VACCINATION**

A. Numerous products have been used in vaccination against brucellosis and attempts have been made to immunize several animal species. The results for the most part are negative or inconclusive, except for abortus strain 19 which will be
covered here. This is the only recorded procedure for which there is wide and statistically acceptable evidence of substantial and uniform value.

B. Calf Vaccination. (Heifers 6 to 8 months of age) Standardized live vaccine administered subcutaneously.

1. Produces a high agglutination titer which appears in about two weeks and usually subsides in three to eight months. There are many variations from this rule. Indefinite persistent reactions are relatively frequent, especially as the age at the time of vaccination approaches or exceeds eight months.

2. Produces a mild and inconsequential febrile reaction and occasionally an abscess.

3. Creates, as a rule, resistance which protects most animals two or three years, or longer. There are frequent exceptions to this rule, especially under heavy and prolonged exposure.

4. Tends strongly to soften the effects of brucellosis so that the abortion rate is lowered, even in those cows that actually acquire infection.

5. The older the heifer when vaccinated, if the consequent reaction subsides the stronger the resistance created; but, the older the animal when vaccinated, the more likely is the reaction to persist.

6. Creates a disturbing number of fluctuating, suspicious reactions that last a long time. These cases tend toward a degree of resistance in that the abortion rate usually is not high among them.

C. Adult Vaccination. (Animals of breeding age) Used principally in efforts to halt "abortion storms" or to reinforce the resistance created by calf vaccination.

1. Creates agglutination reactions which, despite individual herd histories to the contrary, tend strongly to persist. These reactions appear in about two weeks and last usually many months and sometimes for the life of the animal.

2. Produces a mild systemic reaction, a temporary reduction in milk flow and an occasional abscess.

3. The vaccination reactions are as yet indistinguishable from reactions due to natural exposure.

4. Produces abortion in some pregnant cows.

5. Animals vaccinated as adults, if they overcome the consequent reaction, are mostly resistant, but there is a strong tendency for the reactions to persist.

6. Tends to build up some resistance even in cows that show persistent reactions.

7. Cannot be depended on to halt threatened abortion storms because the resistance builds up slowly, as in the natural disease.

8. Is frequently in conflict with legitimate objectives of boards of health, with sound plans to eradicate brucellosis and with the most advantageous sales of breeding cattle. These objections are partially inherent in adult vaccination itself, partially a result of its wide misuse.

9. Raw milk from all reactors, vaccinated or not, represents a degree of danger to man.

XIX. CONTROL AND ERADICATION

A. Brucellosis has been and is being successfully controlled in thousands of herds and hundreds of areas. The procedures required for the successful control have been
well established. However, experience shows that certain modifications of these procedures are necessary for practical application under varying conditions.

B. The United States Livestock Sanitary Association has adopted and the Bureau of Animal Industry of the United States Department of Agriculture has approved and included in its regulations, uniform methods and rules for the establishment and maintenance of Brucellosis-free accredited herds and for modified accredited brucellosis-free areas. While accredited herds and modified accredited areas, as defined by these methods and rules, are the objectives toward which all efforts of control should be directed, it has been found in practice that in some areas and in some herds where the incidence of disease is high or where blood testing and disposal of reactors is deemed impractical, due to the inconvenience or the expense involved, preliminary measures for control are necessary.

C. In order to standardize and coordinate these preliminary procedures, the United States Livestock Sanitary Association in 1947 recommended four plans of control in infected herds. These plans have been approved by the Bureau of Animal Industry and are as follows:

- Plan “A”—test and slaughter with or without calf vaccination (essentially the accredited or certified herd plan).
- Plan “B”—test, calf vaccination and temporary retention of reactors.
- Plan “C”—calf vaccination without test of any part of the herd.
- Plan “D”—Adult vaccination (very limited application). Plans B, C and D are temporary measures to be used by herd owners who are not in a position to immediately undertake control under Plan A. As soon as the incidence of the disease in a herd operating under Plans B, C, or D has been sufficiently lowered these plans should be discontinued and Plan A adopted. These plans have met with general endorsement and the owner of an infected herd can adopt to advantage the one best suited to his conditions.

D. The eradication of brucellosis, however, demands more than voluntary adoption by individual cattle owners of one of the proposed plans. Thousands of herd owners have successfully eliminated brucellosis and are maintaining disease-free herds by careful and intelligent management, especially with regard to the introduction of animals or allowing contact with neighboring herds. To be most successful, however, an orderly systematic program must be put into effect, requiring participation of all cattle owners under the plan which will result in eliminating the disease in the most prompt and practical manner.

E. It is unnecessary for individual cattle owners to wait for the enactment of laws or to wait for officials to institute methods of control in the locality where they reside in order to maintain their herds free from brucellosis or to eradicate it from their individual herds. It is continually demonstrated in thousands of herds that it is possible to free them from brucellosis and to maintain them in that status even in heavily infected territory by the adoption of one of the plans above outlined, provided all activities are aimed at the eventual establishment of an accredited or certified herd.

XX. STATEMENTS OFTEN REPEATED BUT NOT SUPPORTED BY FACTS

A. False Statement No. 1—Not much is known about brucellosis. The basic facts about brucellosis are well known, though there is much detail yet to fill in. We
know its cause, how it leaves the body of the infected animal, how it is taken up by
the susceptible animal and there are accurate methods of identifying infected ani-
mals. Based on this knowledge there are proved methods of control.

B. False Statement No. 2—Veterinarians are not in general agreement regarding
brucellosis. Most veterinarians are in agreement regarding the basic facts, but there
is not complete agreement in all details and, unfortunately, there is an occasional
veterinarian who is not up with the times. But the disagreement is no wider than
it is among other groups, including cattle breeders. All good breeders well know
and agree on the fundamentals of handling their herds, but if they were in complete
agreement there would be only one breed of dairy cattle and one of beef cattle.

C. False Statement No. 3—Tests in laboratories don’t agree. Mostly they do, but
the exceptions to the rule are much over played because it is usually the blood sam-
plies from “suspicious” cases that are sent to several laboratories. When a sample
is marked ‘“suspicious” that means that the health status of the animal is in doubt.
Retests are the only means of clearing up the doubt.

D. False Statement No. 4—Cows do not react in late pregnancy or when they abort.
Infected cows almost always build up a reaction which, according to the individual,
may be prompt or delayed and has little or no relation to the period of gestation
or to the act of aborting. Those that react before dropping their calves will react,
with few exceptions, at that time and subsequently. Some delayed reactions do
not appear until after the cow aborts which often leads to the statement: “Some-
times they don’t react when they abort,” leaving the impression that the act of
abortion causes the failure to react. If we say instead, “Sometimes they have
not yet built up a reaction at the time of aborting”, we make the point clear.

E. False Statement No. 5—Brucellosis is in nearly all herds so its control is hopeless.
Constant repetition of this statement leaves some still believing it. Thousands
of herds are known to have been free from brucellosis for years and there are wide
areas in which the disease in cattle does not exist.

F. False Statement No. 6—One can’t maintain a clean herd unless his neighbors do.
He is “sitting on a keg of dynamite.” It is true that a clean, unvaccinated herd is
the most susceptible of all. It is true, as well, that many careless men and a lesser
number of careful ones, have had unfortunate experiences with clean herds. But
the entering wedge in the control of brucellosis—and one of its chief supports today
—is found in progressive breeders in infected territory who test regularly, raise their
own replacements and prevent actual mingling of their herds with other cattle.
Despite individual exceptions, as a group these breeders are far better off than are
those who are still waiting for their neighbors to “clean up”.

G. False Statement No. 7—Uniform interstate regulations are the obvious and sim-
pIe solution of all sanitary problems involving interstate shipment. Uniformity that
does not interfere with effectiveness is highly desirable, but conditions in individual
states vary so widely that uniform regulations will not be adequate for all. While
brucellosis is the same in all states, the problems of the range states and the intensive
dairy states are not the same; nor are the problems of a state that must import cattle
and one that has a normal surplus of cattle the same. In the transfer of cattle
the condition of the herd of origin and that of the herd of destination are the para-
mount considerations. Fundamentally each state that sells cattle has the inherent
obligation to provide safe sources and each state that buys is likewise obliged to
protect the herds within its borders by requiring that importations come from
"safe sources."

H. False Statement No. 8—Vaccinated cattle should enter interstate traffic without
restriction. This would permit the vaccination and shipment of infected cows;
it would assume that all reactions following vaccination are caused by the vaccina-
tion; and it would eliminate the status of the herd of origin from consideration.
There is conclusive evidence that all would be backward steps.

I. False Statement No. 9—in handling brucellosis, calves represent no danger. It
is true that calves rarely contract permanent infection; hence, the danger to the
calf itself is negligible. But a newborn calf of an infected cow is often covered with
discharge containing Brucella organisms and after it has taken colostrum its diges-
tive tract as well, contains organisms that will appear in the feces. Calves from
infected herds, even though they do not themselves contract brucellosis, represent
great danger to other herds if they are transferred less than a month after weaning.

J. False Statement No. 10—Most animals recover; hence, a brand on an infected
cow is unjust to the owner. There may be legitimate differences of opinion about
branding because some animals do recover.

K. False Statement No. 11—Reaction to the agglutination test is proof of immunity.
Agglutination is merely a process associated with attempts on the part of the ani-
mal body to create immunity but in adults with brucellosis a high percentage of these
attempts are unsuccessful, because the animals do not recover.

L. False Statement No. 12—Reaction to the agglutination test following vaccina-
tion proves that the vaccine was good. Reaction in a group of heifers following vaccina-
tion merely indicates that the vaccine contained Brucella organisms. The organ-
isms may have been alive or dead.

M. False Statement No. 13—The individual agglutination test is not reliable. This
statement leads many to believe that two or more tests must be made in order to
learn the status of the herd and of individuals in it: For this, one test is sufficient.
But the test of the individual, even though negative, is not a reliable basis for inter-
herd transfers of cattle, because the animal, if a member of an infected herd, may
be exposed but not yet reacting. The confusion grows out of a repeated error of
statement. There is a difference between the term “individual test” (one test)
and “test of the individual”. The latter often ignores the fact that the individual,
tested alone, has been in contact with infected cattle and is already in the incuba-
tion stages of brucellosis, but not yet reacting.

N. False Statement No. 14—Two consecutive negative tests on an individual make
the animal safe for inter-herd transfer. If an animal remains with infected animals,
or with those of unknown health status between the tests, no number of consecutive
negative tests gives any assurance whatsoever. If the animal is removed from
exposure between the tests, the assurance builds up with the number of consecutive
negative tests. Depending on circumstances, two may be sufficient (heifers and
open cows) or more than two may be required (pregnant cows).

O. False Statement No. 15—The skin test is reliable in man. Reaction to the
skin test in man means only that the individual has in the past been in contact with
Brucella organisms. It does not necessarily mean that the individual now has
brucellosis. The skin test destroys the accuracy of the agglutination test because it causes nearly all individuals to react to the latter. Some physicians make the error of applying the skin test first.

P. False Statement No. 16—Most brucellosis in man is contracted from swine. In circumstances where man comes in regular and intimate contact with swine (handling of aborts and newborn pigs, working in slaughter-houses) brucellosis caused by these contacts frequently occurs, but brucellosis in man caused by contact with infected cattle and by drinking their milk is widespread and serious. In parts of our Southwest and in many foreign countries, brucellosis caused by the caprine (goat) type regularly occurs.

Q. False Statement No. 17—Vaccination of all cattle will eradicate brucellosis. Brucellosis will die out in many small herds, vaccinated or not. Systematic calf vaccination over a period of years will greatly reduce the incidence of the disease in herds that originally were badly infected, but a breeder eventually must test if he is to have a clean herd. When adults are repeatedly vaccinated eradication is impossible.

R. False Statement No. 18—Birds, predatory animals, streams and various mysterious agencies are the chief influences in carrying brucellosis from herd to herd. There is overwhelming evidence that most new herd infections are caused by the introduction of cattle and their products and that the above influences play only a minor role.

S. False Statement No. 19—The agglutination test is not reliable because I know a cow that has had many negative tests and is now reacting. The cow gives clean tests before she is infected and reacts soon after she is infected. The test is telling the truth each time, but the cow has changed.
CONTROL OF BRUCELLOSIS IN RANGE CATTLE

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In referring to the reports of the proceedings of the U. S. Livestock Sanitary Association, we find that three papers on brucellosis in range cattle have been presented at meetings of this association. In 1932 Dr. W. J. Butler and Dr. D. M. Warren (2) presented a paper under the title “Control of Bang’s Disease Under Range or Semi-Range Conditions.” In 1938 Mr. J. Elmer Brock (1) of Wyoming spoke on “The Range Cattleman’s View in Bang’s Disease Control,” and in 1939 Dr. W. H. Hendricks (4) discussed “Problems Arising in Bang’s Disease Control in the Western States.” However, we believe that the subject has not been exhausted, and that new information which has become available during the intervening nine years warrants a discussion at this time of brucellosis control in range cattle. As it has been our opinion for many years that discussions of brucellosis control should recognize certain basic differences between dairy cattle and beef cattle, particularly range cattle, the assignment on this program was accepted as an opportunity to express our ideas.

Brucellosis of cattle has been recognized in the United States for the past 40 years, and has been extensively investigated by many agencies, but almost exclusively as a disease of dairy cattle. As was the case in the tuberculosis eradication program, when a control plan for brucellosis was proposed, the plan recommended was based on conditions in the eastern states, where dairy and farm cattle only were involved. As in the case of tuberculosis, the method did not fit range conditions, and years of effort were necessary to modify the program to make it applicable to western conditions.

Before proceeding further, we would like to define the term range cattle. In the first place, for the purpose of discussion, the term range cattle involves a geographical factor. The range area of the United States includes roughly all the area west of the 100th meridian, except a strip along the Pacific coast. In general, west of that meridian the annual precipitation is less than 20 inches. This means that grazing cattle in that area generally require from 15 to 100 acres of grass per head per year. In this area the term range cattle originally referred to large herds of cattle of beef type running throughout the year on unfenced land, mostly in public ownership, and subsisting entirely on natural forage. Today the meaning of the term has been modified to include cattle running in relatively large pastures, and cattle which may be fed hay during the winter. Range cattle which are fed hay during part of the year have been designated by this association as semi-range cattle.

There are several differences between beef cattle in general and dairy cattle which are significant in relation to brucellosis. One of these differences is the fact that the udder, which may act as a reservoir of infection, is highly developed.
in the dairy cow and is kept in active lactation for a long period, while the udder of
the beef cow is less highly developed and is functional for a much shorter period. An-
other difference lies in the fact that in well-managed beef herds the breeding
season is limited to a period of two to three months. This results in producing a
period between calving and breeding when all the cows in the herd are open and no
infectious material is being deposited on the range in the form of infected fetuses or
vaginal discharges. On the other hand, in the dairy herd calving occurs throughout
the year, and there are always highly susceptible pregnant cows in the herd.
Another difference which is more apparent than real is that the measure of pro-
ductivity in the beef herd is the calf crop, while in the dairy herd it is quantity of
milk produced. Still another distinction which affects the handling of the brucel-
sis problem is that grade beef cows may be freely culled, because their value as
breeders does not greatly exceed their value as beef, while the beef value of a dairy
cow is relatively small.

In considering brucellosis in beef cattle, we may also make a distinction between
farm beef cattle and western range cattle. The conditions affecting brucellosis
control in beef cattle on the farms are intermediate between those involving dairy
cattle and those involving range cattle. In practice the methods of brucellosis
control for dairy cattle are also applicable to farm beef cattle.

Two principal sources of data were used in preparing this paper. First, in order
to develop a broad view of the subject of control of brucellosis in range cattle, we
consulted federal and state officials in the various range states, submitting to them
a questionnaire which we considered would bring out the information we desired to
enable us to formulate recommendations for the control of brucellosis in range
cattle. Replies were received from twelve states, including Montana, and Canada.
The second source of material was information obtained as the result of investiga-
tion carried on by the Montana Veterinary Research Laboratory.

The Montana Veterinary Research Laboratory has made investigations on several
phases of the brucellosis problem as it concerns range cattle, using for much of the
work the cattle at the U. S. Range Livestock Experiment Station at Miles City,
Montana. In 1932 an experiment was started with a range herd of 1500 cattle to
determine the efficacy of calfhood vaccination with Strain 19. A report by Butler,
Warren, and Marsh (3) was published in 1936 on one phase of the experiment,
showing the rate of disappearance of agglutinin titers in range calves and yearlings.
The severe droughts of 1934 and 1936 prevented carrying the experiment to a final
conclusion.

In 1935 Welch and Marsh (6) reported the development of a whole-blood field
agglutination test, which permitted us to cut out reactors at the bleeding chute,
without a second handling of the cattle. This test was never recognized in official
work, but has been used successfully in private tests.

In 1940 Marsh and Welch (5) reported the results of eight years work with the
cattle at the U. S. Range Livestock Experiment Station, and there are additional
unpublished data. The results of this work show (1) That in the presence of a small
percentage of reacting cows the infection did not spread during a two year period
when the cattle ran on the range throughout the year. (2) That the presence of a
few old reactor cows which were producing calves was apparently the source of a
serious outbreak of brucellosis when all the cows were fed hay during the winter.
(3) That in this herd where the breeding season was limited to seven weeks and all the calves were born before June 1, the shipping of all reactors at 1–50 in two annual tests eliminated the disease from the herd. It is believed that this result should have been accomplished in one culling operation as the result of a fall test. This herd has remained free of reactors since 1937. Vaccination of all heifer calves was started in 1941. In 1946 the entire herd of 595 breeding cows was negative to the test, which was the first test since 1942.

We have attempted to summarize the information which we obtained from the various range states. We find that all agree in recognizing a need for differentiation between range cattle and dairy, farm, and pure-bred herds in methods of control. Texas, New Mexico, and Arizona officials consider that a control program is unnecessary and impractical in their range areas, where winter feeding is not practiced. Many cattle in the range states farther north are run on grass throughout the year, and our work with the Range Livestock Experiment Station cattle confirms their opinion that brucellosis control is not a problem where cattle are not fed. There was almost unanimous agreement as to the value of a controlled breeding season in controlling brucellosis in beef cattle. In regard to calfhood vaccination, the majority of the officials believe that in some range herds calfhood vaccination alone without removal of reactors should be practiced, while testing and removal of reactors combined with vaccination is desirable. The majority also think that adult vaccination has a place in some infected range herds. In connection with the subject of vaccination, the question arose as to whether Strain 19 vaccine should be available to owners for their own use. A majority of the officials replying to our questionnaire stated that it should not be available to the owners for their own use. The officials of two states, Montana and Nebraska, definitely approve making brucella vaccine available to cattle owners, because owner use has resulted in a measure of brucellosis control in many herds which would otherwise have had no control because of lack of sufficient veterinarians to do the work in range areas.

The last item in the questionnaire which was submitted to each range state official was a request for a brief statement of his idea of the best method to use in brucellosis control for range and semi-range cattle.

The three southern range states, Texas, New Mexico, and Arizona, state that their range cattle are practically free from brucellosis and that no general control program is necessary. They feel that any control work should be optional with the owner. If an owner suspects the existence of the disease, it is determined by test, and controlled by vaccination and elimination of diseased animals in fall shipments. These three states are opposed to area testing applied to range cattle.

Montana and Idaho were the only other states from which came an expression of opinion as to area control. The Montana officials favor establishing areas for brucellosis control, but would not immediately promote such area control in the range areas of the state. Idaho stated that in area counties, all dairy cattle are tested, and all beef heifers are vaccinated, and later tested when two years old.

Four states and Canada recommended calf vaccination, with no testing. Two of the four combined vaccination with use of sanitary control measures, and the other two combined vaccination with shipment of dry cows in the fall. The other five states recommend calf vaccination, combined in general with an annual fall test, and culling of dry cows and reactors. Two of these five states also recommend
vaccination alone under some conditions. For instance, in Montana vaccination without any testing has been used extensively on one of the Indian reservations.

In our correspondence with officials in the range states, we find that some states have declined to sign the memorandum of understanding drawn up by the U. S. Bureau of Animal Industry, which provides that the recommendations of the Committee on Brucellosis of the U. S. Livestock Sanitary Association be accepted as the minimum requirement. The objections have been based on the assumption that the adoption of these recommendations would involve compulsory testing or vaccination of range cattle. As we interpret the committee’s recommendation, no compulsion is contemplated except in areas where the owners of 51% of the cattle have voluntarily placed their cattle under supervision. This provision would seem to remove any danger that the range men would be forced into a control program. Montana has a law providing for the creation of disease control areas upon petition of 75% of the owners of not less than 50% of the cattle in the area.

Paragraph 9 of the recommendations of the committee, providing that a date be set after which all breeding females and bulls offered for sale shall be tested except officially vaccinated heifers under 24 months of age, appears to be impractical and unnecessary for the range areas. Otherwise, the committee recommendations are broad enough so that they can be adapted to range conditions, in our opinion.

In consideration of the opinions and experience of the control officials of the western range states, and of the evidence obtained through the investigations of the Montana Veterinary Research Laboratory, the following principles and procedures are proposed as applicable to the control of brucellosis in range cattle.

1. We recognize that, in general, there are three types of management which are of importance in determining control procedures. One of these is the strictly range condition which prevails in the southwest, and to some extent throughout the great plains, where cattle run on grass the year around on range where 15 to 100 acres of grazing land are required to support one cow. We agree with the southwest states that under such conditions, brucellosis control is not a problem. The second type occurs in general on the Great Plains, and is that method of management in which the cattle subsist principally on range forage, but the cows may be fed some hay in severe winters. The third management type is that which prevails throughout the mountain region, and where the cattle must be fed hay in the winter, and are summered in the mountains. The second and third management methods represent the semi-range cattle production.

2. Experimental evidence and practical experience show that the control of brucellosis is not a problem among cattle which run on the range throughout the year. On the other hand, winter feeding of semi-range cattle creates a condition which is ideal for the spread of the infection. The hay is usually scattered on the ground, and there is ample opportunity for infective material to be dropped on the feed and picked up by susceptible pregnant cows. The spread of infection may be quite rapid, as in a beef herd all the cows are approximately in the same stage of pregnancy during the feeding period. It is therefore possible for many young cows in the herd to pick up the infection, resulting in a high percentage of abortions the following winter. It is also true that such a herd often returns to normal calf production very rapidly, even without the use of any control measures. This can probably be ascribed to the fact that in many beef herds there is a period of 9 to 10
months between the time the last calf is dropped in one year and the time the first calf is dropped the following year, and a short period between calving and breeding when there are no pregnant cows in the herd.

3. As was emphasized by several of the control officials with whom we correspond, certain factors in herd management are important, and no control program should overlook those factors. We believe that the most important item in beef herd management from the standpoint of brucellosis control is the short breeding season. Breeding so that all the calves are born within a two-months period is good practice both from the disease control standpoint and from the standpoint of good herd management in general. It is realized that where cattle aresummered on the National Forests, it may be difficult to take out the bulls until the cattle are brought home in October or November. But the breeding season should be cut to as short a time as is practicable. Where cattle are summered on prairie range, it should be practicable to cut out the bulls after a 60 day breeding period. Where brucella infection exists in a herd, and the calves are all born before about June 15, a blood test in the fall will make it possible to cut all infected cows at shipping time. All cows which may have picked up infection at calving time will have had sufficient time to develop an agglutinin reaction, thus making it possible to clean up the herd in one test.

4. In testing grade beef cattle, there should be no suspects. All cattle showing any reaction at 1-50 should be classed as reactors and shipped. The market value of a beef cow in the fall is near enough to her value as a breeder that no breeding cow showing any agglutination at 1-50 should be retained in the herd. In analyzing our records of tests on the herd at the U. S. Range Livestock Experiment Station, we found that most cases where a 1-50 reaction developed in a previously negative cow, the cow later became a definite reactor. On the other hand, reactions occurring in virgin heifers were not significant, as such reactions did not persist.

5. In blood-testing range cattle, one of the objections encountered has been that after the blood samples are drawn, the cattle must be held near the corrals for several days and run through the chute again to find and cut out the reactors. Two possible ways of avoiding this difficulty have been developed in Montana. As mentioned earlier, the Veterinary Research Laboratory developed the whole blood test to be used at the bleeding chute, making it possible to complete the whole operation with only one handling of the cattle. This method has its limitations, but is effective.

Another aid in testing range cattle was developed by Dr. R. W. Davis, when he was testing cattle for the U. S. Bureau of Animal Industry in Montana in 1936. Dr. Davis developed a dye with which the cattle may be marked at the time of bleeding. This dye is applied with a small brush, and the numbers can be read for several months. When the report comes back from the laboratory, riders can cut the reactors from the herd without corraling the cattle. This method of marking has been used successfully in several states. The formula for this dye, as obtained from Dr. G. W Cronen, B. A. I. Inspector-in-Charge for Montana, is as follows:

9 oz. Nyanzol D lumps
8 oz. gum arabic
16 oz. hydrogen peroxide
The gum arabic is soaked for 24 hours in one pint of cold water. The Nyanzol D lumps are powdered and dissolved in three quarts of boiling water. The gum arabic paste is thinned to a pouring consistency and added to the hot dye solution, and the whole is diluted to one gallon. The hydrogen peroxide is added in the proper proportion to the dye solution just before use, being thoroughly mixed.

The hair must be dry when the dye is applied. The numbers become visible in about one hour after application. This dye will not show on black cattle.

SUMMARY

Summarizing the material which has been presented, and attempting to develop from these ideas suggestions for practical brucellosis control in range cattle, we propose the following recommendations:

1. That as a basic factor in herd management a short breeding season be advocated, ideally only about 50 days.
2. That the general practice of shipping dry cows in the fall be advised.
3. That calf vaccination be advocated as a routine procedure, although there are areas where vaccination of range calves is unnecessary. Calf vaccination alone can eliminate the disease from a moderately infected herd within a few years time.
4. That in herds where there is evidence that brucellosis exists, the breeding cows be tested in the fall, and all cows showing any reaction at 1-50 be shipped to market, and that at the same time calf vaccination be started. If the breeding season is limited, one test and culling operation should be sufficient. A second test the next fall may be desirable.
5. That where an acute outbreak of the disease develops in a herd in which it is not practical to eliminate the infected cows by shipping after a fall test, adult vaccination be applied to the cows.
6. That the area control plan be advocated and gradually developed, under a law providing for establishing disease-control areas on petition of the cattle owners, particularly in semi-range areas.

REFERENCES

DISCUSSION OF THE CONTROL OF BRUCELLOSIS UNDER RANGE AND SEMI-RANGE CONDITIONS

H. E. KINGMAN, D.V.M.

Wyoming Hereford Ranch, Cheyenne, Wyoming

I am quite certain that it is the wish of the chairman (and the program committee) that the discussion at the moment be directed to the subject of Brucellosis and not necessarily to the paper that has just been presented. Further, the things I have to say may or may not be in agreement with the opinion of the Association. Remarks at this time are related in part to a report that was made upon the subject of Brucellosis and published in the J. A. M. A. June 1948.

The report serves as an example of handling certain phases of the Brucellosis problem, and is brought to the attention of this Association in order that they may be a matter of record.

The Data are a statement of facts and the records are available as proof (if that is necessary).

The great value of the plate method of testing for Brucellosis in the hands of the clinician is demonstrated. This needs no mention in addition to the thousands of times it has proved its worth in the hands of the clinician as well as in laboratories quite removed from specific details of the problem with which they are working.

In the beginning the test was probably not as good as it is now but even at that time (perhaps 20 years ago) it was accurate enough to accomplish its purpose. Lest we forget, we should never fail to express our gratitude to such men as Bang and Huddleson.

In the report that was mentioned an opinion was expressed that in addition to the use of the test, extent and character of the infection, and the differential diagnosis by the clinician, and the determination of its incidence, two other factors are of equal importance:

1. The willingness and ability of the owner to cooperate with the clinician. (In this connection it must be pointed out that because of terrain, size of herd, location of pastures, proximity of neighbors, and kinds of fences, cooperation may be impossible regardless of willingness.)

2. Climatic environment. Sunshine and dry soil are of great importance in the eradication of many infectious diseases.

Under favorable circumstances a number of large herds have been freed from Brucellosis and have remained free for a period of 16 years or more.

No recommendations are attached for the guidance of others and no prophecies are made.

I am reading this in order to conserve time and avoid wandering.

The chairman has my sincere sympathy. Over the last 60 years some of us have witnessed a great many attempts on the part of the veterinary profession to separate the false from true in regard to brucellosis. Since this group is made up of laymen as well as veterinarians it should be pointed out that marked progress has been made in spite of the apparent chaos. This should be impressed upon all who are connected with the livestock industry.

It is hoped that during this meeting we may look beneath the surface and observe the progress that is being made.
REPORT ON BRUCELLOSIS ERADICATION PROJECT

BY A. K. KUTTLER, D.V.M.¹

The report by the Bureau on the brucellosis eradication project this year will be confined mostly to matters of organization, rather than the technical aspects of the disease. A report on the latter is being prepared by a fact-finding committee appointed by Dr. J. V. Knapp, President of the Association, and Dr. B. T. Simms, Chief of the Bureau of Animal Industry.

I feel fully justified in stating that more has been accomplished since the recommendations of this Association were made last December and approved by the Bureau, than for any like period since efforts were undertaken on a nationwide scale to control and eradicate the disease.

The background for this report was a meeting held under the direction of the Chief of the Bureau in September 1947. There were in attendance at this meeting representatives on a national level of all interested groups in the brucellosis problem. Two very significant requests were made at this meeting:

1. Recommendations were made that more factual information on brucellosis be made available in one volume for use of all who would take time to read it; and

2. It was recommended that action be taken by the United States Livestock Sanitary Association and the Federal Bureau of Animal Industry which will result in greater uniformity in procedures for eradicating the disease.

It seems unnecessary to dwell on the importance of these two points. This association acted more promptly on these recommendations than is the custom for such large groups, by making recommendations to all of the States that procedures be adopted which have proved effective in eliminating the disease when proper cooperation by the livestock owner is given.

RECOMMENDATIONS OF U. S. LIVESTOCK SANITARY ASSOCIATION APPROVED BY A LARGE PERCENTAGE OF STATE OFFICIALS

I am pleased to report to you that cooperating officials of 41 of the States and Puerto Rico have signed the memorandum of understanding which is based on these recommendations. It was understood that in many of the States present laws and regulations would be inadequate for compliance with these recommendations, and that due to varying conditions in the different sections of the country, there would be considerable criticism and specific exceptions taken. However, the unanimity of thinking as shown by the large number of State officials who have approved these recommendations by signing the new memorandum of understanding, is even more than anticipated, when we take into consideration the short period of time since the last meeting of the Association.

¹Dr. Kuttler is In Charge of the Tuberculosis Eradication Division, Bureau of Animal Industry, Agricultural Research Administration, United States Department of Agriculture.
OBJECTIONS TO RECOMMENDATIONS OF THE ASSOCIATION

I feel that this report would be incomplete without a brief discussion of some of the major objections raised. The brucellosis committee of this Association is well aware of the fact that when any considerable number of livestock producers object to procedures for controlling and eradicating the disease, there is little hope for success unless an agreement can be reached. The brucellosis committee and members of the Association fully realized that the standards set in these recommendations would not be reached in the immediate future. However, these standards do give us an objective, and I am sure the criticism would have been even greater had we failed to include in the recommendations those provisions which, at present, cannot be adhered to by many of the States, but which will be necessary as terminal procedures if we are to reach the goal we have set for ourselves. I shall discuss those parts of the recommendations which have been objected to in the order in which they appear in the recommendations.

FEDERAL REGULATIONS GOVERNING INTERSTATE SHIPMENTS OF DOMESTIC ANIMALS

Considerable criticism has been offered by a limited number of States to the proposal that the Secretary of Agriculture be authorized to promulgate regulations covering interstate shipments of livestock, vaccines, and antigen. These objections have been raised, as you would expect, largely from the exporting areas, and more particularly, the range areas. In this connection, it is interesting to note that there are many in other sections who have been equally critical because Federal regulations governing interstate movements of livestock and biologics used in connection with the brucellosis eradication project have not been promulgated. I think it will be recognized by all who are familiar with the great accomplishments made in other livestock disease eradication projects carried on in this country that in dealing with infectious and contagious disease, interstate regulations have been basic to the successful conclusion of the project. In dealing with all other infectious and contagious diseases which have been successfully controlled or eradicated, the Federal regulation was established as a prerequisite and not delayed, as has been the case with brucellosis.

Many of you are familiar with interstate regulations in connection with the cattle fever tick eradication project. In the early days of cattle fever tick eradication these regulations were somewhat limited, permitting, as many of you know, the interstate shipment of dipped ticky cattle. The progress made under these conditions was very slow. Tick eradication work was started as early as 1906. The Crisp Bill, which was enacted by Congress in 1928, made it possible to prohibit interstate shipments of dipped ticky cattle. Progress on the tick eradication work was greatly increased from that time on until the ticks were, for all practical purposes, eradicated. Do we want to take advantage of past experience, or continue spending millions with little actual progress shown for these large expenditures? Interstate regulations will not, in themselves, eliminate all of our troubles in eradicating brucellosis, but if such regulations are enforced, they will be one of the most
important incentives we can offer for eradicating the disease in all of the States at
the same time.

Those who oppose regulations covering interstate movement of domestic ani-
imals, so far as brucellosis is concerned, appear to be under the impression that the
demand for such a regulation is coming from the Federal Bureau of Animal Indus-
try. Nothing could be further from the facts in the case. The Bureau knows
well that the preparation of such a regulation will be very difficult, and even more
difficult to enforce. Modern methods of transportation, and selling through
public sale yards, make the movement of livestock difficult to control. Moreover,
it is from these sources that a great deal of protest against such regulations can be
expected. I would not want to be considered critical of these two important
agencies so far as the livestock industry is concerned, because I am sure they de-
pend as much upon the livestock industry as any of us, and when they can be per-
suaded that these controls are necessary to the welfare of the industry, and can be
made practical, they will go along with us. However, we have not hesitated in the
past to face really difficult situations, and I am sure we will not undertake to evade
the issue on this matter of an interstate regulation.

It has come to my attention on numerous occasions that State officials are of the
opinion that interstate regulations can be promulgated by the Secretary of Agricul-
ture immediately. This, you must know, is not the case. It will take appropriate
congressional action before practical regulations can be promulgated, and the
demand for this action must come from the producers and consumers themselves.

COMPLIANCE WITH ONE OF RECOMMENDED PROCEDURES REQUIRED

More objections have been registered against the compulsory provision in the
brucellosis recommendations than any other. This is well understood, and points
up the common resentment to the idea of force in any way. I like the expression
from one State official on this question, who said, “Compulsory measures will un-
doubtedly have to be applied as terminal procedures in the eradication of the dis-
ease, but our people would resent such measures at this time.” It is unfortunate
that we have as much difficulty as we do in understanding each other. I am sure
it was the intention of the Association that all should read into these recommenda-
tions the thought that they are intended to lead the way to the ultimate goal, and
that each State would not only be expected to select the procedure most suited for
its particular situation, but that it would determine just when the terminal proce-
dures are to be applied. I am sure when we study the recommendations carefully
it is plain that the provision for compliance with one of the procedures recom-
mended for eradicating the disease is not to be effective until 65 percent of the
owners, representing more than half of the cattle, are in favor of it. This, of course,
would not hurry anyone into compulsory brucellosis eradication without proper
provisions for a majority rule. Failure to adopt such procedures will make it
possible for a minority to defeat the majority—something we abhor in this country.
There is a distinct difference between handling infectious and contagious diseases of
livestock, and public improvement projects of other types. The man who is willing
to drive on a muddy road in no way jeopardizes the one who builds a good road.
Not so when we are dealing with infectious and contagious disease. The neighbor
who maintains diseased animals is a menace to the one who has been progressive
enough to free his herds from disease. And when a majority has definitely decided they want to eradicate the disease, the minority should be required to do likewise. The compulsory requirement has been a basic part of every livestock disease eradication project, but it should, in my opinion, be accepted as the ideal only when we have reached the point in our eradication measures where it is necessary to give protection to the majority.

PERMANENT IDENTIFICATION OF DISEASED ANIMALS

In a few instances objections have been made to the provision for permanently marking reactors. We should weigh carefully the fact that reactor animals may recover from the disease, and if permanently marked, may reduce the value of the animal to the owner. This is true, but it applies to a small percent of the infected animals. Failure to permanently mark all reactors in order to salvage the value of those few which might return to normal is not sound disease eradication, and will result in our eventually having to face the charge of contributing to the spread of disease, rather than using the funds appropriated for disease eradication as intended.

ESTABLISHING A DATE AFTER WHICH RESTRICTIONS WILL BE PLACED ON MOVEMENTS

Another part of the recommendations which has been objected to by a limited number of State officials is No. 9 under “Recommendations for State Legislation.” This refers to a future date, after which the sale of animals for other than immediate slaughter would be subjected to established health requirements with respect to brucellosis. This is one of the most important sections in the entire recommendations, and in those areas where they are not ready for it, the time for putting it into operation should be set far enough in advance so that provisions can be made for compliance when the effective date is reached. We cannot hope to maintain herds and areas free from the disease if some steps are not taken to protect them against exposure. There will be, as the brucellosis committee well understood, some necessary changes so far as the actual procedures A, B, C, and D are concerned. In a good many sections, owners are now practicing vaccination of calves at an age beyond that which is recommended. Time will tell whether this advanced vaccination age is preferable. As time goes on, improved methods and materials certainly will be developed, and as soon as their value has been established they will be adopted.

Several well-organized projects on research are being carried on for the purpose of finding a more satisfactory vaccine, or of using the vaccine now available in a more effective way. Reports will be made by those in charge of these experiments as soon as definite information is available. Considerable work is being done at the University of Minnesota on the ABR, or so-called “ring test.” Should continued work on this test prove it to be as effective as present information would lead us to believe, a great saving in manpower could be made through its use, particularly in the dairy sections.

PRESENT INFORMATION ADEQUATE FOR BRUCELLOSIS ERADICATION

In this connection, we should keep in mind that research has already given us sufficient information to make it possible to eliminate brucellosis economically from any herd or area when full cooperation is given by the owner. We cannot hope to
eradicate the disease until we who are charged with the responsibility of using those tools devise ways of applying them. Nor are we likely to get better tools until, as the result of practical application, we find out what is wrong with the ones we are now using. I do not wish to leave the impression that present methods can in any way be considered experimental. They have stood the test and it is up to us to use them. In this connection, livestock disease eradication is an ideal. Ideals, we are told, live, while material things disintegrate. The fruits of our livestock disease eradication work have been as phenomenal as our industrial production, which has led all other countries. As a result of livestock disease eradication projects successfully concluded in this country, reserves of food supplies of animal origin have been made available when they were needed most. Not only has this country been able to produce a large part of the food supplies for the world but livestock disease eradication has contributed materially to the reduction of disease in man. With the world population increasing more rapidly than ever, and livestock numbers being reduced, the challenge to supply food becomes even greater.

**BRUCELLOSIS TRANSMISSIBLE FROM ANIMALS TO MAN**

In the brucellosis eradication project we are again faced with the problem of eradicating a livestock disease which is transmissible to man. If we are willing to work together, we will reach another milestone in the progress of the livestock industry and the veterinary profession, toward greater benefits for all our people. The most important factor in any organized effort is the matter of being able to work together. In order that we may work constructively together, we must have confidence and respect for each other. I can assure you the Bureau has that attitude toward you. Statistical data on the brucellosis eradication project are contained in tables prepared by the Bureau. These tables are available here at the speaker's desk, or may be obtained from the Washington office of the Bureau of Animal Industry.

**SUMMARY**

1. If brucellosis eradication is the objective, it will be necessary that each of the States adopt the basic principles laid down in the recommendations of the United States Livestock Sanitary Association at their 1947 meeting, which were approved by the Bureau.

2. More has been accomplished during the past year from the standpoint of organization than for any like period since the brucellosis eradication project was started on a national scale. Much remains to be done in this connection.

3. Current statistical information shows only the volume of testing and vaccinating being done, and is not a satisfactory measuring stick for over-all progress in eradicating brucellosis.

4. Tools necessary for eradicating brucellosis in domestic animals have been made available through research. Ultimate results will depend upon our ability to use these tools and make improvements as we go along, rather than wait for better tools.
REPORT OF THE COMMITTEE ON BRUCELLOSIS


After holding extensive hearings and giving careful consideration to suggestions made therein, your committee on Brucellosis recommends the following amendments to legislative recommendations made in the December 4, 1947 report:

1. Paragraph 1 formerly read: "Provisions for requiring participation in one of the plans for eradicating the disease by all owners of livestock in a given area when 65% of such owners holding at least 51% of the cattle have placed their cattle under supervision of any one of the plans.”

This paragraph was ambiguous and a psychological obstacle because of the element of compulsion before any plan could get under way. Correcting these shortcomings, a new paragraph 1 was substituted and reads:

“1. In the initial stages of brucellosis control in an area, the state shall sponsor a program when 65% of the livestock owners holding at least 51% of the cattle have placed their cattle under any one or a combination of the four plans set forth below. Those owners not participating shall not be compelled to come under the program. As brucellosis control and eradication advances in a given area, the point will eventually be reached where the incidence of infection is very low. At that time, the few remaining vestiges or pockets of infection must be eliminated. When 75% or more of the livestock owners holding 95% or more of the cattle in a given area sign up under any one or a combination of the four plans, the livestock sanitary official may require the remaining livestock owners to individually select and come under one of the four plans described herein.”

2. In paragraph 3, the words “or cattle eligible to registry” were inserted after the words “excepting registered purebred cattle”.

3. In paragraph 4, the words “as outlined in paragraph 1” were deleted because the services are not specifically enumerated in the opening paragraph. They are covered in other sections.

4. In paragraph 9, the words “and/or moved” are inserted after the word “sold” in the first sentence.

5. In section (b) of paragraph 9, the age at which vaccinated feeder cattle may be sold and/or moved is raised from 24 to 30 months.

6. Paragraph 11 concerning classification of reactors then has this added statement: “Feeder cattle vaccinated from 6 to 12 months of age will not be classed as reactors until after reaching 30 months.”

The foregoing six amendments constitute all modifications to the 1947 Recommendations for State Legislation.
Under Educational Policies, all recommendations remain with the exception of two paragraphs that are deleted. The first deleted paragraph read: "It is recommended that the President of the United States Livestock Sanitary Association and the Chief of the Bureau of Animal Industry appoint for immediate action a joint committee of livestock sanitary officials and research workers to prepare a bill of proven facts explaining the foundation for the foregoing recommendations for State legislation." That committee was appointed. Following painstaking effort throughout 1948, it brought forth the Bill of Proven Facts that was presented this morning.

The second paragraph deleted read as follows: "When these plans have been adopted by the United States Livestock Sanitary Association, and approved by the United States Bureau of Animal Industry, they shall be made a part of the memorandum of understanding between the United States Bureau of Animal Industry and the cooperating States."

Considerable misunderstanding arose as a result of this statement. Several persons were under the impression that federal cooperation and assistance depended upon a state’s acceptance of these Recommendations for State Legislation. Such was not and is not the case. The Bureau of Animal Industry advised your committee that compliance with these recommendations is not required for federal assistance in brucellosis control. The 1947 report and the 1948 amended report are designed as guides and guides alone designed to encourage a more unified and consistent program for brucellosis control and eradication among the several states.

The complete amended 1947 report is appended hereto as the 1948 report of the Committee on Brucellosis.

Brucellosis continues to be one of the most serious infectious diseases of cattle in this country. Although good progress has been made in the past in many areas, the program must be enlarged if the disease is to be controlled and eradicated. The control and eradication of brucellosis require the full cooperation of the cattle owners and the livestock sanitarians. Cattle owners must be informed as to the part they must play in the program.

It is generally admitted that the problem of the control of brucellosis in man is dependent upon the reservoir of the infection in animals and that the most effective method for reducing human brucellosis is the control of the disease in animals. It is evident that a major effort needs to be directed to bringing the disease under control in animals with consideration of all and not just several important species that may act as reservoirs or a means of transmission to man.

Therefore, your Committee on Brucellosis submits for your consideration the following report:

**LEGISLATION**

*Recommendations for Congressional Action*

Authorization for the Secretary of the United States Department of Agriculture to promulgate regulations governing interstate movement of animals affected with or exposed to brucellosis.
Recommendations for State Legislation

1. In the initial stages of brucellosis control in an area, the state shall sponsor a program when 65% of the livestock owners holding at least 51% of the cattle have placed their cattle under any one or a combination of the four plans set forth below. Those owners not participating shall not be compelled to come under the program. As brucellosis control and eradication advances in a given area, the point will eventually be reached where the incidence of infection is very low. At that time, the few remaining vestiges or pockets of infection must be eliminated. When 75% or more of the livestock owners holding 95% or more of the cattle in a given area sign up under any one or a combination of the four plans, the livestock sanitary official may require the remaining livestock owners to individually select and come under one of the four plans described herein.

2. Reports to State and Federal cooperating agencies of all activities, such as agglutination tests and vaccination, in connection with the disease, on forms furnished by the State or Federal cooperating agencies must be compulsory.

3. A permanent brand with the letter “B” not less than 2 inches high and 2 inches wide on the left jaw of all reactors, excepting registered purebred cattle, or cattle eligible to registry, otherwise permanently identified, and quarantine of such reactors to the premises where found, limiting movement of these animals by permit of State officials, to slaughter at points where State or Federal inspection is maintained, except in case of valuable purebred animals, which must be branded and may be allowed to move on permit of State officials, to other herds where Brucella infection is known to exist.

4. All services in connection with brucellosis control to be made available to the owner without expense to him so long as funds for such purposes are available, except for the handling of his cattle. When State and/or Federal funds are not available, it is recommended that the breeder shall continue his program at his own expense with his private veterinarian, and under the supervision of State and Federal veterinarians.

5. 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.

6. Authorization for those engaged in the project to enter premises, etc.

7. All phases of official brucellosis control programs to be conducted under supervision of full-time employed State, Federal, County, or Municipal veterinarians. This provision does not intend to eliminate the practicing veterinarian, but is intended to promote and include his services and to provide for supervision of his activities by regularly employed veterinarians.

8. Permanent identification of all vaccinated cattle with tattoo “V” in the right ear, preceded by numeral of the quarter of the year and followed by the last number of the year. A calf vaccinated in December 1947 would be marked “4V7”, or hot iron brand on the right jaw, “CV” for vaccinated calves, and “AV” for vaccinated adults. Special ear tags should also be used in the right ear of all vaccinated animals, to aid in recognizing them.
9. A future date should be set after which no female cattle or breeding bulls more than 6 months of age shall be sold and/or moved except for slaughter, unless such cattle either
   (a) have been tested for brucellosis and found negative within 30 days prior to the date of sale, or
   (b) are dairy cattle and breeding cattle under 24 months of age and were vaccinated against brucellosis with an approved vaccine when they were not less than 6 months nor more than 8 months of age and were identified as provided in paragraph 8 and reported at the time of vaccination to State and Federal cooperating agencies, excepting beef cattle in range or semirange areas which may be vaccinated at not less than 6 months nor more than 12 months of age, or
   (c) are in a brucellosis-free accredited herd or area at the time of sale. Accredited herd certificates shall be issued only by the Bureau of Animal Industry, United States Department of Agriculture, and State Livestock Sanitary officials, under provisions adopted by the United States Livestock Sanitary Association and approved by the Bureau of Animal Industry.

10. Legislation should be broad enough to authorize promulgation of regulations by State Livestock Sanitary authorities after hearings before representative livestock producers, public health authorities, and veterinarians to include the following methods of procedure for eradicating brucellosis:

   Plan A. Test-and-slaughter; with or without calf vaccination.

   Test-and-slaughter has the advantage of being a short-time program, since many lightly infected herds may be freed and remain free of the infection after a limited number of tests. Where negative herds are surrounded by heavy infection, the advantages of calf vaccination should be explained.

   Test-and-slaughter is recommended for infected herds in which the immediate removal of reactors will not cause serious economic losses, provided owners appreciate fully the necessity of following recognized sanitary procedures. These procedures must include prompt removal of reactors, thorough cleaning and disinfection of barns or buildings in which reactors have been kept, and retests at frequent intervals not to exceed 30 days until the disease has been eradicated.

   Test-and-slaughter is apt to be unsuccessful unless all of these procedures are followed. However, it has been successful in thousands of herds where suitable precautions have been observed.

   Calf vaccination should be encouraged in infected herds and areas, but shall not be a substitute for sound sanitation and management, and it should be explained that failure to follow sound management practices, so far as replacements are concerned, accounts for most of the breaks in clean herds. Owners should be warned that as is true in many other disease control programs, occasional herds do not respond satisfactorily.

   Plan B. Test, calf vaccination; temporary retention of reactors until they can be disposed of for slaughter without excessive loss to the owner under provisions of the law.

   The objective should be to dispose of reactors for slaughter as soon as possible. Full recognition is given to the fact that vaccinated calves will not all be resistant.
However, with a high percentage of vaccinated animals having an increased resistance to brucellosis, the percentage in favor of vaccination is sufficient to support its wider use.

**Plan C.** Calf vaccination without test of any part of the herd.

This plan 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.** Adult vaccination, only when approval is received in writing from State and Federal cooperating agencies prior to the time of vaccination, which should be confined to herds where there is evidence of rapid spread of virulent infection indicating the need for emergency measures, and only after the owner has been informed in writing that the vaccinating of his adult animals may not prevent the spread of infection. In herds where adult vaccination is adopted, the herd must be subjected to the agglutination test prior to vaccination, reactors identified as provided for in paragraph 3, and vaccine administered only to negative animals within 10 days after the completion of the official test.

11. Reactors will be classified as under present policies of the United States Bureau of Animal Industry, except that calves vaccinated from 6 to 8 months identified as outlined in paragraph 8, and reported at the time of vaccination to State and Federal cooperating agencies, shall not be classed as reactors until after reaching the age of 2 years. Feeder cattle vaccinated from 6 to 12 months of age will not be classed as reactors until after reaching 30 months.

**EDUCATIONAL POLICIES**

Education should be promoted as follows:

All properly verified facts concerning the disease and methods of control should be kept before the public under the direction of those trained in disseminating information. This should include bulletins and leaflets more attractively illustrated, based on and confined to our present knowledge of the disease which has been properly verified by research and practical application; moving pictures; news releases; radio programs; and all known methods of publicity.

Frequent group meetings should be held, led by regularly employed State or Federal cooperating veterinarians, in the interest of eliminating confusion.

All properly verified useful information which becomes available through research should be disseminated, in connection with the control of brucellosis in other animals, including swine, goats and sheep.
DISCUSSION OF REPORT OF THE COMMITTEE ON BRUCELLOSIS

MR. ARNOLD (South Dakota, Livestock Sanitary Board): We feel that this is not an opportune time to present an order or a recommendation which in time would be one that we would have to conform with. We out here in this western country and the range are just as anxious for the eradication or control of brucellosis as those of you in the Eastern States or any other section of the country. We have to work with our people the same as you do. I am speaking to those of you in the eastern part of the country, because this committee was made up almost entirely of the men from the dairy section of the country and for some reason or other those of us in the western part of the country and the range and beef area were not given a voice or have much of a voice on this committee.

In order to get this job done we have to work with our people, and it is not possible for us to go out and lay down a compulsory or a must program and get the job done. As far as we are concerned in South Dakota we have worked very closely with the Bureau. As a matter of fact the inspector in charge does sit in with us and requested that he sit in with us on the deliberation of all of our problems to come before our Board, and he has the right to say whatever he thinks and discuss these problems with us. Because of that we have had complete harmony in South Dakota, and I think that Dr. Simms will bear me out in saying that that is true. We want to continue that relationship. We want to continue the same relationship with the Bureau.

Now, the inspector, I am sure the inspector in charge out there will bear me out when I say that we can push this program too far, and, if we are going to do this job, we must have a program that our cattlemen will agree upon and not one that has been formulated such as this one is being formulated and the kind of a program that I want to see and the one that I know our Western men want to see is one that the inspector in charge together with the sanitary officials who have sat down and worked out and one which they have agreed upon and that we can agree on with the Bureau and not one that has been concocted here in a meeting of this kind. Now, that is what we want. It is not that we don't want any program. We do. But we want a program that we can work with and not one that we are going to take home and defeat the very thing that you and I are trying to put across.

As far as any compulsion is concerned and as far as this program goes it may look very fine to us here and to all of you men, but when we take that back to our men and they throw it in our face and tell us no, what are we going to do? Now, let's just leave this thing open so we can get our people to agree upon such programs, and as time goes along that we can work on a program of control or eradication of this disease.

I think that we, the sanitary officials of South Dakota, know better how to do that job in South Dakota, than some man in Connecticut, New York, New Jersey or some other place. It is the same thing in Texas or California. I don't think I know how to handle the California, nor I don't know how to handle the Texas deal nor neither do you. As far as passing a law that empowers the Secretary of Agriculture to lay down rules and regulations for the Livestock Industry for the beef industry we say
no. We want to talk with you, with the Secretary of Agriculture and have something to say about what these rules and regulations shall be. You know we have had a lot of Secretaries in the last few years; some of them we are not so proud of; and we may have some more.

Now, let’s just don’t throw this thing in the lap of a thing of that kind. I think that, if we pass this thing, you are going to be sorry for it. There aren’t many stockmen here. We are very much in the minority. There were about 18 or 20 western states that met here. We formulated some regulations and presented them to this Committee. It took them just about two minutes to throw them out. That is what we are getting. So far as the Dairy Industry is concerned we have a great deal of respect for them. We want them to have whatever regulations that they need. We will help them get those that they want, but we don’t want them cramming those down the throat of the cattle industry, the beef industry, which will not fit, and I want to say, gentlemen, if this thing passes, that it is going to be one of the greatest mistakes of this organization, and I think that we had better table this thing until you get away from—I was going to say a canned committee and put a few of our western men on these Committees and give us a voice in this thing and don’t let the dairy industry speak for us.

DR. SMITH: I might say that, if the report is tabled, we will revert right back to last year’s report which is on record and has been accepted and evidently is much more offensive to the gentleman than the one which we have presented here. I suppose it becomes my duty as chairman to defend the Committee. He referred to several states who have got together and have put in resolutions and it took us two minutes to throw them out. We sat there in conference last night from 9:00 until 10:00 o’clock and heard this gentleman speak, not once but a half dozen times which was his right, and we were glad to hear him. He read this resolution, and then he presented it for consideration. We went into executive session at 10:00 o’clock, and we did not come out until two minutes past 12. How does he know we took two minutes to throw it out? I do find since that resolution has been presented four states have been to me and asked to have their names, their states crossed off. So much for that.

I thought we would not have to take this time but we might as well go to it. This is on the old report which is much more offensive according to the argument you have just heard than the present. A statement of Mr. Frank W. White, President of the Minnesota Farm Bureau Federation and Chairman of the National Dairy Committee of the American Farm Bureau Federation, representing that organization at the U. S. Livestock Sanitary Association to the Brucellosis Committee. Those are his credentials. “The control and eradication of brucellosis—Bang’s Disease is of great significance not only to the Dairy and Livestock industries but also to the general public. The need for an adequate program to control and eradicate this disease as well as the development of uniform livestock sanitary rules and regulations has been the subject of executive discussions in the meetings of the American Farm Bureau Federation Dairy and Livestock Committees and many State Farm Bureaus. Approximately one-half of the State Farm Bureaus have held state-wide meetings for discussion of brucellosis problems, and most of these have sent in recommendations.
DISCUSSION OF REPORT

"In addition, several Farm Bureau leaders participated in central state conferences participated in by the Bureau of Animal Industry and Extension Service. A meeting was called by the Illinois Agricultural Association to consider specific programs in connection with the procurement of feeder cattle as related to brucellosis programs. The majority of the State Farm Bureaus adopted some type of resolution on these matters during the past year. Recommendations of the American Farm Bureau Federation have been made from time to time in the last several months including the following: 1. That the Livestock and Dairy Departments of the American Farm Bureau Federation bring about a better understanding of the programs for the control and eradication of Bang's Disease throughout the Nation. 2. That recognition be given to the importance of careful vaccination as a most valuable aid in the control of bovine brucellosis and also to the importance of further research in both swine and bovine brucellosis including the development of improved diagnostic tests which will determine whether positive reactions are a result of the disease or from the vaccine. 3. That such State Farm Bureaus, which have not already done so, take the responsibility for calling together all interested parties in the state such as the representatives of the Livestock Associations, Livestock Sanitary officials to develop a better understanding of the problem involved in the development of a uniform plan for the control and eradication of brucellosis as plans or uniform laws and regulations for livestock. On the basis of studies and recommendations made by the States, the Regional conference, and the National Livestock and Dairy Industries Committee it appears that there is general agreement on the following: First, there is definite merit in calf vaccination and in the close distribution of vaccine. Two, there should be more liberal and uniform regulations governing the movement of heifers vaccinated and permanently identified and officially reported. Three, a very large majority recognized the need for training qualified laymen and veterinarians and assistants in administering the vaccine under the supervision of State or Federally employed veterinarians. Four, brucellosis is a problem in each State. The Secretary of the United States Department of Agriculture, State Officials should be authorized to promulgate regulations governing interstate movement of infected cattle. Five provisions for eradication of brucellosis in swine must be included in the program. Six, the four alternative plans in the uniform program developed by the U. S. Livestock Sanitary Association and approved by the Bureau of Animal Industry appears to meet the requirements of most of the States and have been generally approved. Objections have been raised by certain livestock groups in the range area. Seven, an aggressive program of research should be inaugurated to develop further facts regarding brucellosis and susceptible species of livestock. Special effort should be made to develop improved vaccines and diagnostic tests which will determine whether the positive reactions are the result of the disease or from the vaccine.

"State Legislation. The recommendations for state legislation made by the Brucellosis Committee last year appear to be acceptable to the majority of our state and commodity committee members. There is one exception: It is our opinion that the permissible age for calf vaccination should be changed from six and eight months to six and twelve months of age and that the age at which they
are classified as reactors should be raised. We have done that for the range states, and we have raised the tolerance for the range states from 24 to 30 months. The last action taken by the Board of Directors of the American Farm Bureau Federation in this connection is as follows—" and then that goes on with their procedure. There is nothing else here that I see that has to do with this program. Now, they definitely go on record as favoring the very things that this group seem to not want in there, and the Committee went just as far as we felt we had any right to go when we raise the 51 per cent to 95 per cent before we recommended that to the state. It is all up to the state anyway, and I might say that already 35 states have signed the memorandum of agreement based on this last year's report.

Seven additional states have signed it with the reservation only they deleted that part, and they wrote in exceptions where provisions in the new memorandum of agreement conflicts with State laws, and seven states have not replied. Last February, without anyone from this Association that I know of being present or any agitation on the part of any group of livestock officials, the American National Dairy Council in convention in South Carolina unanimously approved the program as it was submitted to you last year.

Now, the Committee on Brucellosis of this association has been fair; they have listened to every argument. We have weighed it as you would have weighed it, and the preponderance of evidence is on the side of the report as it was, and we don't know what we are going to be accused of when we let down the bars the way we have.

**Judge Montague:** I would like to make a motion at this time, and in doing it I will have to ask the Chairman of the Committee to hand up the resolution that Mr. Arnold handed to his committee last night, and I move you, sir, as a substitute for the committee report that the resolution by Mr. Arnold be adopted by this Association as a substitute.

**Dr. Smith:** There is a motion before the House.

**Judge Montague:** It is always permissible to offer a substitute.

**President Knapp:** If you offer it as a substitute.

**Judge Montague:** I offer it as a substitute.

. . . The motion was seconded . . .

**Judge Montague:** We will ask that the Chairman of the Committee let me have that and read it as the substitute.

**President Knapp:** We are having our Panel discussion now. While Judge Montague is getting up here and reading the resolution I would like to say for the benefit of all present: There is nothing compulsory about this committee report that has been submitted. It is entirely up to the State just as it would be up to you if you wanted to buy an automobile or a fur coat. All right, Judge.

**Judge Montague:** Before reading this I would like to reply to the chair, while it is not compulsory on the part of the State to adopt any of these plans, that the recommendation is made and the states are requested to sign an agreement by which they would take over the program and enforce compulsory programs in their state.

**President Knapp:** They don't have to do it unless they want to.

**Judge Montague:** The request is that they put themselves in shape to enforce
that, and the Secretary of Agriculture be requested through this organization to promulgate regulations that would enforce such a program.

PRESIDENT KNAPP: Not today.

JUDGE MONTAGUE: It is just that we do not understand it the same.

PRESIDENT KNAPP: We are not talking about the same thing.

JUDGE MONTAGUE: I offer this resolution as a substitute for the committee report: "Be it resolved by the United States Livestock Sanitary Association that:

1. No program dealing with the Brucellosis problem that would be compulsory on any person whether the same be on an area basis, percentage basis or otherwise should be instituted or attempted by the Federal Government at this time.

2. Calves that have been officially vaccinated for brucellosis between the ages of six months and twelve months should be allowed free and unrestricted movement into or across any state or states without further test when such vaccination is officially certified to by the appropriate state official of the state of origin and until such calves reached the age of 30 months.

3. Range cattle intended for feeding and slaughter and shipped from the State of origin for that purpose should be allowed to enter or cross any statelines without vaccination or certification upon permits issued by the proper official of the state of destination. No legislation should be requested of or enacted by the Congress that would authorize the Secretary of Agriculture to promulgate regulations, and no regulations should be promulgated that are in conflict with the foregoing principles and practices as expressed herein.

"We recommend continued intensive research into the problems of brucellosis, and we urge that all departments of the Federal Government and respective states exert every possible effort to properly inform the livestock people of the United States concerning all phases of the problem. We so recommend because we know that cooperation is a requisite to any successful approach to the problem, and we further know that correct and full information about the problem is necessary to secure cooperation."

Now, Mr. Chairman, speaking to this motion to substitute, I will take up the various paragraphs individually. Paragraph number one states—and I will not read it again—that no program should be adopted with reference to brucellosis that would be compulsory on any person regardless of the plan upon which it might originate. To us in the range states that is the only plan that can be followed with any degree of hope of success. To try to bring about any compulsory program will mean the assassination of all programs, because you are not going to be able to enforce a compulsory plan in the range states with reference to this disease.

Now, with reference to the second one with calves that are officially vaccinated and are so certified we make that recommendation on the strength of very strong reports made by many of the State Veterinarians, many of whom are here today who tell us that the movement of that type of calf, one that has been vaccinated between the age of six and 12 months that its movement would be safe at any time up to 30 months. We recommend that calf may be allowed to be moved without further blood test and without restriction. We do it strictly on scientific veterinarian reports.
The third one we recommend with reference to range cattle, and, of course, that item is of particular significance to the range people whom I speak for. We ship the cattle, and, as Dr. Wilkins pointed out in the paper he read here a while ago, the brucellosis problem is not one of any degree of seriousness to the range cattle. We ask that those cattle be allowed to be shipped provided the correct and appropriate official in the state of destination allows them to come into his State under permit, under his own rules and regulations. We don't attempt for one moment—we would resent anyone else attempting it—to impose any obligation or any kind of penalty upon any other State. We merely ask that no regulation be adopted by the Government in any way, that would interfere with the movement of cattle from the range state to the feeder lot of the states that want them and that would allow them to come in on the permit, and, if that is not democracy where a few states agree upon the plan, if that is not the correct democratic principle to regulate the economy of the two states so affected, what right has any state got to come in and tell us we cannot do that when the two states affected are satisfied with that plan.

Now then, with reference to the next paragraph that no legislation should be requested and none should be enacted by the Congress that would authorize the Secretary of Agriculture to promulgate regulations and that no regulation should be promulgated by him that are in conflict with the principles expressed in paragraphs one, two, and three. With reference to that paragraph I want to say, as I understand this organization—and I am newly in it—the purpose, your charter provides that it is an organization of livestock and sanitary officials, not necessarily officials, but it is an organization of people who are interested in questions involving the sanitation of livestock. It is not an organization of state officials, it is not an organization of Federal officials although there are some who say that very often the Federal officials almost take charge.

It is not simply an organization of producers or of feeders or of slaughterers, but it is an organization of the whole industry of people who are interested, who have their living coming out of the industry, and I say this with some hesitation because I would not hurt the feelings of any person intentionally, but I am afraid that in formulating the original plan and in bringing out the committees' reports that some persons may have forgotten that they are working for an entire industry, and they have left out the interest not only of the one particular branch but they have concentrated on a smaller interest to the disadvantage of others.

The entire industry must be considered, and we do not want the Secretary of Agriculture or any other living person given such despotic power that he can write a regulation that will put us out of business. We like our business. We want to stay in it. They may answer us and say, "But none of them would ever do it." The history of the last decade of this country proves that when you give people power they are darn sure going to exercise it at some time or other, maybe not that particular individual but some person following him up will, and we do not like despotic power even though it may be in the hands of a benevolent despot. We don't like it in any form.

Now, the next paragraph in the substitute that I offer is that the educational program with reference to brucellosis be continued and intensified, and I say this.
for this reason: that we of the range states who have attempted to inform ourselves at all with reference to this disease and the control of it, the more information, we get, the stronger we are for it. I know that I personally am strongly in support of a program that will work in the range country, and I know that the ranchmen I represent are almost daily coming into support of this program, and more and more of them are using calfhood vaccination as a mode of control, but when you tell him that he has got to do it because the State or Federal Government says so he is going to tell that person that says that to go to hell and he won't do it.

Mr. Chairman, the program that was proposed in the original plan of agreement, the original resolution that was adopted in December of last year, the plan that is carried out in the committee report today is not one that will work; it is not one that is fair to the large range-producing segment of the industry. It is not one that will bring about eradication of brucellosis, but we offer you one here in substitute that we in all seriousness and in great faith in the possible elimination of the disease, we offer you one that will work. Thank you, Mr. Chairman.

Mr. Messerschmidt (Alliance, Neb.): I have been attending the United States Livestock Sanitary Association conventions for several years. I am a cattle producer. I went into committee in Chicago wanting to have them formulate a plan that would be acceptable by all states. In order that we might ship our livestock into all states, if there was a program of vaccination that was the right way, we wanted to vaccinate. Any program that was the right way to accomplish this, we wanted that to be followed. I was instrumental in getting this meeting to Denver hoping that a place would be made on the Resolutions Committee and their Executive Committee for some of the cattle producers of the western area. We had this same program that you are trying to amend presented at Boise.

The chairman of our sanitary committee gave every consideration to every member present, heard all sides, gave consideration to each angle. As soon as the discussion was over a member of the U. S. Livestock Association moved that it be tabled, and it was passed immediately. Now, the thing that alarms me is the fact that we have come to the cattle area with the President of the State Veterinarians on these committees, passing a resolution that they know the cattlemen will not be in favor of, they will not work with. I think the cattlemen are as much interested in brucellosis eradication and control as anybody in the United States. They have been working with it for a good many years. We have always recommended it.

The Bureau of Animal Industry perfected the vaccine that would be effective in its use and control. But we have always asked that no compulsory program be placed before us until we are willing to accept that as the program that should be followed. I feel sure that all members present want to work in harmony with the great cattle-producing area. We are asking for time to complete this and to have a word about this and in it. I am saying this in support of the amendment that Mr. Arnold presented.

Mr. F. E. Mollin (Denver): It seems to me there is one point that ought to
be cleared up. At the committee meeting last Sunday night to which Dr. Smith referred it was stated by the representatives of the Bureau that they do not now possess the power to write such an interstate regulation as is suggested in the report. At the meeting of the legislative committee yesterday while this was under consideration it was stated by Dr. Simms and others present that they already had that power and that the language that was in the report of the Legislative Committee was necessary only to enable them to deal with other domestic animals. Now, it seems to me that we ought to know whether or not the Bureau of Animal Industry does have the power today to write the kind of a regulation that is proposed in this report. If he does have the power, of course, he can use it.

But the inclusion of that recommendation in this report it would seem to me it would be accepted by Dr. Simms as urging him to proceed to issue that kind of a regulation. I think we ought to know right now whether or not they do have that power and so that this Association will not go on record as urging something that is already there and it will be used for another purpose than that for which it is intended.

PRESIDENT KNAPP: Thank you, Mr. Mollin. Do you care to answer that question, at this time Dr. Simms?

DR. SIMMS: In reply to Mr. Mollin's question our solicitor has advised, as near as I can state it, something like this: The Secretary of Agriculture does have the power to issue regulations for the prevention of the movement of diseased animals interstate. Under the present set-up, however, the Secretary does not have the power to make exceptions to such a regulation which would allow the movement of reacting animals interstate for immediate slaughter. Most of you may recall in regard to tuberculosis we had specific Congressional action which placed in the hands of the Secretary and, of course, that was delegated to the Bureau when the regulation was drawn up—authority to make exceptions to the interstate regulation so that diseased animals could be moved across state lines for immediate slaughter.

That provided, of course, regular procedure for marketing reactor animals say in Iowa that were adjacent to Omaha or reactor animals in Wisconsin that were adjacent to Chicago. Until that bill was passed it was not possible, according to the way I understand our solicitor's version, for a regulation to prevent the interstate movement of tuberculous cattle and at the same time allow the diseased or reactor animals to be marketed in an orderly manner by crossing state lines for immediate slaughter. If there is a brucellosis order, Congressional action would be needed in order that diseased animals could be moved across state lines and be marketed. Does that answer your question, Mr. Mollin?

MR. MOLLIN: Dr. Simms, it answers my question, but it shows clearly that you do have the power to prevent the movement of cattle unless they have complied with these regulations, and what you are seeking is merely after you have used that power then to be able to permit the marketing for slaughter of the reactor animals. Isn't that correct?

DR. SIMMS: I believe the statement was made, Mr. Chairman, that we needed legislation in order that the Secretary could promulgate orders that would be practical,
MR. MOLLIN: But you do now have power to issue the regulation to prevent the movement of animals unless people comply with the program.

DR. SIMMS: According to the solicitor that is correct, I don’t think that would be a question of debate.

PRESIDENT KNAPP: I would like to make this statement, Mr. Mollin, with reference to that: If the Secretary passed that order, it would still prevent the interstate movement of reacting cattle whether the state was cooperating under the plan or not cooperating under the plan. That would be immaterial.

MR. RAY WILLOUGHBY: Mr. Chairman, I believe you asked a moment ago that the men on the panel might make a few observations. My name is Ray Willoughby, and I live in Texas. I represent Texas and the Southwestern Cattle Raisers Association. First I would like to qualify my presence here. I am new to you people, and 95 per cent of you are new to me or were new to me when I got here on Monday. I have met a lot of you, and I like you a lot, and I want to come back. Now, as I said, I wanted to qualify my presence here. Dr. Hendershott contacted me in the summer at my ranch in Alpine and asked me to come up for which I am very grateful, Dr. Hendershott.

I am not a scientist, and I am not a veterinarian. I am a ranchman. I have a paper here that will take me about two minutes that I would like to read that I think would clear up some of these things as far as the way people in Texas feel about this brucellosis question or any of these other questions. I hope there is no antagonism among you people here. I want to tell you just a little old story before we start. It has to do with a dog fancier from some of the eastern states that sent his female dog to a fox hunt up in Dr. Green’s State of West Virginia. It had long since been decided that no female dogs would be allowed in these fox hunts for obvious reasons, but unknown to this man he sent her on anyhow. After a lot of discussion it was finally decided that he would be allowed to enter this female dog in the fox chase. They had not been out just but a few moments when the fox was let loose. The hounds tore after him, and they were all out of sight in just a little while, and for a little while they could not even hear them barking.

Two of the enthusiastic riders in the lead spotted a farmhouse over on a hill. They rode over to the farmhouse and asked the farmer, “Did you see a fox chase go by here?” “Yep, I sure did,” he said. “Well, what progress were they making?” He said, “That is the funniest fox race I ever saw. I have lived here nigh onto fifteen years, and this is the first time I ever saw a race with the fox running third.”

All right, gentlemen, Mr. Chairman, and delegates, this is the first time I have attended a meeting of the U. S. Livestock Sanitary Association, and I am most surprised and flattered by the invitation to participate in the convention program as a member of this panel, and, since I am not familiar with your procedure and methods of working, I am at some disadvantage in trying to address these remarks to you. This Panel deals with Livestock Diseases and Regulations. As a livestock producer I am, of course, keenly interested in everything you do. You have given this Panel a double-barrelled subject to discuss, and I am frank to say that neither subject is exactly in my line. Regulations cover a multitude of, let us say not sins but necessary evils, and diseases are more properly a subject for veterinarians, but in putting me on this Panel for discussion I suppose your idea.
was to get a layman's viewpoint. This is all I have to give you. For technical treatment of this subject you are referred to the scientist and experts on regulations.

I always had an idea about animal diseases and the handling of them that may sound a bit crude. To my mind I think these diseases divide themselves into the two classes, those diseases not dangerous to human health and those that are dangerous to human well-being. Diseases that are not harmful present one problem, and that is economic. If an animal has a disease that does not constitute a menace to people, it is simply a matter of what is to be done. If that animal can be treated, then the owner will treat it, but, if the treatment costs more than the animal is worth, then the animal would be destroyed. Preventative measures for such diseases apply the same standard for a guide. Of course, if they are strictly animal diseases, infectious or contagious, and there are adequate facilities for preventing their spread, but at the same time the basic consideration is the economics involved. Foot and mouth disease is an example of this latter type. The disease is not dangerous to humans, but its economic effect cannot be exaggerated, and, of course, such diseases may indirectly affect human well-being by the effect they have on food supplies and diet. Black-leg is another example, because preventative measures against Black-Leg are so small that its application is a matter of annual routine in the cattle. The same condition applies to sore mouth in sheep.

The other type of diseases that constitute a menace to human health has all factors the first type has and much more. I am sure that you are more interested in this type. I am not well enough informed on the various diseases that come in this category to enable me to discuss them or even enumerate them. But I do know this type of disease is an enemy to our livestock industry and deserves serious consideration by every branch of the industry. Producers of livestock want to put healthy animals on the market for slaughter, animals that will be good for men, women, and children. No one wants to market livestock affected by a disease that is dangerous to mankind. But we do not always know the facts about such conditions.

Experience has shown that sometimes an apparently healthy animal has a disease of the type under discussion, and most often such fact can be discovered only by post-mortem examination. This does not happen often, but it does happen occasionally. Every precaution possible should be taken to prevent such an animal from reaching the channels of food trade. That again is in the province of the scientists. Year by year the dependence of the industry upon science becomes not greater but better known. Regulations—that is an awful word—encompass the concept of Federal, State, and municipal regulatory processes. Any one of those divisions alone would be a time-consuming subject. I don't like the word "regulation", gentlemen. It implies the thought that some agency or some phase of the Government makes a law for me to live under, and I am just old-fashioned enough to have pretty well-grounded ideas about how laws should be made by legislative bodies such as the Congress of the United States and our various State Legislatures, but life has gotten too complex, and it is too much to expect that our legislative bodies should spend a lot of time regulating all phases of industry.

Yet controls—and that is what regulations are—are necessary in almost all
types of industry. While it is absolutely necessary that regulatory powers must be delegated to Governmental agencies, yet it is a requisite that such delegated powers must be carefully used and used only when absolutely necessary. The history of the human race is full of examples of misuse of regulatory powers by Governmental agencies, and the surest way to destroy the power to regulate is to abuse that power, because the people will when subjected to such treatment find ways to rid themselves of such abuse.

I, a layman engaged in the business of producing livestock believe that while some regulations are necessary for economic and human consideration yet these regulations must always be based on good sound reason. A regulation that is basically economic must be founded on sound economics, and a regulation that goes beyond economics and is founded on human health must be firmly supported by scientific facts. Any regulation that is not so founded will soon be regarded a burdensome, unreasonable imposition, and would be more honored in the breach than by observance, and such a regulation will bring discredit to the regulatory agency that must enforce its provisions. Whenever science can prove to industry that a regulation is necessary for the well-being of the human race and that it is scientifically sound then industry will accept and support such regulation. But we in the industry do not like to be pushed around by an unreasonable regulation when science does not have the answers. The answers must be available.

It is all right for the scientists to use individual animals for experimentation, but the whole livestock industry should not be made an experimental field. They should think well before violating these principles. There is no fight between science and industry. Scientists are working for industry, and industry supports science, but in this as in everything else in the world the controlling influence must always be old-fashioned but often overlooked common sense. Thank you for listening, gentlemen. I say this in support of these gentlemen that just talked.

PRESIDENT KNAPP: Thank you, Mr. Willoughby. Anyone else care to be heard on this subject? Dr. Kuttler.

DR. KUTTLER: Mr. Chairman, I have just now come to appreciate a little slip of paper I found on my desk when I went to Washington, D. C. As I told you a while ago, I was born and reared in this country and spent most of my life here. Twenty years of it was in Texas. It seems like happy days are here again. While we were down there in Texas on the tick eradication project I heard a lot of speeches, similar to those we have just listened to.

As a member of the Brucellosis Committee I want to tell you that I sat up with the other members every night this week, and last night I could hardly go to sleep worrying about the difficulties we have had, in our efforts to adjust the recommendations so as to meet the demands of the majority. I was one of those that voted with the Committee. I believe the recommendations are sound so far as disease eradication is concerned. I want to say this about the Bureau's position. Judge Montague especially mentioned we Bureau Veterinarians. I am not going to speak
for the Bureau, as an organization since the Chief is here. However, I am going to
tell you how I understand my relationship with the livestock industry and the
officials of the various states. I understand that it is the duty of the Bureau to
render service in line with the projects that the livestock industry and the people
in the country want. I am glad that there are some here whom I have worked
with. I saw Dr. Fidler over here a while ago, and I recall very well on many
occasions we did not agree. I always told him what I thought, and then I said
this: We will go along with you regardless of whether your procedures are just
what we think ought to be followed as long as it looks like there is any chance to
do the job, and we have never been in any state where we didn't think they knew
enough to do this job.

I never gave up an idea or opinion simply because others do not agree with me.
However, I have never given any state official—and I will challenge anyone to
prove I have ever undertaken to force my ideas over. I think we should all under-
stand each other. Judge Montague has a notion that the Bureau men may wield
quite a little influence with the U. S. Livestock Sanitary Association. Now, we
are here with the idea of working with the different states. We hope we will be
able to work with the livestock industry of this country. The Bureau, as you
know, is 64 years old, and we have helped in many of the livestock eradication
projects; in fact, all of them that have been carried on.

But we don't try to impose our ideas on anyone. We give them the information
that we are able to accumulate, and we hope, of course, they will decide the way
that will give the best results. If they don't, we go along with them. The thing
I had in mind—Judge Montague had a notion we wield influence here—the facts
in the case are, we are not even allowed in the councils of the state officials during
some of their preliminary sessions.

There is one member of the Bureau that attends the executive session. We
don't go in and tell the members of the Association what to do, do we? You make
up your own mind and are not unduly influenced by the Bureau representative.
Gentlemen, I want to assure you as far as I can, we will go along with you, on any
decisions made by the Association, the Chief of the Bureau is here and can speak
for the Bureau.

JUDGE MONTAGUE: Have you any objection to substituting this motion?

DR. KUTTLER: Very, very definitely. I don't think it is worth a damn.

PRESIDENT KNAPP: Does anyone else wish to speak to this question?

MR. A. H. QUINN: What the hell are we arguing about? I don't know.

MR. DAVIDSON (Texas): I want to make a statement for my good old friend,
Dr. Kuttler, about our misgivings about Federal interference. We have over the
chief's signature a statement that they have already seen fit to construe their
solicitor's report as making it prohibitive to extend Federal aid to any state that
had not signed that memorandum, and since he has expressed himself and I have
great respect for the doctor, I don't think that was worth a damn.

PRESIDENT KNAPP: Thank you.

DR. KUTTLER: Do you have that letter, Mr. Davidson?

MR. DAVIDSON: I don't have it with me. You don't deny it?

DR. KUTTLER: There was no such statement made. We didn't make it to
anyone. We simply said in order to carry on the Brucellosis eradication project that it would be necessary for us to have some kind of a memorandum of understanding. We have not discontinued the work in the states where they haven't signed the agreement, and we don't propose to do it unless you want us to do it.

MR. DAVIDSON: In order that they might have the proper information I will be glad to supply this organization, and if Dr. Kuttler doesn't have a copy of this correspondence in his own files, I will be glad to furnish him with photostatic copies of it.

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Animal Industry
Local Office
503 U.S. Court House
Fort Worth 2, Texas

Mr. D. A. Davidson
Director
Livestock Sanitary Commission
2002 W. T. Waggoner Building
Fort Worth 2, Texas

Dear Mr. Davidson:

The paragraphs below are quoted from a letter received from the chief of the Bureau dated June 3 which is explanatory. It is thought you will be interested in this information:

"TO BUREAU VETERINARIANS IN CHARGE OF TUBERCULOSIS ERADICATION STATIONS:

"A large number of the memorandums of understanding which were submitted with Bureau letter ZW-217.52, dated April 1, 1948, have been completed and returned by cooperating State officials.

"Since this memorandum covers practices which will in the future govern the operation of the brucellosis eradication program, there is some question regarding Bureau authority to continue expenditure of funds for this purpose in those States where the memorandum has not been completed.

"As pointed out in the above-mentioned letter, it was not expected that all States would be vested with legal authority for, or that conditions in each State would permit, immediate compliance with all provisions as recommended by the United States Livestock Sanitary Association for brucellosis eradication.

"However, in the interest of regaining lost ground and making the greatest possible advance in eradication of brucellosis on a nation-wide basis, it is suggested that all States which agree in principle with the recommended policy complete the memorandums, even though exceptions to certain provisions must be taken at this time. In such instances, an attached statement in explanation of this situation will serve as ground for continuing Bureau support until full State compliance may be possible.

"Some of the objections already registered by certain States refer to the lack of both uniform regulations covering interstate shipments of livestock and the control of interstate shipments of Brucella vaccine and antigen. Progress has been slow in finding a solution to these problems; however, we do not give up when the going is tough, and we have received some encouragement recently."
“The Bureau feels that all interested agencies recognize the need for brucellosis eradication, and that a nation-wide attack based on uniform practices offers our only hope for achieving this purpose. The Bureau is anxious to cooperate with each State which is working toward this goal.

“If the memorandum of understanding has already been signed and forwarded, this letter is merely for your information.”

Very truly yours,
H. L. Darby
Inspector in Charge.

President Knapp: Thank you, Mr. Davidson. I would like to clarify this a little if you will permit the chair to speak. This resolution, as I read it, not only speaks relative to the Brucellosis Committee’s report but it also violates the Legislative Committee’s report and likewise the report of the Committee on Laws and Regulations. That is, it contains material that relates to three committees and not just one committee. Therefore, in your consideration of it you have got to give that consideration. This, as a matter of fact, would violate and make void the committee reports of not only the Brucellosis but Laws and Regulations and the Committee on Legislation.

So far as I know in some 28 years of experience with the Federal Government in cooperative livestock disease control work they have never instituted regulations for the control of livestock diseases in the states. That is entirely up to the state. They offer a plan; you take it or leave it. But your state laws and your state control officials formulate the regulations. That is involved in the first paragraph of this resolution. The second paragraph of the resolution deals with calves vaccinated, calves moving to destination when officially certified as vaccinated animals by the state veterinarian of the state of origin. That is fully covered in the same language, in the presently effective rule of this organization.

Now, in section three, of course, it deals with adult animals vaccinated for interstate movement. Paragraph numbered four, “No legislation should be requested or enacted by the Congress that would violate or authorize the Secretary of Agriculture to promulgate regulations and no regulations should be promulgated that are in conflict with the foregoing principles and practices as expressed herein.” A clear violation of the prerogatives of the Committee on Laws and Regulations. If this is a Brucellosis Committee substitute, then it should stay within the realm of brucellosis. I am going to call on the Panel in a minute or two if others of you have nothing to say.

Judge Montague: I am going to question the statement of the chair that it violates the prerogatives of these committees. This confines itself to the three principles and practices outlined in paragraphs one, two, and three and doesn’t affect and could not be so construed as affecting any of those.

President Knapp: That is a difference of opinion, of course.

Judge Montague: I am speaking of a fact. It confines itself to the three principles outlined in paragraphs one, two and three and could not in any way affect any other report.

President Knapp: It would most certainly affect them in my opinion.

Judge Montague: I beg to differ with your opinion. When the matter limits
itself to the application it could not be confused or construed as going beyond that. If the situation is developing here where the conflict is something you don’t want, it is a good thing to have a fight in any organization. It is a good thing; that is fine. But if it is developing itself to the position where it is a fight between the producers of livestock and a small group, a large group of people who work with and for the livestock people, they don’t want to forget the fact that they exist for the industry and not the industry existing for them.

**President Knapp:** My position is merely to clarify the thinking of the group so they may vote intelligently. Are you ready for the question, gentlemen?

... The question was called for ...

**Dr. Birch (Ithaca):** We have wandered quite a ways from our parliamentary procedure, I am afraid, and maybe some of us should get back again. There is a substitute motion before the house. The substitute motion, as I understand it, was offered by Judge Montague. If we vote yes on the motion that is before the house at the present time, that means that we are supporting the Judge’s substitution. If we vote no, it means that we are not supporting it and are going back to the committee report which was originally before the house. Is that correct?

**President Knapp:** That’s correct, Dr. Birch.

**Dr. Birch:** I would like to say one other thing before the vote comes. I would say as far as setting one group against the other, the dairy East against the beef-producing West, there is absolutely nothing of that kind in the thoughts of the committee, and anyone that attended the deliberations would know that that is the case. This is not a group decision. I agree perfectly as our friend over here has said, this is an industry proposition. It has been approached by the committee from that very standpoint. I don’t believe the Judge’s substitute motion is worth a damn, and I think we should vote against it.

**Secretary Hendershott:** Mr. Chairman, I am not going to speak on this matter at all only to say this: If this was the only thing that happened in coming to Denver, it has certainly been worth-while. I wish that I could enter this fight, but I don’t think I should. I have had more fun, downright eastern and western fun sitting here and listening to you fellows calling each other honest-to-God names than I have had in the last 12 years of attending these meetings. I only hope this continues. If there is anything that will bring the livestock producer, the livestock consumer, the regulatory officials together, it is a good healthy all-out argument. I don’t care if we ever have any Panel discussion if we can keep this up the rest of the afternoon.

I was a little bit alarmed when I wrote Mr. Mollin to get some questions ready for the Panel and he sent a questionnaire out to the American National Livestock people, their replies must have been good because he didn’t show them to me nor did he give me an opportunity to select some questions for which I am now thankful. Of course, he knew his group. All you need to do is drop a hat with the sign of Eastern State on it here in the lone star country and, brother, you start something. I appreciate very much particularly the remarks made by Ray Willoughby. Here again, I am happy that I came out here to meet some of these fine gentlemen. Of course, I knew Judge Montague from contacts with him down in Washington. It has been my privilege to know Mr. Messerschmidt for a long time. Others it has
been my good fortune to know. Many others I have met here for the first time. I like all of you. Now I am going to tell you what I think: I think Texas is all wet. I am afraid that when you fellows out here that are objecting to this thing have an opportunity to sit down and look it clearly in the face that you are going to find out that there isn't a damn thing in it that you would have objected to. It simply provides what they ask us to give them, and that was a uniform plan. I recall sitting in Washington in September, 1947 and being much chagrined to hear Judge Montague, Ferd Mollin, and Mr. Tomson who represented the Shorthorn Breeders Association intimate that we had no plan for control of brucellosis in this country. When at that time there was one state declared Brucellosis-free, there were 500 counties Brucellosis-free, I had either rightly or wrongly issued certificates of freedom of disease to over a thousand herds in my own state, and still they told us we had no plan.

As I told them at that time, I said, "If there is anything wrong with this program, it is that we have too many plans. There is a multiplicity of plans." Last year's Committee boiled these plans down and we offer them as a uniform plan of attack with sufficient latitude to be applicable to all conditions encountered in livestock farming. Now the stumbling block seems to be that number one paragraph. In my state, which is a heavy buying state we bring in something like one-sixth of our milking population every year. Obviously, anyone acquainted with disease control knows that the little old State of New Jersey is going to be on the tail end when the herds of country are freed from brucellosis. We cannot eradicate the disease in our State in advance of eradication in the other states. We like that number one paragraph, because it provides a means where, if some of my people in a little township down there want to engage in area work, they may do so. I might say beyond that that most everybody that is acquainted with disease control is imbued with the idea that, until you attack the disease from an area standpoint, you are not going to make real honest-to-goodness solid progress.

So, let's take a good healthy look at it. I do not think there is anything in here you need to be alarmed about. Certainly I have no idea that I want to force upon the beef breeders of this Nation the ideas of a little State like New Jersey. We are satisfied if you let us go our way and we like to see you go your way. I am just as much for those right, perhaps more so than those that proclaim themselves. Let's have a good fight, and let's take a good look at it, and whatever we do let's come back again. Let us see you fellows at our meetings from here on out. We need you. I hope you come back, and let us not get so far out on a limb in these arguments that we leave this place without being able to shake hands and say we are going to meet together next year and fight harder than ever for what we feel is to the best interests of the people we serve or represent.

Mr. Will J. Miller (Kansas): I was rather surprised to hear the name of Kansas as supporting the substitute report. We could not sign a thing like that although we try to be as helpful to the range states as we can in letting their livestock come in under a feeding and grazing permit in which we have not handicapped them in the past year or two. Then on behalf of our own people in our state we have a brucellosis plan, and we have lived under our rules and regulations for the past three years. I don't see how we can make any changes in that, and, as I was
talking with one of our commissioners, we have a board of commissioners, and
Mr. Brock was just telling me a little bit ago that the board certainly would not
want to change their plans as far as the dairy and the purebred cattle are concerned.
So, I don't believe you could consider us strictly a range state, because we have a
lot of purebred cattle and dairy cattle, and we certainly think our regulations are
very satisfactory. We also signed the new Brucellosis Memorandum of Agree-
ment with the Bureau of Animal Industry in Washington which we signed a month
and a half or two months ago. I feel very friendly to all my friends in the range
states, and I hope they will see the position of Kansas.

PRESIDENT KNAPP: Thank you, Bill. Anybody else wish to speak on the ques-
tion? Are you ready for the question?

PRESIDENT KNAPP: If you vote in the affirmative, you vote for the substitute
motion made by Judge Montague. If you vote in the negative, you vote against
it. All in favor of the substitute motion say "aye". (ayes) Contrary, "no".
(noes) The noes seem to have it. The question reverts to the original motion
made by the Vice Chairman of the Committee. Are you ready for the question?

PRESIDENT KNAPP: All in favor of submitting the report to the Executive
Board say "aye". (ayes) Contrary? (noes) The motion is carried.
Greetings from the National Association of Commissioners, Secretaries and Directors of Agriculture.

In my talk I would like to present to you the resolutions of National Association of Commissioners, Secretaries and Directors of Agriculture.

Before I present these resolutions, let me say to you that our group very much appreciated the advice and counsel at our last two meetings of a number of members of your association, who serving as livestock sanitary officials and state veterinarians have attended and contributed materially to the annual meetings of the National Association of Commissioners, Secretaries and Directors of Agriculture. We are always glad to welcome representatives of your group to our meetings and I am sure that our mutual understanding of livestock problems will materially help us in the various states. The discovery of the scientist and the practical observation of the layman and the breeder, will combine to better control and eliminate disease among the livestock of our nation.

Prior to our recent meeting at Portland, Oregon, I wrote our various State Commissioners, Secretaries and Directors of Agriculture relative to problems of livestock and poultry production in their several states and some of these letters were answered by the head of the Department of Agriculture of the particular states. In others, the letter was given to the State Veterinarian or Livestock Sanitary Official, and, like all letters or questionnaires, some were not answered at all.

In the answers I received, Bangs disease or brucellosis was listed by 30 states as the big problem in the management of dairy cattle herds and 27 listed this disease as of top importance in problems confronting the producer of beef cattle. 16 gave mastitis a top ranking in the dairy field. 19 reported cholera as of top importance in swine production. 21 states listed Newcastle disease as a top problem in poultry production and 16 classed pullorum disease as a serious handicap in the growing of poultry.

Other diseases were mentioned,—many of them already ably covered by papers and discussions at this meeting. I have mentioned these few, however, to help stress my point as to the importance of research, diagnosis and of laws and regulations to help our people control and eliminate contagious and infectious diseases.

Our Association of Commissioners, Secretaries and Directors of Agriculture passed the following resolutions and we submit them to your group.

RESOLUTION 1

"Be it resolved, that the National Association of Commissioners, Secretaries and Directors of Agriculture request the Congress of the United States to amend
the Livestock Disease Control Laws which will permit the Secretary of the United States Department of Agriculture to promulgate rules and regulations making an official interstate health certificate a prerequisite to the interstate movement of livestock by trucks, and be it further resolved, that the Secretary of the United States Department of Agriculture be requested, as soon as such authority has been given him by Congress of the United States to amend Regulation No. 7, Bureau of Animal Industry, Order No. 309, revised, pertaining to the interstate movement of cattle regarding tuberculosis to include similar and appropriate restrictions covering bovine brucellosis."

Movement of livestock by truck has in many regions largely replaced the railroad method of shipment. It is practically impossible to patrol the many roads entering the states. Hence, a considerable number of livestock thus make entry into the states. Too many times these cattle are known to be infected with brucellosis. Dr. Simms, Chief of the Bureau, tells us that he has no authority to control this interstate movement as does the federal government in the case of movement by railroad. We have asked Congress to give this authority and when granted we would advise adding of cattle infected with brucellosis to the regulation governing the interstate movement of cattle which have reacted to the tuberculin test.

**RESOLUTION 2**

*Adult Vaccination*

"Be it resolved by the National Association of Commissioners, Secretaries and Directors of Agriculture that we urge the Bureau of Animal Industry to immediately pursue a program to ascertain the feasibility of adult vaccination for the control of brucellosis."

This resolution may seem rather broad in nature. However, it was prompted by repeated demands of cattle owners and of regulatory officials for more information relative to the use of Brucella M. or Huddlestons vaccine, developed and used experimentally in Michigan. The cost of adequate research on these so-called new vaccines or treatments is a mere drop in the bucket when we compare it with the yearly cost of this disease to livestock or to the human population of our nation.

**RESOLUTION 3**

*Sale of Vaccine, et cetera*

"Be it resolved that the National Association of Commissioners, Secretaries and Directors of Agriculture request the Congress of the United States to amend the Livestock Control Laws, which will permit the Secretary of the United States Department of Agriculture to promulgate laws and regulations requiring manufacturers and distributors of serums, vaccines, viruses, toxins, to render concurrent reports to the Chief Livestock Sanitary Official of the state of destination covering all sales and distribution of the products containing live disease producing organisms such as Swine Erysipelas, Ovine Ecthyma, Laryngotracheitis, Fowl Pox, Hog Cholera, Newcastle Disease, and Anthrax Vaccines, all products made from Brucella organisms, Tuberculin, Mallein and such diagnostic agents as enter into the control of these diseases."
Original laws controlling these products, passed many years ago dealt with their manufacture and preparation. Today, State Regulatory Officials are continuously baffled by indiscriminate shipment of some of these products,—some live virus,—to outlets or users who, by carelessness, may spread disease or cause other handicaps in the livestock disease control program. We believe State Regulatory Officials should be advised of such shipments so that they would be better able to cope with conditions that may arise through the use of these products.

RESOLUTION 4

Brucellosis Control

Whereas, brucellosis constitutes one of the widely disseminated diseases of bovine animals, and

Whereas, substantial efforts have been made by the U. S. Department of Agriculture, Bureau of Animal Industry, to control this disease looking toward its eventual eradication, and

Whereas, the Brucellosis Committee has, on behalf of the United States Livestock Sanitary Association recommended a program for brucellosis control and eradication,

Now, therefore, be it resolved, by the National Association of Commissioners, Secretaries and Directors of Agriculture that it commend the efforts which have thus far been made by the U. S. Department of Agriculture, Bureau of Animal Industry, and of the Brucellosis Committee of the United States Livestock Sanitary Association, and

Be it further resolved, that this Association recommend continued studies by the U. S. Bureau of Animal Industry and the U. S. Livestock Sanitary Association for the purposes of developing the most effective and practical methods and programs of controlling brucellosis having as an ultimate objective eradication of this disease.

"We as a group are very appreciative for the advancement already accomplished in the control of this disease. We hope that no one is encouraged by this progress however, to try to live with the disease, but rather work to the end that brucellosis be eliminated.

We were heartily in accord with the present 4 plans of control now recommended by the Bureau's programs which I believe are in progress in one form or another, in most of our states.

It seemed to be the feeling of many of our group, however, that this plan should be on a voluntary basis until a sound educational program could thoroughly sell the merits of the program to both the cattle owners and to the practicing veterinarian.

RESOLUTION 5

Interstate Movement of Livestock

Whereas, the control of livestock diseases is one of the most serious problems confronting the livestock industry today, and

Whereas, proper regulation of the interstate movement of livestock is one of the most important factors in controlling livestock diseases, and
Whereas, there is a wide variation in regulations covering the interstate movement of livestock among the various states, and

Whereas, uniform regulations between states are very desirable and would assist in disease control and,

Whereas, it is very difficult to secure uniform regulations among the states on a nation wide basis or even among regional groups of states, due to the differences in local conditions,

Now, therefore, be it resolved, that the National Association of Commissioners, Secretaries and Directors of Agriculture recommends that each state endeavor to work out, with its adjoining neighboring states, uniform regulations covering the interstate movement of livestock.

We, as a group are interested in uniform regulations covering interstate movement of livestock. We, however, realize the regional differences of the various sections of our nation and for that reason we recommend that states with the same type of agriculture or problems attempt to agree on such laws and regulations. — I believe many of us have or are working out such a program.

All of us that are connected in any way with the regulatory field are vitally interested in the reliability of the health certificate. I have bought, sold, shown and imported livestock and I am sorry to say that there are too many folks trying to "get by". Maybe that is one of the reasons for so many different state regulations.

These papers that accompany livestock across state lines are mighty important pieces of paper. I hope we will all realize their value as a certificate of health for the animal and a testimony of honor for the veterinarian whose name is signed thereto.
REPORT OF THE COMMITTEE ON LAWS AND REGULATIONS

I. G. Howe, Albany, New York, Chairman; T. O. Brandenburg, Bismarck, North Dakota; C. P. Bishop, Harrisburg, Pennsylvania; W. J. Butler, Helena, Montana; A. K. Carr, Sacramento, California; L. J. Faulhaber, Raleigh, North Carolina; T. C. Green, Charleston, West Virginia; L. A. Izquierdo, San Juan, Puerto Rico; J. V. Knapp, Tallahassee, Florida; Harry Linn, Des Moines, Iowa; F. E. Mollin, Denver, Colorado; Ray V. Swanson, Pocatello, Idaho.

Your committee on Laws and Regulations wishes to point out that there are still several states that have not either seen fit or have been unable to adopt the uniform laws and regulations as recommended by this Association at the Chicago meeting in December 1944. Due to the variations in the type of livestock industry in different sections of the country this is quite understandable. We do not believe that any state fails to recognize the value of uniformity in regulating the interstate movement of livestock.

After due consideration of the health and economics of livestock production and movement of the same, your committee submits for your consideration the following:

1. We recognize the economic importance of the community livestock auction market, and also recognize such markets as an important factor in the dissemination of infectious and contagious diseases of livestock and poultry, therefore all states should proceed to enact laws and promulgate regulations, the proper enforcement of which, will minimize the danger of spread of communicable diseases among livestock and poultry.

2. It is noted that some states require a special permit as a prerequisite to entrance of livestock into their states in addition to properly approved health certificates. This, in many cases, offers what seems to be an unnecessary barrier to the movement of qualified livestock and your committee believes that such a requirement should be removed.

3. That the Bureau of Animal Industry, U. S. Dept. of Agriculture, amend B.A.I. Order No. 379, Section 92.20 governing the importation of cattle into the United States to the end that the federal regulations be comparable to state regulations governing the interstate movement of livestock and poultry.
REPORT OF THE COMMITTEE ON PUBLIC RELATIONS

R. W. Smith, Concord, New Hampshire, Chairman; William Knox, Fort Atkinson, Wisconsin; Charles Hughes, Des Moines, Iowa.

Mr. President and gentlemen, you will recall that this committee is a new committee in our Association. It is one that I think we have needed for a long while, and it is a committee that I do not qualify for only in perhaps one particular way. Being a new committee no plans were made until Wednesday morning when two gentlemen who were serving with me, Mr. Knox and Mr. Hughes met with our President and our Secretary and outlined the work that we would do. The boys are taking all of these papers and breaking them up into what would be good publicity and good reading matter for the public and what has not been already given to the local papers, even though that is what we intend to send out to all the farm papers and journals, they will use that sort of material.

I merely looked some of them over. I want you to get it right straight: that they are doing all the work, and up to the present time Mr. Knox tells me that Mr. Hughes has done all the work, but in doing that I want you to know that we have kept Mr. Knox very busy on the Committee on Brucellosis, and after yesterday I don't have to repeat that to you. You know what is going on. He was Secretary of the Committee, and he got the report printed, and he sat up until midnight every night with us and so forth and so on.

I think that we can do a lot more with this committee in another year. We will find out as we go along where we can improve it and how it goes over and how hungry these papers are for such material and review the year's work and get the comments and another year be on the job. There is no doubt an organization of his size and importance the United States Livestock Sanitary Association, should have a very, very strong public relations committee, and I am simply taking the honor of coming up here and reporting for the work that my two colleagues are doing. I thank you.
Resolved by the United States Livestock Sanitary Association in its 52nd annual meeting assembled at Denver, Colorado, October 15, 1948:

1. That we extend our thanks and appreciation to the good service rendered our Association throughout this meeting by the management and employees of the Shirley-Savoy Hotel and the many courtesies shown our members.

2. That we commend our fellow member, Dr. R. M. Gow, for the excellent local arrangements for this meeting and for the many kindnesses he has shown all in attendance who have gone to him for information, city transportation or anything else in which he could serve their convenience or enjoyment of the meeting.

3. That we extend our thanks to Mr. R. M. Paxton, president of the Denver Union Stockyards Company, and to Mr. Val Blakely, president of the Denver Livestock Exchange, and the organizations they represent for the splendid dinner tendered those of our members who arrived in the city Tuesday. It was a friendly gesture by organizations whose cooperation with our members in livestock disease control is important and deeply appreciated.

4. That we extend to Lic Oscar Flores, Assistant Secretary of Agriculture of the Republic of Mexico, and to General Harry H. Johnson, Assistant Secretary, United States Department of Agriculture, assurance of our appreciation of the courtesy shown us by themselves and their associates, including Dr. Leandro Lujan, Mr. Lauro Ontejo and Mr. Francisco Tovar, in attending this meeting. Also, that we are grateful for their valuable contributions to our program and for the information they have supplied individuals at every opportunity and, further, we wish them to know that our Association is solidly behind them in their difficult task of eradicating Foot-and-Mouth disease from the Republic of Mexico and pledges its support in any and every way that it can be helpful.

5. That we reiterate our resolution of last year that in our opinion a fence along the whole Mexican-United States border is essential to the protection of the livestock industry not only because of the present outbreak of Foot-and-Mouth disease in Mexico but as an aid in the maintenance of the tick fever quarantine now and in the years to come and any future animal quarantine that may be desirable for any infectious disease that may threaten to cross the border. We regard the construction of an animal-proof fence as not only an essential protection to our livestock industry and the national food supply but as a sound investment economically in improving the effectiveness and reducing the cost of present and future animal quarantines on the Border.

6. That the Secretary of the United States Department of Agriculture be urgently requested to allocate funds, to the Bureau of Animal Industry or other appropriate agency, to establish a division of animal vital statistics; since far more and better information on this subject is essential to both Federal and State animal disease control, prevention, and eradication forces for the most effective and economical
operation. And, further, if Congressional action is necessary to make funds for this purpose available, that the Secretary be and hereby is petitioned to intercede with the Congress to that end.

7. That the Bureau of Animal Industry, United States Department of Agriculture be commended for the efficient operation of the Foot-and-Mouth disease patrol on the United States-Mexican border. And, further, that no relaxation be permitted in the border patrol or in other measures presently taken by the Bureau for the protection of the livestock industry from animal disease introduced through sea or airborne traffic. It is, also, urged that no measures be taken by any State government that will handicap the livestock sanitary authority of any state preparing for the early detection and prompt suppression of any outbreak within our borders of any disease not now endemic in the United States.

8. That the Secretary of the United States Department of Agriculture be and hereby is petitioned to modify the regulations controlling the importation of cattle of the dairy breeds and other cattle imported for dairy purposes, in such a manner as to provide that cattle imported from the Dominion of Canada shall be identified as originating only from herds officially certified as tuberculosis free or from a qualified negative herd in a modified tuberculosis free accredited area.

9. That the Secretary of the United States Department of Agriculture be urged to promulgate regulations prohibiting the interstate movement of dairy cattle, purebred cattle and other cattle being moved interstate for breeding purposes, except such cattle as are free from brucellosis as determined by a negative reaction to the agglutination test made within thirty days prior to shipment. And, further, to provide that cattle vaccinated against brucellosis may be moved interstate where the importation of such animals will not conflict with the laws or regulations of the state of destination. If Congressional authorization is necessary for the promulgation of the foregoing regulations, the Secretary is hereby petitioned to intercede with the Congress for the purpose of obtaining such authority.

SWAN ISLAND

10. WHEREAS, the establishment of a quarantine station on Swan Island in the Caribbean Sea was promoted by the Bureau of Animal Industry before the outbreak of foot-and-mouth disease in Mexico, and for the express purpose of providing a means for interchange of breeding animals between the American countries at the least possible risk of spreading contagious or infectious diseases; but

WHEREAS, the importation of vaccinated bulls from Brazil into Mexico brought foot-and-mouth disease to that country, despite the quarantine period of almost six months on Sacrificios Island in the Harbor of Vera Cruz; therefore be it

RESOLVED, by the United States Livestock Sanitary Association in convention at Denver, Colorado on October 15, 1948 that we urge the Bureau of Animal Industry to forego the plan of establishing this quarantine station now almost ready for operation.

In view of the circumstances cited above, this nation with its tremendous livestock population cannot afford to run the risk of importing breeding cattle from any country where foot-and-mouth disease exists, even though held at such a quarantine point for a period that would be workable and practicable in the operation thereof.
11. That we protest proposal now advocated by certain sections of the poultry processing industry to have poultry graded and the stamp of the U. S. Department of Agriculture affixed without a postmortem inspection of such poultry or any determination of the health of the birds or of the wholesomeness of the carcass for food. Our protest is based upon the hazard to the public health such inspected poultry will constitute and, also, upon the fact that the housewife will be misled into believing that poultry bearing the stamp of the U. S. D. A. is a wholesome product and fit food for her family, whereas the grade stamp has no such implication. We further insist the stamp of the U. S. D. A. should never be placed upon a food product that may turn out to be unwholesome, and we urge the Secretary of the U. S. Department of Agriculture to prohibit any such prostitution of its honored stamps on a food product.

DR. H. F. WILKINS: Mr. Chairman I move that these resolutions be accepted and referred to the executive committee.

DR. KNAPP: Gentlemen you have heard the motion to refer resolutions 1 through 11 to the Executive Committee. Is there a second . . . The motion was seconded.

DR. KNAPP: Is there any discussion?

DR. D. M. CAMPBELL: I would ask that resolution number 10 be considered separately.

PRESIDENT KNAPP: Would you care to amend your motion to consider resolution number 10 with reference to the Swan Island Quarantine Station as a separate resolution?

DR. WILKINS: Yes.

PRESIDENT KNAPP: The motion is that all resolutions except number 10 be referred to the Executive Committee for their consideration. All in favor of that motion say "aye". (ayes) Contrary? (no response) The motion is carried and so ordered. What is your pleasure now with regard to resolution number 10?

DR. D. M. CAMPBELL: I move it be rejected.

DR. R. W. SMITH: I would request that it be reread.

PRESIDENT KNAPP: You have heard the motion and request. There is no second.

DR. D. M. CAMPBELL: Mr. President, you will note that Public Law Number 522 does not provide for cattle from countries where foot and mouth disease and/or rinderpest are endemic shall be admitted to the United States. That is to the discretion of the Secretary of Agriculture. First I will speak to the question of the competency of the motion. Resolutions are read here to be received and referred to the Executive Committee or to be rejected. We have received nine of them. I believe we should reject the tenth. The Constitution and Bylaws contemplate that
action. I regard the resolution as a direct slap at the competence of our research personnel.

In the first place, the Secretary of Agriculture must be assumed to have sufficient judgment to act upon the recommendation of his technical advisors in that matter. If they, and that means the officials of the B. A. I., feel an inability to prevent foot and mouth disease on an island far off our coast from invading the mainland let them tell the Secretary so, and, of course bringing it to the island will not be permitted. It is a reflection on the competence of the Bureau to assume that only the Congress has the wisdom to decide a matter of this kind.

Foot and mouth disease has been investigated in laboratories in various parts of the world, and there is no record that the infection has escaped from those laboratories. We have been deluged with hysteria ever since foot-and-mouth disease appeared in Mexico. Only hysteria could proclaim that our research personnel cannot handle this disease without letting it get away from them. I think the resolution is unnecessary and mischievous.

PRESIDENT KNAPP: Does anyone else wish to say anything else on this question? I am sure that this Association will not wish to do anything that is not in accord with the Bureau’s wishes with reference to this matter, and we have all confidence in them. I was not advised that the Secretary had any jurisdiction perhaps or could use his discretion in permitting or denying cattle coming to Swan Island if they meet the regulations. I may be in error.

DR. D. M. CAMPBELL: May I comment on that subject? When this public law was before the Congress the livestock industry, the Bureau and anyone else who wanted to be heard were given an opportunity to be heard. At that time, it was the recommendation of the Bureau of Animal Industry, that this Swan Island Quarantine Station be established for the identical purpose of permitting animals, from countries having foot-and-mouth disease and rinderpest, to come there under quarantine. The quarantine station would be of no use if the law were amended as this resolution provides. It would defeat the whole purpose of the law as it now stands and of the quarantine station. Animals have come into this country from countries where both foot-and-mouth disease and rinderpest were and are rampant on at least nine known occasions and no one knows how many unknown occasions. The Brazilian bulls would be in this country right now if they hadn’t exhibited the disease before they got across the border. The real question is, shall they come through Swan Island quarantine in broad day light under every possible safeguard, or shall they cross the border surreptitiously in the dark of the moon. The Rio Grande del Norte is long and lonely. Our present patrol there is not permanent, normally it is not guarded even by a fence on stretches of hundreds of miles.

PRESIDENT KNAPP: Anyone else, gentlemen, before we put the question?

DR. B. T. STIMMS: Dr. Campbell’s statement concerning the attitude of the Bureau and of the livestock industry is borne out by the record. Swan Island was established for the specific purpose of allowing us to introduce into this country, and into other countries of North and Central America, livestock from those areas from which importations are now prohibited because of the presence of infectious and contagious diseases. You might be interested to know that the movement for the establishment of Swan Island Quarantine Station was begun before the present outbreak of foot and mouth disease in Mexico.
RESOLUTIONS

We knew the pressure was very high and was increasing in height right along, to bring in animals from countries in which foot and mouth disease and rinderpest exist. The Swan Island Station has been developed to keep foot and mouth disease out of those areas in the Western Hemisphere where the disease does not exist. The financial rewards for the introduction of such animals would be so great that sooner or later it is very probable that these diseases would be brought in through either violation of treaties that were already in existence or through, as you might say, more or less negligence of rules and regulations of the country concerned, it is no wonder this was desired. We had evidence in Washington that animals were being brought to the North American Continent from countries in which foot and mouth disease existed, and we felt that because of the profit motive concerned this would continue to happen.

Swan Island was established then with the idea that it would allow safe control of animals which were being brought to the North American Continent. That has been our idea and still is. This would be an international quarantine station to be used not only by the U. S. but also by Mexico and the Central American countries. We will have complete charge of it, and it will not be thrown open for introduction of animals from any and every place regardless of their condition at the time of shipment. Before animals are brought to Swan Island it will be required that a permit be issued. That means before they are loaded. If, for instance, somebody in England or Brazil wants to introduce animals into Mexico or the United States through Swan Island, a permit for the use of the quarantine station will be issued before the animals are ever loaded. The conditions in the country of origin will be investigated and it will be determined, whether these animals have been exposed to these exotic diseases before the permit issues.

Then, of course, the usual quarantine measures will be followed when they are on Swan Island, and, if they are coming into this country after they have passed through the quarantine on Swan Island, they will still be required to come in in the usual manner as foreign animals, in other words, come to our quarantine station here. They won't simply come off Swan Island into New Orleans and be driven to a farm or plantation but will come to the quarantine station and undergo the same quarantine that animals now undergo coming from Ireland, New Zealand, and Australia. We believe we have established procedures which will protect our livestock, and we believe that, unless some such procedures are established, we will continue to have animals brought to the North American Continent from dangerous areas and brought in without proper precautions. So, we feel that this is a step to protect our livestock industry rather than to endanger it. Thank you.

PRESIDENT KNAPP: Thank you very much, Dr. Simms, for your clarification of this rather confused situation. The Chair did not have all of this information as perhaps some of you. Are you ready for the question? For the benefit of those who came in late perhaps we should read this resolution again. The motion is to reject this resolution number 10.

. . . Dr. Wilkins presented resolution number ten . . .

PRESIDENT KNAPP: The motion is to reject this resolution. All in favor of the motion say “aye”. (ayes) Contrary the same. (no response) The motion is carried, and the resolution is rejected.
DR. SMITH: I wasn't aware that Dr. Kord had left, but we didn't have any meeting. We did talk things over, and we had thought that there were some things that would come in in the Executive Committee that we would have to take action on. I have been on the committee for sometime, as you know, chairman for one or two years, and we have made several recommendations; some of them have been forgotten. But there are things that come up here, and, as a matter of fact, the Executive Committee has referred the matter of policy to the incoming Committee on Policy. While we have no further report to make I do want to say this: that this committee should be strengthened and that it should take a very active part in formulating the policies of this Association. Now, that doesn't mean that the three or five men that are appointed should formulate the policies. It means that it should function like all other committees that, should any controversial question or change of policy of this Association come before the Committee and so on, they should hear all the facts and gather all the information for the Association.

There was an illustration right here this morning. I did not object to that resolution being killed, but I did want to know what it was all about, because I was ignorant and inasmuch as it was explained clearly, that is another picture. So, I hope just because we haven't any report that the incoming President will see to it that a good strong Committee on Policy will be appointed for the next year. It is true that some years they won't have anything to report to you, but they must be there, they must be alive so that, if there is a suggested change in policy either for the good or for the detriment of the organization, that they will be on the job to get the information and make a report.
THE PRESENT STATUS OF THE UNITED STATES PUBLIC HEALTH SERVICE IN RELATION TO THE NATIONAL PROGRAM FOR THE CONTROL OF RABIES

Veterinary Public Health Division, Communicable Disease Center, U. S. Public Health Service

During the past several years the incidence of rabies in this country has increased at an alarmingly persistent rate. The implications of this terrifying disease to the public health, agricultural economy and wildlife conservation are manifest. In 1946 thirty thousand persons were required to take the long and often painful series of vaccine inoculations as a result of exposure to rabies or suspect dogs. The cost to the country each year for human vaccine treatments and livestock losses exceeds five million dollars.

Surveys of present rabies control activities throughout the nation on state and local levels have indicated an overall lack of uniformity which has minimized the effectiveness of individual control activities. Many communities in the country have demonstrated very effective rabies control programs; it has also been shown that neighboring communities have ineffective programs or none at all. This lack of coordination often causes epidemics to be reintroduced into rabies-free areas. Where one State employs one type of control program, the State to the north of it employs another which conflicts with the strategy and tactics of its neighbor, while the State to the west may have no planned program at all. The hard fact that confronts us in the face of this situation is that the rabid animal respects no county lines, no state lines, but is driven by pathological impulse to roam for miles and causes the spread of an epidemic from one area into another.

The Subcommittee on Rabies, National Research Council in 1945 and the National Conference on Rabies in 1947 unanimously agreed that nation-wide uniformity of control procedures will be necessary for the eradication of rabies from the country, and that this can be achieved only if a properly authorized national agency assumes the responsibility of coordinating rabies control activities.

On the basis of this agreement it was recommended that the federal government participate in means for the control of rabies through cooperation with the states contributing funds and personnel.

It has therefore been proposed that a federal rabies control commission be formed which will be composed of members of (1) Public Health Service, Federal Security Agency, (2) Bureau of Animal Industry, U. S. Department of Agriculture, and (3) Fish and Wildlife Service, U. S. Department of the Interior.

It has been further proposed that this inter-agency commission draw a pattern of uniform control methods based on scientific information for adoption and action by the States. Thus the commission through its component agencies can (1) distribute to the states the latest accepted diagnostic techniques; (2) institute an accurate system of reporting; (3) keep local control authorities posted on the most effective immunization techniques; (4) draw up model licensing and dog control ordinances;

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and (5) prepare and distribute educational material to insure wholehearted cooperation by the general public.

The U. S. Public Health Service has embarked on a functional plan for participating in the national control program. The various activities, services, funds and personnel of the Public Health Service which will be made available for this program are outlined as follows:

Serving as the nerve center for rabies control activities is the Rabies Control Branch, Veterinary Public Health Division, Communicable Disease Center. This Branch is now active in investigations directed toward all aspects of the control of rabies. These include the improvement and standardization of laboratory diagnostic techniques, the training of State and local public health laboratory personnel through organized practical short courses, the study of the immunology and pathology of the disease, the testing and improvement of new experimental vaccines for animal immunization, the preparation and distribution of educational material, the epidemiological evaluation of reservoirs of infection, the operation of field demonstration control projects, the furnishing of epidemic aid and the rendering of consultation services for the development of permanent and long-range rabies control programs at the State and local level.

Those aspects of rabies and its control which relate to the human disease are being studied in the Institute of Microbiology, National Institutes of Health. Here basic information is being sought through research of the disease in man. Another important activity at the Institute is the routine potency testing, improvement and establishment of minimum requirements for rabies biologics production.

One of the most vital functions of the Veterinary Public Health Division is the assignment of qualified public health veterinarians to State health departments throughout the country. These Public Health Service veterinary officers are responsible for the organization and development of sound control programs in the States to which they are assigned. There they establish the extent and limits of the problem and set into motion the mechanism of control according to the results of their surveys. Many State health departments employ full time public health veterinarians who cooperate with the U. S. Public Health Service. These men, whether State employed or federally assigned, are the keystones in the fight against rabies. Through the offices of the Rabies Control Branch and Veterinary Public Health Division they report the progress of their respective programs, learn of the problems and activities of other State programs and obtain latest information on the technical and administrative aspects of effective control procedures. Most important of all, they serve as liaison officers between the private practicing veterinarians of the State and enlist the active support of practitioners in local control programs.

One of the three primary resolutions adopted by the National Rabies Conference held in Philadelphia in 1947 was "that rabies in animals should be made a reportable disease and the information be properly analyzed and distributed to all the States". On the heels of this resolution, arrangements were made by the U. S. Public Health Service to print information concerning incidence of rabies in animals, as well as in man, in the Public Health Reports which is published by the Division of Public Health Methods and circulates among all the disease control agencies in the country. State health departments were asked to include rabies in animals in their
weekly telegraphic reports to this Division. This important statistical information is now compiled and distributed to all the States so that each will have a week by week picture of the extent and movement of the infection in neighboring and other states.

An important phase in the national control program will be the inauguration of educational campaigns to insure the effectiveness of local operations. The professional public health educators of the U. S. Public Health Service will be available for consultation in the highly specialized activity of organizing community interest.

The Public Health Service has recognized the great need for educational material in rabies control activities. The Production Division in cooperation with the Rabies Control Branch of the Communicable Disease Center is engaged in the production of audio-visual media for disseminating information in rabies control methods. Two sound filmstrips, "The Fight Against Rabies" and "The Laboratory Diagnosis of Rabies" have been released thus far during the past year and copies of each have been enjoying wide distribution throughout the country where they have proven valuable adjuncts in local control campaigns. The first filmstrip is serving as an excellent orientation tool for health department workers as well as an effective mass educational device for the layman. The second filmstrip is being used as a training aid for public health laboratory workers in bringing to them visual demonstrations of the most efficient and practical techniques in the laboratory diagnosis of rabies.

Throughout the country, Public Health Service District Offices are available for consultation in rabies and in other disease control problems. District Office staffs can serve to stimulate reporting, encourage control activities and assist in their coordination within the districts. For states which require financial aid in the development of rabies control programs, grants-in-aid funds are available from the Public Health Service under Title VI for the operation of general health programs. These grants to the states are administered by the District Offices.

At the end of the war the Armed Forces requested that the Public Health Service include animal rabies provisions in their quarantine regulations. These regulations, now in effect, are administered by the Foreign Quarantine Division and require that all animal pets coming from countries where rabies is known to exist, be vaccinated not more than six months prior to debarkation at the Port of Entry.

The eventual eradication of rabies from the United States is not an unobtainable goal. Its achievement can and will mark one of man's great victories over a dreaded scourge. It is felt that the integration of the services outlined above with those of the Bureau of Animal Industry and Fish and Wildlife Service in a unified national rabies control program will provide the modus operandi to reach this goal.
THE PRESENT STATUS OF THE BUREAU OF ANIMAL INDUSTRY IN RELATION TO THE NATIONAL PROGRAM FOR THE CONTROL OF RABIES

H. W. Schoening, V.M.D.¹

Through various acts of Congress starting with the establishment of the Bureau of Animal Industry in 1884, the Bureau has been charged with the responsibility for the control and eradication of diseases of livestock. As the work of the Bureau increased over the years, additional legislation was enacted from time to time giving it authority to perform the work delegated to it. In these various acts and laws, the term "livestock" is used. The Bureau in its regulatory activities has in the past confined itself to the diseases of horses, cattle, sheep, swine, goats, and poultry. In more recent legislation the term "poultry" was included in some of the acts.

Since rabies is a disease of livestock, research work and diagnostic work have been done on this problem under the Bureau's appropriations. Since the disease is mainly propagated by dogs, the research work included studies on vaccination of dogs and its efficacy in controlling rabies in dogs and thus reducing the hazard of the disease in livestock. In recent years, attention has been given to the control of rabies on a national basis, and the part that the Bureau of Animal Industry might play in such a control program has been the subject of study. In order to determine the Bureau's authority to engage in a control program of rabies in dogs, the Solicitor of the Department was asked to review the various acts under which the Bureau of Animal Industry operates and to render an opinion as to whether the Bureau had authority under the present laws to engage in a control and eradication program of rabies in dogs.

This matter was examined by the Solicitor of the Department, and he has ruled that the present laws under which the Bureau operates do not permit the Bureau to engage in the control and eradication of rabies among dogs, since the laws mention only livestock and poultry, and he has ruled that dogs cannot be construed as livestock, and that for the Bureau to participate in the national control program it would be necessary that new legislation be enacted.

Several bills pertaining to the enactment of legislation which would permit the Bureau to engage in a rabies control program among dogs have been introduced in Congress. None of the bills introduced have been reported out of committees. The latest bill, which was introduced in the last session of Congress (80th), was referred to a subcommittee. This subcommittee had planned to take up the bill for consideration, but owing to the pressure of other work it could not be considered. Since the bill introduced in the 80th Congress was not acted upon, the matter became inactive at the close of the final session of that Congress. New legislation, therefore, will be necessary and will have to be introduced at the next (81st) Congress, which convenes after January 1, 1949. There are two ways of introducing legislation—one is through the Department itself; the other is through some organi-

¹ Chief, Pathological Division, Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture, Washington, D. C.
zation or person. The veterinary profession in general and the State livestock sanitary authorities in particular are vitally interested in a program that will bring about the control of rabies in the United States.

On April 9, 1947, the chairman of the special committee on rabies of the American Veterinary Medical Association called a meeting of representatives from various scientific and professional organizations and associations to discuss a national rabies control program. The United States Livestock Sanitary Association was officially represented at this meeting. Paragraph 7 of the conference report stated the following:

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

This conference report was accepted by the American Veterinary Medical Association, by the U. S. Livestock Sanitary Association, and by the Bureau of Animal Industry.

It is of extreme importance, therefore, that the necessary legislation be obtained which will permit the Bureau of Animal Industry to take its part in a national rabies control program, a program which is vitally needed and one which has been long delayed. The representatives of the U. S. Livestock Sanitary Association, the American Veterinary Medical Association, and the Bureau of Animal Industry should meet to discuss all phases of the subject to be certain that any proposals presented to the Congress to that end would be mutually acceptable.
THE FISH AND WILDLIFE SERVICE IN RELATION 
TO RABIES CONTROL

By STANLEY P. YOUNG

Biologist, Fish and Wildlife Service, United States Department of the Interior

Wolf depredations on national forests and the surrounding public lands were primarily responsible for putting the Federal Government into the business of controlling injurious predators in 1915. The part played by rabies, however, must not be discounted. When an outbreak of this disease spread so alarmingly among predatory animals in the far west during the early fall of 1915, pressure from western stockmen and sportsmen caused the Congress to appropriate $75,000 on February 28, 1916, for the immediate control of rabies. On August 11, 1916, an additional $125,000 was made available to be expended during fiscal year 1917 in Nevada, Oregon, California, Idaho, and Utah.

By June 1916 rabies was found mainly among dogs and coyotes over all of the country east of the Cascade Mountains in Oregon, up to the Washington line, one or two cases being reported in Asotin County, Washington; in all of the open country in southern Idaho, known as the Snake River Plains east practically to the Wyoming line; in all of northern Nevada south as far as the third standard parallel, with several isolated cases appearing in southern Nevada. In Utah the disease had spread into the three northwestern counties of Box Elder, Juab, and Tooele. In California the counties of Lassen and Modoc were the seat of a serious outbreak.

Under the terms of the Congressional appropriations, predator control became a part of the regular work of the former Bureau of Biological Survey, one of the predecessor agencies of the present Fish and Wildlife Service. The agency was directly ordered to destroy wolves, coyotes, and other animals injurious to agriculture and animal husbandry on the national forests and public domain.

This authority gave the old Biological Survey the opportunity to correlate the activities of those agencies which were then at work on the problem of rabies control along lines that were most effective and economical. The result was a reduction in the existing chaos in injurious wild animal control work, some of which had already been found to be detrimental to many beneficial forms of wildlife. Whenever field studies indicated the need of control of wolves and other species, operations were begun. By the close of fiscal year 1916, a large portion of the western livestock ranges was organized into control districts under competent supervisors assisted by field control agents.

Since 1915 the appropriation acts making funds available to the Fish and Wildlife Service have provided for investigations, experiments, demonstrations, and cooperation with other agencies for the control of wild animals injurious to agriculture, horticulture, forestry, animal husbandry, and wild game, and for the suppression of rabies in predatory wild animals.

The leadership of the Service in control operations during the years since 1915 has been requested and encouraged by State and other cooperating agencies. Many of the states and counties have legislated appropriations for cooperation with
the Federal Government. These funds have been supplemented by money raised cooperatively through direct assessments on livestock, in addition to various contributions from private stockmen and farmers, either in cash, labor, or materials.

Wild animals play an important role not only in the economic life of man but also in his health as well. In addition to rabies, some of the diseases carried by wild animals are bubonic and sylvatic plague, tularemia, Rocky Mountain spotted fever, and endemic typhus. The control of predators, therefore, as well as other mammals, particularly rodents, is necessary to check the spread of some of the most dread diseases that are known to man.

The preservation of many of the fine big-game species also depends upon rigid local control of predatory animals, just as the cattle-raising and the wool-growing industries and other forms of stock and agricultural production are dependent upon the control of injurious predators and rodents.

It is not the policy of the Fish and Wildlife Service to exterminate any injurious species of wildlife but rather to effect the necessary local control. This is a most important distinction. Scientific knowledge not only of control measures but also of the habits and distribution of wildlife is required to accomplish this end. Scientifically trained men on the staff of the Fish and Wildlife Service carry on continuous research along these lines.

In wild animals rabies occurs in its two recognized forms or clinical types: furious or excited; and the quiet, silent or paralytic. Those wild animals susceptible in the order of their importance are: feral dogs, coyotes, foxes, wolves, skunks, bobcats, badgers, pumas or mountain lions, and martens or the so-called American sable.

The date when rabies made its first appearance among wild animals in North America is buried in antiquity. In Colonial America the first appearance seems to have occurred in the North Atlantic states. Those who first contacted the Plains Indians soon learned that they were well aware of rabies as carried by wolves and coyotes and administered a unique but crude treatment for it.

The early beaver trappers, mountain men, and those early troops of the U. S. armies of the Indian west were well aware of rabies, at that time spread by wolves, coyotes and skunks. Lewis and Clark during their memorable journey to the west coast had trouble from a rabid coyote in one of their camps established on the upper Missouri.

In 1812 an outbreak occurred among foxes in Massachusetts; among skunks in Kansas in 1875; and also among skunks in Arizona between 1907 and 1910. The West Coast outbreak among coyotes during 1915 to 1916 has already been mentioned.

In their monograph on *The Wolves of North America*, the authors, Young and Goldman, believe rabies the cause of the wiping out of timber wolves in eastern North America. During 1890 rabies was apparent in the foxes of Alabama and it has been sporadic among foxes of the southern states until the serious outbreak which began in Georgia in 1939. Lately, it has been of concern among foxes in New York, Pennsylvania, and in Ohio.

Since the northwest outbreak among coyotes during 1915–1916, sporadic outbreaks have occurred among this predator on the western ranges each succeeding year up to the present time. A serious one occurred in the Gardiner area of south-
ern Colorado during the winter of 1923. Apparently the disease was introduced on the San Isabel National Forest by a rabid dog. The case was not reported for several months and a large number of cattle and other domestic animals were bitten and died. Five people were also bitten and promptly took the Pasteur treatment. One of these was bitten by a bobcat, two by coyotes and two by dogs.

Responding to this emergency, the Fish and Wildlife Service made a special detail of men to conduct a vigorous control campaign. As a result, the range was thoroughly freed from coyotes and bobcats and the disease was effectively controlled. Sometime later, however, rabies made its appearance among dogs and coyotes on the eastern edge of the San Luis Valley. It spread rapidly. The evidence indicated that it had been brought in from the Gardiner area by rabid coyotes and dogs which had crossed the Sangre de Christo divide in the vicinity of Pass Creek. Shortly after its appearance the citizens of this part of Colorado formed the San Luis Valley Anti-Rabies Association. On its representation the county commissioners of six counties affected, promptly appropriated county funds to cooperate with the State and Federal Government. A thorough field campaign got under way under the supervision of ten hunters to wipe out coyotes and worthless dogs. Regulations regarding the muzzling of dogs and cats were also enforced. With this splendid cooperative set-up, the close of 1923 ended any appearance of rabies in this area.

I would like to discuss in some detail the cooperative rabies control work of the Fish and Wildlife Service carried on against foxes, both the red and gray species, in the southern states for the better part of the past decade. This program, like other rabies control campaigns, involves the method whereby the reduction of wild animal life, particularly the carnivores, in known infected areas is sought before much danger has been occasioned to man and domestic animals.

The first recorded occurrence of rabies in foxes in the southeast was in Burke County, Georgia, in 1939. Since then it has spread to at least half of the 159 counties in Georgia. Since 1939 rabies has appeared among foxes also in Alabama, Mississippi, Louisiana, Arkansas, Kentucky, and Florida. From one to five or six outbreaks have occurred at rather widely separated places in each of these states. In Georgia there appears to have been a progression of the infected areas about the state. The rabies outbreaks appear to strike in areas of heavy fox population.

During the year 1944, in twelve counties and parishes of Louisiana, Mississippi, and Arkansas in which rabies was present among foxes, 405 domestic animals valued at $28,295 were bitten and died. Ninety-eight people were bitten and took the Pasteur treatment.

When an outbreak starts in a locality almost anything can happen. Foxes chase dogs and attack people. They may be found anywhere, in a farm yard or in the middle of a town. One fox was killed on the second floor of a county court house.

The Service's control or suppression work has, with a very few exceptions, been confined to the reducing of foxes in the areas where the disease is already present in more or less serious form. Lack of interest, and quite often active opposition to destroying foxes, has made pre-suppression impractical in all but a few rare cases. Because of the controversial issues involved in the matter of fox control the Service follows a policy of undertaking no actual fox reduction work in any county until the
county commissioners or other responsible officials sign a cooperative agreement which among other things gives sanction to the work. The Service has carried on control work in perhaps half of the counties in Georgia in which fox rabies outbreaks have occurred. In the other states we have worked in a somewhat higher per cent of the problem counties, although there is no significant difference.

With reference to pre-suppression work, the reduction of fox populations in localities where rabies has not yet appeared among these animals, the Service has recommended that the State Game Departments ease up on the restrictions that protect foxes. We have advocated that fox populations be reduced when found to be abnormally high, particularly if rabies is known to be prevalent in either dogs or foxes anywhere near. The Service has not advocated positive action on a state-wide scale to control or destroy foxes because to do that effectively would cost more money than is available.

The fox rabies control work is carried on in cooperation with the State Game Departments. In Georgia the fox work is coordinated with the human, dog, and domestic animal rabies control work of the State Health Department by means of a simple memorandum of understanding and a practical working relationship.

As previously mentioned, before any control work is undertaken in a county, we require that the county government enter into a cooperative agreement. This agreement specifies that we will furnish a man for technical supervision, and that the county will furnish a local supervisor for the project, pay a bounty (usually $2.00 per fox) for the duration of the campaign, provide traps, and pay miscellaneous costs. The average operating time in a locality is two to four months. Within that time the fox population is usually reduced by rabies and by control work to a point where further danger is practically eliminated.

The Service representative first selects—with concurrence of the county officials)—the local supervisor and gives him some fundamental schooling. After that, a series of demonstration meetings is usually held, generally with the county agent or county health officer. Methods of trapping, den hunting, and other pertinent control methods are covered. Provision is made for interested persons to obtain traps. Sometimes the fox hunters offer to help with their dogs and a section of the county is set aside for them in which no traps are to be placed.

After the round of demonstration meetings, the Service representative and the local supervisor visit those who are trying to perform control work and give them additional coaching on the trap line; or they may help organize hunts among the fox hunters. They also arrange for receiving fox heads and for shipment to the state laboratory for examination when desirable. The whole program is designed to get the local fox population reduced as quickly as possible. The plan is to give directions and technical supervision to local cooperators. Work is concentrated in and around the places where mad foxes have appeared, and a buffer area around the hot spots as wide as interest and conditions will permit.

When the situation in a locality is safely under control the Service recommends that the program be discontinued. This type of attack is local and is temporary, and thus far the payment of bounties appears to be justified. Probably this is because a project in any one area does not last long enough for a bounty racket to get going, and the supervision given by the county supervisor and our representa-
tives is a discouragement to would-be chiselers. State and Federal employees are not eligible to receive bounty awards.

The number of foxes required to be taken in any one county is not great. Usually it runs from 300 to 700, with an occasional one going to 1200 or 1500. We operated in ten counties in Georgia during fiscal year 1948 just ended. Approximately 3200 foxes and 24 bobcats were taken. Rabies in foxes was reported from 29 counties in Georgia during the year, compared with 42 counties in the preceding year.

Expenditures by the ten cooperating Georgia counties in 1948 totalled about $9300 for employment of local supervisors, bounties, traps, gas cartridges, etc. Expenditures of Federal funds was less than half that amount in Georgia; and expenditures by the State Game Commission probably did not exceed $1000. During the year 237 head of livestock valued at $11,875 were lost due to rabies, compared with 2570 head valued at $100,000 the year before. This was in the fox rabies counties, but there is no way of knowing just how much of the loss was caused by fox bites. It is believed, on the basis of evidence and observations, that foxes caused more than 50 percent of the losses.

According to Georgia State Health Department records for the entire state in 1946, there were 1735 people given anti-rabies treatment, of which 106 had been bitten by rabid foxes. In 1947 there were 1358 given treatment, of which 61 had been bitten by rabid foxes. This refers to calendar years. Meanwhile, the State Health Department, in cooperation with local health units and other local authorities, is carrying on an extensive program of dog vaccination and where necessary dog quarantine. In 1947 there were 68,321 dogs vaccinated, and up to Oct. 1 in 1948, 112,338.

For many years states cooperating with the Fish and Wildlife Service in rabies control have used the slogan: "Kill the coyote and muzzle the dog," further stating "It is better to be sure (and alive) than sorry (and dead)."
REPORT OF THE COMMITTEE ON RABIES


Your Committee on Rabies has arranged presentation by three Federal agencies, namely, the Fish and Wildlife Service, the U. S. Public Health Service, and the Bureau of Animal Industry, relative to the status of each organization in a national rabies control program. This is in line with recommendations made by a Conference on Rabies reported to this Association in 1947.

Your Committee further recommends that representatives of this Association be authorized to confer with representatives of the American Veterinary Medical Association, the Bureau of Animal Industry, the U. S. Public Health Service, and the Fish and Wildlife Service, to discuss the national program and institute legislation to permit the Federal agencies to engage in the national program.

There is appended, as usual, the report of the Bureau of Animal Industry on the incidence of rabies in the United States in 1947.

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**Fig. 1.—Cases of rabies reported in various states in 1947**

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TABLE 1.—Rabies in the United States by states during the year 1947

<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>
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* Includes coyote, fox, rabbit, mouse, gopher, ground squirrel, rat, squirrel, skunk, wild cat, raccoon, opossum, and muskrat.

**UNITED STATES DEPARTMENT OF AGRICULTURE**

**AGRICULTURAL RESEARCH ADMINISTRATION**

**Bureau of Animal Industry**

**Washington, D. C.**

April 8, 1948

**INCIDENCE OF RABIES IN THE UNITED STATES**

**CALENDAR YEAR 1947**

Statistics on the number of cases of rabies in the United States in the calendar year 1947 have been collected by the Bureau of Animal Industry of the U. S. Department of Agriculture.

There were 8,946 cases reported. There were 6,949 cases in dogs, 766 in cattle, 40 in horses, 15 in sheep, 20 in swine, 393 in cats, 9 in goats, 728 miscellaneous, and 26 in man.
This material was compiled from a questionnaire sent by the Bureau to the livestock sanitary official and the health officer in each State. In some instances, data from both sources in a State were used. When there was a difference in the number of cases reported for the same species, the greater number was used, since it is believed that the reported cases do not represent all of the cases that occurred.

Table 1 gives the number of cases reported in each State by species.

Fig. 1 shows the distribution of the cases by States.
For many years biological products have played an important role in the control of infectious diseases of livestock. Although chemotherapeutic agents and antibiotics have proved to be effective in the treatment of some microbial diseases, most of the specific infections in animals are still most effectively treated with biological products, and active immunization with biological products is the surest means of prevention.

Biological products produced in the United States measure up to the highest standards of any country in the world, and there is little doubt that they far exceed the standards of many countries. This enviable position has been attained through exhaustive production research that has been conducted continuously by the manufacturing laboratories, together with the splendid cooperation of the Division of Virus-Serum Control, U.S. Bureau of Animal Industry, with the biological Industry.

The biological Industry and the governmental agencies have a common objective, i.e., development and improvement of biologicals to the highest degree of potency and safety that is possible in the volume production that is needed to be socially effective. When research discloses the ways and means of increasing the potency and/or safety of any product in test tube quantities, the production laboratories can be depended on to raise the standard for that product as soon as the procedure can be applied to volume production with equal success. It may be well to mention that many months or even years of production research may be needed to successfully convert an improved test tube technic to commercial volume production procedures. Sometimes, a technic that will improve a product in test tube volumes will not only fail when applied to full volume production, but will actually result in an inferior product.

The biological Industry is continuously conducting research aimed at the development of new and more effective biologicals, and the improvement of the old. For this purpose, a number of biological laboratories maintain research departments that are staffed with highly qualified bacteriologists, biochemists, and physicists, each working in laboratories that are completely equipped to conduct research in their respective fields. In addition to the usual facilities found in well equipped research laboratories, the biological Industry's research departments have ultramodern facilities such as ultraviolet irradiation equipment, drying equipment, ethanol fractionation facilities, and electrophoresis equipment.

Despite the accomplishments of the Industry research groups, comprehensive study remains to be given to those biologicals for which no standard of potency has been established, and more particularly the group of products comprising the mixed bacterins and the corresponding antisera. An Industry-wide study was made in 1939 and 1940 of this group of products and standard formulae were established for all mixed bacterins and the corresponding antisera. To accomplish this in the scientific manner, considerable research had to be done to insure, insofar as possible,
that the revised formulae would be in keeping with the best information that could be obtained. Nation-wide surveys provided data as to the kinds of microorganisms that were encountered in the mixed infections of the respiratory system, and those encountered in the gastro-enteric system. Revisions of formulae were made in accordance with these findings. The new formulae were submitted to the Bureau and without exception were adopted as the official standard formulae.

Considering the fact that almost nine years had elapsed since the last revision of the formulae, the Industry deemed it advisable to undertake a new survey, obtaining data from diagnostic laboratories, agricultural colleges, veterinary schools, and the like, on a nation-wide basis. The data resulting from this survey, which is now being made, will disclose whether any of the formula now in use should again be revised.

Whether or not revisions of any formulae will be found to be in order, extensive studies on antigenicity should be undertaken. Representatives of the Industry are in agreement that a project of such complexity and magnitude could best be accomplished through an united effort of the entire Industry. With this thought in mind they have created the Veterinary Biological Licensees Association, the objectives of which shall be:

1. To conduct, direct, and support research and investigations directed toward a reduction in mortality and morbidity of livestock.

2. To improve biological products used for the diagnosis, prevention, and treatment of animal disease.

3. To conduct or support animal disease surveys leading to the accumulations to the mortality and morbidity statistics for distribution to the membership.

4. To promote the best interests of the livestock industry.

Management of the Association, including supervision of all plans and research programs, will be carried out by a Board of Control, consisting of eight members who equitably represent the Industry. It can be expected that this Association will do its best to stimulate research on biological products in agricultural and veterinary colleges and other institutions where qualified personnel and facilities are available. It will aim first at those phases of the problem where attention is most needed. It can be assured that the scope and extent of the research that will be undertaken will be limited only by the availability of funds and the qualified personnel that can be engaged to conduct the work.
WHAT HAS HAPPENED IN THE BIOLOGICAL, PHARMACEUTICAL
AND ANTIBIOTIC FIELD IN THE PAST YEAR

MARK WELSH, D.V.M.

Veterinary medicine, like human medicine, is rapidly changing from an art into
a more exact science. As the fundamental sciences upon which our work is based
are better understood and further developed, we can confidently expect marked
improvement in our therapeutics, nutrition, and management practices. The
field of chemotherapy is still very new and although several valuable products
have come from this source, the field is far from exhausted, and the research lab-
oratories still have much to do.

During the war years there was a tremendous number of new and intermediate
products produced in our effort to advance our cause. These are now being eval-
uated. We all know the story of how sulfanilamide and DDT sat on the shelf
for 20 or more years before their particular values were determined. There should
be no repetition of these unfortunate experiences. Under the guidance of a special
branch of the Federal Government, there are listed some 300,000 products being
studied. These studies are being made in Federal, State, and commercial labora-
tories, and each product is examined for its pharmacological values, its bactericidal
and bacteriostatic activity, its value as a parasiticide, and for whatever other prop-
erties it may have that are useful to man. When any product is put through such
a screening process and is found to have a particular use, all other products in the
same series are put on similar exacting tests. Frequently, such a product is re-
turned to the chemical laboratory, the chemist painstakingly adds or removes
radicals from the basic compound, and virtually tailor-makes a new product to the
specifications of its particular need.

It might seem that testing such products by trial and error is a highly unscientific
procedure for scientists to employ. It is, however, the quickest and simplest
means now available for the development of a new product that has superior values.
Such studies require a big backlog of products, an efficient testing procedure, a
large staff of well trained scientists, and the capacity to accept disappointments
day after day without losing hope. I know of one group that, over a period of three
years, tested some 1200 products before finding one that seemed to have value for
their particular purpose.

When a product shows value under laboratory conditions and in laboratory ani-
imals, if it is to be used in animal work, it must be carefully tested on all the species
of domestic animals on which it may be used. We have long since learned that there
is a marked difference in the absorption and excretion rates of drugs in different
animals and a considerable difference in the tolerated dosage. When the labora-

tory tests are completed, the therapeutic dose determined for each species, and
something is known about the range of effectiveness, the product then must be
tested under field conditions. Such a product, for proper evaluation, should be
put in the hands of unbiased observers such as investigators at colleges and ex-
periment stations. Unfortunately, the facilities and personnel at such institutions
do not permit of as full cooperation in such work as they would like to give and as is really needed for public protection. Often the cooperation of practicing veterinarians can be obtained in evaluating a product under field conditions, but usually they do not have the laboratory facilities for making an unquestioned diagnosis, determining pathological changes, compiling data, and writing reports on their findings. All such data, however, must be obtained, submitted to Federal agencies, and have their approval prior to the marketing of a new product. The gestation period of a new product is necessarily long and indefinite. There is usually an interval of at least one to three years from the time that someone gets a pregnant idea and the product is born and ready for its first showing.

These are some of the reasons why we do not have, at present, effective agents for treating brucellosis, trichomoniasis, anaplasmosis, and several other diseases. Undoubtedly, techniques for their study and solution will be developed. It is obviously impossible to test any large number of drugs and chemicals in as large an animal as a cow when often these products are made in only 1- and 5-gram quantities in the laboratory. Attempts have been made to grow anaplasmosis in laboratory animals, but so far they have failed. Until some one finds a means of surmounting this fundamental obstacle, studies of this kind will, of necessity, be delayed.

It may seem that I have painted a rather drab picture of the difficulties of developing a new product. But it is also a true picture. Despite the obstacles, however, new and better products continue to come from the careful and continuous studies of able scientists in our Federal, State, and commercial laboratories. I cannot hope to cover all of them today, but I would like to mention some few that, to me, are interesting, and that may have considerable value in the prevention and treatment of animal disease.

The field of antibiotics is attracting the attention of a very large number of investigators. The phenomenon of antibiosis has been known for a considerable time, and everyone who has taken a course in bacteriology has seen antibiotic action on culture plates. It has only been since 1939, however, that a combination of good biological chemistry, together with other forms of biological investigation, has brought practical results in the study of antibiotics. There are an infinite number of sources from which antibiotics may be obtained and these range from the smallest forms of life to the largest. The field is so new, however, and the techniques imperfectly developed, that we actually have only four antibiotics commercially available today. Reports indicate that there have been 5,485 sulfonamides made, to date, of which only about a dozen are of commercial or medical importance. These were largely developed within the past ten years. There are about 150 antibiotics listed in the February 1, 1948 edition of the National Institute of Health report on “Antibiotic Substances”. These have largely been developed and studied within the last four years.

There are several definitions of antibiotics, but the following seems to be a little more exact than others: “An antibiotic is a chemical compound derived from or produced by living organisms which are capable, in small concentration, of inhibiting the life process of microorganisms”. To be useful in medicine, an antibiotic should have many, or all, of the following specifications: (1) it must have
powerful action in the body against one or more types of bacteria; (2) it must have specific action; (3) it should have low tissue toxicity—repeated doses should not give accumulative injury; (4) it must be active in the presence of body fluids such as serum, pus, and cerebrospinal fluids; (5) it must not be destroyed by tissue enzymes such as trypsin. It is desirable, but not essential, that the drug be absorbed by the intestines so that it can be administered orally; (6) it should, in itself, be stable, or should remain active in preparations that give it stability; (7) it should not be so rapidly excreted that frequent dosing is necessary; (8) it should not be of a structure that permits pathogenic organisms to readily become resistant to its action. It should be stated in passing that there is no antibiotic currently available that meets all of these specifications. But penicillin probably comes closer than any of the others.

Within the past year or two, means have been found to prepare penicillin in a crystalline form which increases its stability and reduces the necessity for refrigeration. Several agents have been developed so that, following a single injection of penicillin, therapeutic blood concentrations are maintained for longer periods of time. (1) For some time it was believed that an oil and water emulsion of penicillin extended the maintenance of effective blood concentrations. In the light of recent investigations, it would appear that such an emulsion is little, if any, better than an aqueous solution of penicillin. (2) The Romansky formula containing oil and beeswax does delay the excretion of penicillin, but has the disadvantage of being somewhat difficult to handle and leaves the beeswax as a residue in the tissues which the body seems incapable of absorbing. (3) Caronamid was introduced within the last year. It is reported to have a direct action upon the kidneys, and reduces the rate of penicillin excretion. This, of course, has the effect of keeping the penicillin in the circulatory system for a longer period of time, and Caronamid seems to have little, if any, detrimental effect on renal cells. (4) Tween is a surface-active agent or wetting agent, and, together with such agents as methylcellulose, aids in coating the particles of penicillin and reducing its rate of absorption. Recent studies indicate that this means of maintaining and prolonging penicillin concentrations in the blood is less effective than was previously believed. (5) Another new agent employed in prolonging penicillin blood levels is aluminum monostearate. This is usually used in oil preparations of penicillin and it has the effect of thickening or causing a jelly-like formation when used at the rate of 1 or 2 per cent. It appears to definitely retard the rate of absorption of penicillin, and, following one injection, it is reported that therapeutic levels have been maintained for as long as 96 hours. (6) One of the more recent developments is procaine penicillin. There is a chemical combination between the procaine and penicillin to make the procaine salt of penicillin, a highly insoluble compound which brings about slow absorption.

Through one or more of these new forms of penicillin, following a single injection, a therapeutic blood concentration can be maintained for 48 hours. This, of course, markedly lowers the cost of treatment with penicillin, reduces the labor involved, and brings this product well within the economic range for use in domestic animals. Aside from its use in the treatment of mastitis, penicillin, in the past, has been used but little in the treatment of larger domestic animals. The recent developments
of this product should stimulate its use in the treatment of anthrax, actinomycosis, swine erysipelas, and other infections susceptible to penicillin. So far as is known, no harm results from large dosage of penicillin and little good results from under-dosage. A total daily dosage of penicillin in aqueous form of 1500 to 2500 units per pound of body weight, administered in divided doses every 6 to 8 hours, is most effective. Less frequent administration would be necessary with other forms of penicillin, and a smaller total amount of penicillin would be equally as effective.

Streptomycin is chiefly effective against the gram-negative organisms, and although it does have some effect upon the gram-positive group, most strains are more sensitive to penicillin. It has relatively low toxicity, but organisms seem to rather rapidly build up resistance to it. It is, therefore, recommended that large initial doses be given, rather than small doses over a longer period of time. Streptomycin would seem to supplement penicillin rather than replace it. It can be given by any of the usual parenteral routes, but it is not absorbed from the intestinal tract. Kelberg has reported the successful use of this drug when given subcutaneously at the rate of 0.25 gram per day, in divided doses, to dogs weighing 20 to 30 pounds. In man, it has been reported as being effective in the treatment of urinary tract infections, tularemia, tuberculosis, gram-negative bacteremias, and, in combination with sulfadiazine, it seems to be quite an effective treatment for brucellosis. It has some disadvantages, including injury to the auditory nerve, injury to the kidneys and blood-forming organs, and, as previously mentioned, organisms rather rapidly become resistant to it. It is, of course, too early to evaluate this drug for use in domestic animals as the production, so far, has been largely employed in the treatment of man. It is quite possible that some of the current disadvantages of this drug will be modified or corrected as has been the case with penicillin.

Tyrothricin is chiefly effective against gram-positive organisms, but it cannot be used parenterally. It is chiefly used, at the present time, in topical applications and in bovine mastitis. It is stable, needs no refrigeration, and appears to be faster acting than penicillin in streptococcal and staphylococcal infections. It can be used in sprays and ointments. It has several desirable properties and some few undesirable ones, but it would seem probable that it will be superseded by some of the newer antibiotics which are less toxic.

The last of the four currently available antibiotics is bacitracin which is obtained from Bacillus subtilis. It was discovered at Columbia University in 1943, and has shown promise against certain gram-positive pathogens. It has been used chiefly for topical applications and has a wide range of activity. Early forms of the drug were somewhat toxic when given parenterally, but blood concentrations could be maintained about six times as long as those obtained with penicillin G. Recent improvements in the production of this antibiotic give promise for its parenteral use, and may lower its toxicity and renal damage. It is potentially an important antibiotic.

The sources of new chemotherapeutic agents are almost infinite in number, and include (1) bacteria, (2) higher bacteria, (3) fungi, (4) algae, (5) higher plants like onions, garlic, wild ginger, tomatoes, burdock, and other forms. Several antibiotics have been made from B. subtilis, including bacitracin, but so far the majority
Several antibiotics have been developed from the Actinomyces. Among these are actinomycin, streptothricin, grisein, and streptomycin. From the molds have been isolated aspergillin, penicillin, and others. Stangely, there have been no antibiotics of any major importance isolated from yeasts. Preliminary work indicates that the various forms of algae and lichens should be further investigated, as many of them have the ability to kill or inhibit the growth of acid-fast organisms. Rocellic acid and diplocin, isolated from these sources, show some promise. Antibiotics have been isolated from several of the higher plants. Among these are allicin from garlic, raphinin from radishes, protoanemonin from buttercups, puchin from water chestnuts, quercetin from horse chestnuts, and dicumerol from spoiled sweet clover hay. Rhubarb, especially certain of the Australian varieties, yields quite potent antibiotics. Perhaps the outstanding and the most hopeful of antibiotics from plant sources, up to date, is tomatin that has been isolated from ripe tomatoes. This product is relatively non-toxic, and has quite a wide range of activity.

Among the more promising antibiotics that have been studied in considerable detail is aureomycin. This antibiotic has been reported as being quite highly effective against the rickettsial diseases and some of the larger viruses. It has shown great promise in such infections as Rocky Mountain spotted fever, tularemia, and “Q” fever. Early reports indicate that it is also effective on brucellosis, typhoid fever, and several gram-negative infections. It can be used parenterally. It may also be given orally. It is quite low in toxicity, and organisms do not seem to readily become resistant to it. Chloromycetin is also isolated from the Streptomyces and appears to be quite similar to aureomycin. There have been relatively few reports on the activity of this antibiotic, but it does seem to be effective in the treatment of typhus fever.

Polymyxin, isolated from Bacillus polymyxa, has been studied in both England and the United States. In the British literature, however, it is referred to as aerosporin. There are apparently four forms of this antibiotic only two of which have been fairly well identified. It is active only against gram-negative bacteria, and is bactericidal in action rather than bacteriostatic, but is rapidly excreted, and, to maintain effective blood concentrations, it must be given at about four-hour intervals. It is relatively non-toxic, but more toxic than penicillin, and is reported to produce albuminuria and some renal damage.

The mechanism by which antibiotics function is still imperfectly understood. Some antibiotics are bacteriostatic in lower dilutions, but become bactericidal in higher concentrations. Some seem to cause interference with the permeability of the cell membrane, interfere with metabolism of sugars, and with the respiration of the cell. Any interference with cell functions so that normal division of the cell is impeded causes the cell to become nonviable, and lysis or phagocytosis occurs. The development of resistant strains of organisms occurs more frequently with some types of antibiotics than others, and the administration of subminimal doses over a prolonged period should be avoided. In most instances, optimum to maximum
dosage should be initially employed, and in the treatment of animal infections with antibiotics, the patient should immediately respond favorably, and treatment may be discontinued after a two to a five-day period. Organisms that are resistant to one antibiotic are not necessarily resistant to others. It appears now that two or more antibiotics may be employed at the same time to increase the range of activity. It has been found also that certain antibiotics and sulfonamides, used in combination, give better results than when used separately. Spink has successfully employed this procedure in the treatment of brucellosis in man using streptomycin and sulfadiazine.

We have much to learn about the proper and effective use of both sulfonamides and antibiotics in the treatment of animal disease. There is no doubt, however, that the chemotherapeutic approach to the treatment of disease is the means which we have long sought to reduce our mortality and morbidity losses in livestock and poultry. Progress has been made, and the old treatments are being superseded by new and better ones.

Work in the biological field is making steady progress, but the strong light of publicity focused on the chemotherapeutic field has rather kept the accomplishments in the dark. The development of a modified or avirulent live virus Newcastle disease vaccine is now well known and being extensively used. So far, the results seem highly favorable and it appears that this widespread infection can now economically be controlled.

The technique of modifying virulent virus by passage through animals normally resistant to it is now being employed toward the development of vaccines against various virus diseases. This technique was successfully employed in the development of a rinderpest vaccine. Two years ago, it was reported that hog cholera virus had been successfully adapted to rabbits, and, according to Baker, pigs injected with this lapinized virus at the tenth and fifteenth rabbit passage level did not show any signs of disease (except febrile response), but became immune to subsequent challenge to virulent virus.

A recent report by Haig from South Africa tells of the successful cultivation of canine distemper virus on chick embryos. The report did not give any data on immunization studies, but the successful cultivation of canine distemper virus on chick embryos would appear to be a step in the right direction in the separation and identification of the various viruses which attack dogs and are now but poorly identified.

Considerable progress has been made also in the study of bacterial nutrition. Adequate amounts of iron, manganese, cobalt, and other minerals have been found to markedly stimulate growth. Vitamins, amino acids, and other food substances also play their part in the growth of organisms and in the improvement of their antigenic properties. Studies of this kind are leading to the improvement of better agents for preventive vaccination and for the development of serums of higher potencies.

Our stockmen, poultrymen, and dairymen can get good information on the management, breeding, nutrition, sanitation, and other factors that make for effective and economical production. The ravages of acute and chronic disease still remain their greatest hazard. Our domestic animals have been so changed in their form,
structure, and functions, that they often bear little resemblance to the stock from which they were derived. Obviously, they are more useful to man in their present form, but the high speed at which they function in the production of milk, meat, and eggs, possibly makes them more susceptible to functional disease, if not bacterial infections, than were their ancestors. No one, of course, would wish to change the present status, but those who are charged with the prevention, treatment, and control of diseases of domestic animals have their problems complicated. The problems are difficult and the solutions obscure. The research laboratories have presented us with many solutions, but we continually ask for more. If we could spend the next ten years getting our stockmen, dairymen, and poultrymen to put into effect the practices and procedures we now know, it would be time well spent even though nothing new came out of research in the same period. Much as we need more and better research, it is, to my mind, even more important that we get our people to put into practice that which we now know.

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REPORT OF THE COMMITTEE ON BIOLOGICS AND PHARMACEUTICALS


The scope of the work of your Committee, this last year, was greatly enlarged through the inclusion of pharmaceuticals and biologicals as a part of its work. It is evident that there is a marked trend toward sulfonamides, antibiotics, and other pharmaceuticals as their efficiency is proved and the cost of treatment reduced to the point where they can be economically used. There is, however, still need for specific biologicals of high immunizing value which we do not now have and there is need for improvement of various ones of those now available.

To stimulate action in the study of biologicals, your Committee was, in part, responsible for conferences of the biological licensees held during this past year. Your Committee feels that most forward-looking action has been taken by this group, and Dr. William Gochenour has presented a more complete report of the accomplishments to date and the objectives for the future.

Only a few new biologicals have been produced within the last year for the prevention or treatment of animal and poultry disease. The Huddleson Mucoid Vaccine for immunization against Bang’s disease is being extensively tested under field conditions in Michigan. It is also being studied under experimental conditions, co-operatively by a group of states comprising West Virginia, Virginia, Maryland, New Jersey, Pennsylvania, and Ohio. The early reports indicate that it is effective in the prevention of brucellosis and is particularly useful in the control of Bang’s disease in naturally infected herds. It is probable that within the next year, a fuller and more accurate evaluation of this product will be available.

The new type K antigen for determining pullorum disease is meeting with general approval and seems superior to the previously used types. In some few states, however, some flocks are infected with a variant strain of pullorum and the usual antigens do not identify birds so infected. It has been proposed, but definite action has not been taken, on the inclusion of variant strains in standard antigens, and it is a problem that your Committee feels should be further investigated. A modified or avirulent live virus Newcastle vaccine was introduced during the past year and appears to confer lifetime immunity on birds vaccinated with this type. This type of vaccine has been widely used in the past 6 months, but there is a wide variation in the restrictions under which it may be employed in various states. As data accumulate toward its evaluation under field conditions, your Committee feels that this Association should study the results and make recommendations leading to greater uniformity of regulations in the various states.

An increasing amount of attention is being given to the diseases of fur bearing animals and particularly mink, foxes, chinchillas, and rabbits. The prevention and treatment of their diseases follow much the same lines as in other species of animals and, within the last year, one or two immunizing agents have been developed for
mink distemper and for a virus infection of dogs believed to be similar to virus encephalitis in foxes.

Anthrax vaccine made from avirulent unencapsulated variants has been brought into regular use in South Africa. The strains sporulate readily and immunization tests are run in guinea pigs obviating the use of large animals for this purpose. All domestic animals are immunized with the one vaccine, with results reported as superior to those obtained with the Pasteur type of spore vaccine.

It has recently been reported that canine distemper virus has been successfully cultivated in chick embryos. This work is still in the experimental stage but could easily prove to be of major significance.

The use of sulfonamides in the treatment of animal and poultry disease is too extensive to permit other than brief comments here. It should be reported, however, that within the past year, Sulfapyridine has been dropped from the U. S. Pharmacopoeia, and notice has been given that Sulfathiazole will be. They were omitted on the basis that the newer sulfonamides, such as Sulfadiazine, Sulfamerazine, and Sulfamethazine, have equal activity but have less toxicity and require less frequent dosage. In addition to the sulfonamides that have been available for some years past, a new drug, Sulfadiazine, has recently been introduced. It is currently recommended in the treatment of poultry diseases, particularly coccidiosis.

New forms of Penicillin have also been introduced within the past year. The change has been chiefly in the vehicles used, through which the rate of absorption or excretion has been reduced. It has been reported that the new forms of Penicillin can, on a single dosage, maintain therapeutic levels for 48 to 96 hours. Relatively little work has been reported in the use of these products under field conditions, but the use of Penicillin in these forms should bring the cost of animal treatment well within economic limits. One of the major developments through which these new products have increased value was the development of crystalline penicillin which reduces the necessity for refrigeration.

There are, at present, only four antibiotics commercially available—Penicillin, Streptomycin, Bacitracin, and Tyrothricin. Of these, only Penicillin and Tyrothricin are used to any extent in veterinary medicine. Many agents used effectively in human medicine cannot be economically used in veterinary medicine. Four years ago, this was true of Penicillin when the limited total production had a value of some $35,000,000. In 1947, there was about 35 times as much Penicillin produced as in 1944, which had a value of approximately $100,000,000. While the volume was increasing by 35 times, the value was increasing by only about 3 times. Many new antibiotics are under experimental study and some few are on clinical trial, but it is probable that few of them will be commercially available in less than one to five years.

Allergies in animals are receiving increased attention and there have been reports that some types of bloat in cattle, laminitis in horses, and various digestive disturbances, and skin and respiratory conditions are attributable to specific allergies. Obviously, if the cause of the allergy can be determined, it should be eliminated, if possible, but various antihistamine agents have been developed within the last year or two that give temporary relief. The antihistamine preparations probably have greater use in small animal practice than in treatment of other domestic stock.
Several new parasiticides have been introduced within the last year or two. Benzene hexachloride is primarily used for external parasites, including ticks, fleas, lice, and mange mites. It is reported as being an effective agent, but unfortunately, has an obnoxious odor which may limit its use. Chlordane is also reported to be effective against ectoparasites. Hexachlorophene is reported as being effective against tapeworms in poultry. Diphenthane is reported as being effective in the treatment of tapeworms in dogs, and causes a rupture and destruction of the tapeworm segments. Lead arsenate for the treatment of bots in horses and tapeworms in sheep has been reported to be effective.

A piperazine compound is reported as being effective against large roundworms of dogs and cats and against heartworms of dogs. It has also been reported as effective in the treatment of filariasis of man.

Several new preparations have appeared on the market in the last year or two for the treatment of parasitisms, which appear to be combinations of previously known effective agents but, through the combination, may have increased range and effectiveness.

Several new aids in the nutrition of animals have appeared on the market in the last year. Among those are thyroprotein, an iodized casein preparation, which stimulates the thyroid gland and is reported to increase egg and milk production. Folic acid is now being used for vitamin supplementation, chiefly in poultry and, to some extent, in other types of domestic animals. A new vitamin, designated as B12, is reported as an anti-pernicious anemia factor in man, and apparently a somewhat similar factor has been developed that is designated as the Animal Protein Factor. These have had only limited use so far, and, although it is presumed that they may have value in animal nutrition, the extent of this value has yet to be determined.

Various protein hydrolysates, or amino acid preparations, have recently been prepared and are finding quite extensive use in dog nutrition. They are reported as being effective in other species as well, and are of particular value in seriously ill or convalescent animals that refuse food or whose intake is too low for maintenance of health.

It is doubtful if your Committee has covered all of the new agents that are currently available, or will be shortly, for the treatment of domestic animals. It is probable also that more detail should be given and a fuller evaluation of the products under discussion be presented. This is, however, a quite extensive assignment for your Committee, and the procedure for making a clear, concise, and explicit report has not been developed. We strongly feel, however, that future committees can and should present to this Association a currently complete picture on the new aids developed for the reduction of livestock and morbidity losses.
THE IMMUNIZATION OF BIRDS AGAINST NEWCASTLE DISEASE

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In any consideration of the control of Newcastle disease, it should be remembered that this disease has demonstrated its ability to invade and become enzootic in new areas. A brief review of the known infected countries will establish the point.

DISTRIBUTION OUTSIDE THE UNITED STATES

In 1943, the author (1) reviewed the geographic distribution of the disease as of that date. The countries included the Dutch East Indies (1926), England (1927), India (1928), Philippine Islands (1928), Korea (1929), Ceylon (1930), Australia (1931), Japan (1933), Federated Malay States (1935), Kenya Colony (1937) and Syria and Palestine (1940).

In 1946, Brandly et al. (2) reviewed the literature that had accumulated since 1943 and added to the list Italy (1940), Germany (1941), Belgian and Middle Congo (1942), and South Africa (1945).

Meanwhile, there can be added to the list Romania, Hungary, Switzerland (3) (1940), Mexico (4) (1946), Russia (5) (1947), China (6) (1947), Tunisia (7) (1948), probably Spain and Sweden (7) (1948), Hawaii (8) (1948), and finally Canada (12) (1948).

DISTRIBUTION IN THE UNITED STATES

A disease ultimately identified as Newcastle may have existed in California as early as 1931. In spite of apparent failure to spread, the virus was isolated in New Jersey in 1945, and the disease was diagnosed by virus isolation, or other means, in 41 states and the District of Columbia by July 1, 1947 (9). Rather than this seemingly rapid spread in about two years, it would seem more likely that the disease had been extending itself across the country without notice or without being correctly diagnosed.

DISTRIBUTION IN NEW JERSEY

The extent to which the disease may spread in a state where commercial poultry farming is carried on intensely is illustrated by events in New Jersey where the disease had been expected and where training and facilities for diagnosis made early recognition possible. The first diagnosed outbreaks occurred in Cumberland and Atlantic Counties in February, 1945. In spite of continuous examination, no additional cases were diagnosed outside this area until June, but by the end of the year, the virus had been isolated in five more counties. During 1946, seven more infected counties were identified and three more were added by April, 1947. To date, the virus has been recovered from chickens in nineteen of the twenty-one

1 Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, Department of Poultry Husbandry.
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Counties in the state. Of the remaining two counties, one is highly industrialized and the other is known to be infected even though virus has not been isolated. Having gained entrance to a farm or area the disease usually reappears each year.

ERADICATION AND CONTROL MEASURES ATTEMPTED

By slaughter:

Eradication of a disease by the slaughter method is possible only when the disease is easily diagnosed and when the distribution is limited enough to justify the expenditure. Fowl plague is a good example of such a disease. It is easily diagnosed, and the outbreaks of 1924–25 and 1929 were so few that eradication by the slaughter method was entirely successful. Other than in the United States, Newcastle disease, by virtue of its high mortality, is easily diagnosed, and eradication by slaughter has been effective in a few cases. Thus, the 1926 and 1933 outbreaks in England, the 1930 and 1932 outbreaks in Australia, and the 1940 outbreak in Palestine yielded to the slaughter method.

By embargo:

During the 1930 outbreak in the state of Victoria, Australia, embargoes and other restrictive measures were instituted by the adjoining states of New South Wales and South Australia and were apparently effective. The 1944 (10) Natal outbreak was brought under control by the slaughter of a few birds and prohibition of the movement of birds out of the infected area.

During the last outbreak in England, the Minister of Agriculture, under the Diseases of Animals Acts, prohibited, as of October 30, 1947, the movement of poultry (other than day-old chicks) from England and Wales into Scotland, which was free of the disease. The disease, however, was reported in Scotland (Leith, Midlothian) by July, 1948 (11). Restrictive measures against the movement of poultry from the United States into Canada unfortunately failed to exclude the disease. The first outbreak was diagnosed in Ontario in February, 1948. To date, Walker (12) has definitely diagnosed eight outbreaks in Ontario, Quebec, and Saskatchewan.

Finally, within the United States, certain states hoped to exclude Newcastle disease by embargo but without success.

By sanitation and hygiene:

Sanitation and hygiene were not spared in the case of Newcastle disease. From the beginning of the war, New Jersey poultrymen were warned of the possibility of accidental or deliberate introduction of Newcastle disease and fowl plague. When Newcastle disease did appear, the educational program was intensified, but in spite of a more receptive audience, the disease continued to spread as already indicated. No regulatory measures were invoked.

From this brief review, it is evident that Newcastle disease has been eradicated in certain areas by the slaughter method (England and Australia) and that spread of the disease has been held in check by restrictive measures (Australia and South Africa). It should be noted, however, that in these places the disease was of the
high mortality type that facilitated such early diagnosis that eradication could be started before the disease was widespread. On the other hand, Newcastle disease assumed a rather benign form in the United States and did not attract serious consideration until it became so widespread that eradication was out of the question. Consequently, the only solution of the problem seems to rest on the wise use of immunization.

CONTROL BY VACCINATION

Two types of vaccines are available, namely, live and dead.

The dead or inactivated vaccines are suspended in saline or some vehicle to retard absorption. The saline-suspended material requires two injections. This of course, is not desirable. The vehicle used in the single-injection type produces a change in the muscles which is undesirable if the bird is intended for table use. A more important disadvantage of the dead vaccine is that some birds fail to respond. This failure amounts to about 40 per cent in young birds, and to about 15 per cent in grown birds. A further disadvantage is the short duration of whatever immunity is developed. At best, immunity may last about four months, and it may last no longer than three weeks. In fact, the only advantages that can be ascribed to this type of vaccine are that its use will not introduce an active agent on the farm and that it provokes no marked systemic reaction in the birds.

With reference to the live or active vaccines, a distinction has been made between live and modified virus vaccines, a distinction based on whether the vaccine strain was a naturally weak or avirulent one or whether the weakening or modification was brought about by some special method of cultivation. Specifically, a strain propagated only on hen eggs is classed as a live virus vaccine, whereas one weakened by propagation in duck eggs is referred to as a modified virus vaccine. But, as pointed out elsewhere (13), this distinction may not be valid because while duck embryo tissue is an alien tissue with respect to tissue of the chicken—the assumed natural host—nevertheless, chick embryo tissue is only less alien to adult chicken tissue, and therefore, propagation in the embryonating hen egg will likely bring about modification eventually.

Whether classed as live or modified, both are alive. Unlike inactivated vaccines, the live vaccine immunizes all susceptible individuals, regardless of age, with one administration, and the immunity is durable. Thus, the 100 per cent response and the durability of immunity are the two sound advantages of this type of vaccine. That the immunity is durable and will be transmitted to the offspring of immunized females may be assumed from the fact that the concentration of immune bodies in immunized birds is of the same grade as that found in naturally recovered birds, which are known to enjoy a permanent immunity and which will produce chicks that are passively immune for about a month.

The live or modified vaccine is not without disadvantages. One of these is that its use introduces an active agent into the flock, but if vaccination were justified in the first place, then at least it becomes a case of substituting a mild strain for a more lethal naturally acquired strain. And, as will be pointed out later, the vac-
cinated flock will be a safe source of hatching eggs after a short time, whereas a naturally infected flock may shed virus for some time.

In contrast to the reaction produced by an inactivated virus, a live virus produces some systemic reaction and some mortality. The systemic reaction is of no serious consequence in young birds, but in flocks under heavy egg production the loss in eggs has to be considered. However, vaccination of laying flocks would be an emergency measure resorted to largely in the event of an outbreak. Normally, vaccination should be done long before production begins. The mortality incident to vaccination should average less than 2 per cent, which is an insignificant price to pay for the protection.

Basically, no distinction should be made between the live and the so-called modified virus vaccines, provided neither has an advantage over the other in producing less mortality and less systemic reaction. It may be surmised, however, that the more alien the tissue used for propagating a virus, the greater the modification, and, in time, the degree of modification may become so great as to influence adversely the immunity response. It might therefore be reasoned that the so-called modified type of virus, since it is propagated in duck eggs, might eventually lose much of its immunizing power. But, as pointed out above, chick embryo tissue is also alien to adult tissue, and therefore a virus propagated in hen eggs, given a longer time, might also lose its antigenic property as well. Immunity response is measurable, however, and reputable laboratories are not likely to distribute vaccine that does not immunize satisfactorily.

Since one of the modified viruses has to be propagated in embryonating duck eggs, it is well to point out a definite hazard in the use of eggs from this species. Both duck and goose eggs are notoriously infected with Salmonella organisms either by way of the ovary or by penetration of the shell. If such eggs escaped detection, the organism would not be destroyed by processing the vaccine and would be free to infect the chicken at the time of vaccination. Even hen eggs may contain the pullorum or typhoid organisms, but at least carriers of either infection can be detected by the pullorum agglutination test. As yet, no such test has been developed for the detection of paratyphoid carriers in spite of numerous attempts.

Since the immunizing power of an active virus vaccine depends on its being alive, it is extremely important that the virus be properly dried to insure its survival through the expiration date. This might appear to be an unnecessary warning, but insufficiently preserved (dried) vaccines have been and still are occasionally found on the market. The possibility of insufficient drying, therefore, must be mentioned as a disadvantage.

From the above discussion, it is clearly evident that the active virus vaccines, which, by one administration, produce a durable immunity in every susceptible bird, have advantages that far outweigh their few disadvantages. In fact, the possible disadvantages are largely controllable—improper preservation, contamination with pathogens, and faulty antigenic properties. In contrast, the failure of inactivated vaccines to immunize all birds or to produce a permanent immunity in any bird is a feature of this type of product that has not been improved in spite of extensive research. The one disadvantage, namely, that the use of a live vac-
cine introduces the infection on a farm, is hardly a valid objection, for the reason that if vaccination is justified and is not practiced, then the flock is likely to contract a far more virulent disease, suffer a heavy loss, and in the end be a source of a more virulent strain over a longer period.

USE OF LIVE VIRUS VACCINES IS NOT NEW

Regarding the idea that the use of a live virus vaccine is likely to result in a further spread of a disease, one has only to recall that such products have been used on chickens for years and are accepted. Moreover, there is no evidence that incidence of the poultry diseases against which such products have been used has increased. Outbreaks of laryngotracheitis, for example a disease that used to be widespread is rarely seen in our state where vaccination is extensively practiced. Moreover, laryngotracheitis vaccine is prepared from fully virulent virus in contrast to the relatively apathogenic strain used in Newcastle disease vaccine. Again, vaccination with fowl pox virus is extensively practiced, and yet the virus is fully virulent. In addition, the pox-vaccinated bird is probably a source of infection for mosquitoes, which are known vectors of the disease. And lastly, in some states along the Atlantic coast, fully virulent bronchitis virus is introduced into flocks at an age when the disease is not likely to produce much mortality and before egg production begins.

WHAT FLOCKS SHOULD BE VACCINATED?

Assuming, then, that the idea of live virus vaccination is acceptable, we must prescribe the conditions under which such vaccination should be practiced in order to avoid possible abuses. These conditions may be described as follows:

1. Prophylactic vaccination: To be practiced on farms in thickly populated poultry areas where the disease is enzootic. Many such farms are separated only by a wire fence, and consequently during an outbreak every farm is attacked.

2. Emergency vaccination: To be practiced on a farm at the beginning of an outbreak that has been diagnosed by an experienced person. In such a case, diagnosis cannot await the isolation of virus or a serological test, which is useful only when birds have been affected long enough for immune bodies to develop. These cases are most likely to occur on isolated farms where vaccination has not been done because of their supposed protected locations, that is, outside an enzootic area.

3. Vaccination to ensure parental immunity: To be practiced on intended breeders in order to obtain parental immunity in chicks which are, in turn, to go into infected areas. Unfortunately, this will mean vaccination of thousands of well-isolated flocks in areas where the disease is presently of no consequence and where vaccination is otherwise not justified. At least one such area now exists, and the chicks go largely to a well-known, heavily infected broiler area. Since few of these chicks carry parental immunity and since the broiler area is infected, the chicks usually contract the disease early and suffer a heavy mortality. Vaccination of the young stock intended for breeding purposes would give the parental immunity to carry the broiler stock to an age suitable for vaccination.

The parentally immune chick is protected against transit-acquired infection,
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which not infrequently occurs, and such a chick is therefore less dangerous, especially for export to countries now supposed free of the disease.

Many hatcheries whose chicks are intended for layers or breeders in an enzootic area are justified in vaccinating to obtain the parental immunity in the chicks and, moreover, to insure that no outbreak occurs at the height of the breeding season to disrupt or completely ruin operations. In 1945, when Newcastle disease appeared in New Jersey and when poultrymen were trying to prevent the disease, the chick buyer avoided purchases from breeding flocks that were known to have had the disease, on the possibility that the disease was transmitted through the egg. That year few hatcheries would admit having had the disease. When the advantages of the parentally immune chick were recognized, however, the hatcheryman boasted of the fact that his flock had had the infection.

Traffic in live birds (day-old chicks excepted) is definitely a serious practice, but the fact is that many large hatcheries furnish breeding cockerels for their supply flocks. Since any one or several of these supply flocks might acquire the disease and since the supply of cockerels is limited to the number grown for the season, such birds should be vaccinated long before they are distributed to the out-flocks.

SPECIES TO BE VACCINATED

Since turkeys are susceptible to Newcastle disease, it is advisable to vaccinate them when they are on farms where vaccination of chickens is practiced or if a turkey farm alone is so situated as to justify vaccination. Pheasants are also susceptible. Other farm birds may be ignored.

WHEN NOT TO VACCINATE

In view of the known methods of spread, a poultry flock on a general farm is probably the least likely to become infected and therefore should not be vaccinated, provided it is not supplying eggs to a hatchery that requires parentally immune chicks. Such flocks are usually well isolated and may produce their own replacement chicks. The general farm is less likely to be visited by disease-bearing itinerant poultry buyers. Much of the feed is grown on the place and therefore not brought in from the outside in used bags that might carry the virus. Lastly, these farms are less likely to be visited by salesmen and service men who might have come from an infected farm.

Flocks already affected by other diseases should not be vaccinated until they have recovered.

AGE OF BIRDS TO BE VACCINATED

The live virus vaccines now available commercially are made from strains calculated to be supported well by chicks four to five weeks old. There is no advantage in a strain that could be supported by younger chicks because such chicks might carry parental immunity which would render vaccination ineffective. Chicks should not be vaccinated, therefore, until they are four to five weeks old. To delay vaccination this long may result in some outbreaks in younger chicks, but as vaccination becomes more routine, a correspondingly greater percentage of the chicks will have parental immunity. At least, whether the parent stock has been
vaccinated may be determined with more certainty than whether an outbreak of a respiratory disease was Newcastle disease, bronchitis, or something else. It is safe to predict that the demand for chicks from immune breeders to insure protection for the first month will increase, and consequently vaccination practiced at four to five weeks will complete the cycle of life-long immunity.

There is, of course, no objection to vaccination of older birds except that to delay vaccination in an infected area invites an outbreak. Vaccination should not be delayed until production begins because the systemic reaction is reflected in a lower production. If a laying flock should acquire the natural disease, one should not hesitate to practice an emergency vaccination beginning with the seemingly clean pens, if there be any, and leaving the affected pens to the last.

Vaccination of successive ages is possible on a farm if the chicks carry parental immunity. In this case each group is vaccinated at four to five weeks of age, and no attempt need be made to isolate the younger chicks. On the other hand, if successive ages are to be vaccinated and none carries parental immunity, and if, too, there is a great spread between the youngest and oldest, the problem is more difficult. In this case the lots old enough to be vaccinated will have to be isolated and provided with a separate caretaker for about three weeks post-vaccination. In our experience this has proved ample in every case. In fact, mere isolation, without a separate caretaker, has been sufficient in the majority of cases, but not in all. In this connection, we have reported elsewhere (13) that even when vaccinated and non-vaccinated birds were confined to the same rooms for 28 days and then challenged, less than half of the contact birds had acquired enough virus from the exposure to produce any immunity.

There will be occasions when young stock will have to be vaccinated while laying birds are on the same premise. In this case the adults should be given a separate caretaker for at least three weeks. Then, if it is desirable to hold over any of the adults as layers or breeders, vaccination of these can be delayed until they have gone into a moult.

**CARE OF VACCINATED BIRDS**

As already indicated, the vaccinated bird or flock should be considered as a source of infection for about three weeks and therefore should be kept isolated from non-vaccinated birds. If birds on range on adjoining farms are separated only by a wire fence, the owners should arrange a vaccination date mutually agreeable.

**TRANSMISSION THROUGH THE EGG**

The presence of the virus in the yolk of about a third of the eggs laid during the acute stages of a natural outbreak has been reported by several investigators. The chances are that this is true also of eggs produced after administration of a live virus vaccine. In fact, we had no difficulty in recovering the virus from eggs laid during the period of the systemic reaction following the administration of a relatively avirulent strain of virus. Moreover Massachusetts workers (15) examined 250 eggs from 18 females up to 33 days post-vaccination but recovered the virus from only 6 eggs, of which 3 were laid on the fifth day, 1 on the sixth, and 2 on the seventh day after vaccination.

This raises the question of the possibility of transmission of the disease through
the egg. The work of DeLay (14) shows that though virus could be recovered from infertile eggs and dead embryos, it was not recovered from live embryos examined at various stages of development. It would appear then, that generally the effect of virus in the yolk is to eliminate the egg; however, DeLay did succeed in finding the virus in four-day-old chicks hatched from eggs laid during an acute attack. It is evident therefore that eggs laid during an acute attack of the disease or during the period of reaction following vaccination should not be incubated because of possible transmission through the egg or because of the hazard created by the breaking of an infected egg in the incubator and subsequent infection of the chicks.

As to the exact period over which virus is deposited in the eggs of vaccinated birds there is little information, but that which is available is encouraging. In the Massachusetts results just cited, it is to be noted that although eggs were examined up to 33 days post-vaccination, no virus was recovered beyond the seventh day. Unfortunately, data on daily egg production in this case are not available except that production dropped four days after vaccination and remained low for fourteen days. In our own experiments, eggs were incubated over a period of 27 to 77 days post-vaccination. Every sterile infertile egg or dead embryo was examined individually for virus, with the result that no virus was recovered. More than a hundred eggs were examined. It would appear, then, that virus is deposited in the egg only during a relatively short period and therefore it is safe to incubate eggs three weeks after vaccination.

CARRIERS

There is no evidence to date that a vaccinated bird becomes a carrier. On the other hand, the exact time at which a vaccinated bird ceases to shed virus is not known. On the basis of the citations above with reference to virus in the egg, however, it may be surmised that this is within three weeks, and limited field observations would seem to confirm this.

These results would seem to be contradictory to the findings of Beach, who reported recovery of virus from the lungs of a bird two months after an acute attack in a flock from which the bird was taken. In this connection it is important to remember that a vaccinated flock is not comparable to a naturally infected one because in the former, all birds are inoculated on the same day, whereas in the latter, the disease spreads from bird to bird and the time interval between infection of the first and last birds may be very great. Moreover, it is not likely that the symptomatic disease can be used as a guide to the interval, because the last birds to acquire the disease are probably the most resistant ones. For this reason the last cases are likely to have an inapparent type. This is possibly the type of bird that Beach examined. We have already reported one instance in which virus was recovered from a flock at five weeks of age and again when the flock was in about ten per cent production. It would appear far safer therefore to set eggs from a flock of three weeks post-vaccination than from a naturally infected flock even two months after the onset of the disease in the flock.

PRECAUTION AGAINST HUMAN INFECTION

Infection of the human eye with Newcastle disease virus has been definitely established by recovery of the virus or by serological methods (16, 17, 18, 19).
The infections were acquired in the laboratory or by handling diseased chickens. In the process of mixing vaccine or vaccinating chickens the fingers are likely to become contaminated and therefore care should be taken to keep the fingers away from the operator's eyes.

**MULTIPLE VACCINATIONS**

*Newcastle and Fowl Pox:*

Van Roekel et al. (20) reported that on the basis of preliminary studies it appears feasible to combine Newcastle disease and fowl pox viruses for vaccination by the stick method. Purely on the basis of the effect of these viruses administered separately, the practice of combining them for a single administration or for separate administration at the same time would not seem to be a sound practice for two reasons. In the first place, both viruses produce a systemic reaction and the combined effect could be disastrous, especially since fowl pox vaccination alone often produces a too severe reaction. In the second place, in an enzootic area, Newcastle vaccine should be administered as soon as the parental immunity wears off, that is, at four to five weeks, and this is rather young, in view of a possible outbreak of coccidiosis, to complicate the situation further by pox vaccination. Nor would the situation be improved by applying the two vaccines at a later date more suitable to pox vaccination because this would invite an attack of Newcastle disease.

*Newcastle and Pigeon Pox:*

We have combined Newcastle and pigeon pox viruses and applied the mixture by the feather follicle method. The whole chorioallantoic membrane of an egg inoculated with pigeon pox (119th passage) was ground with 2 cc of undiluted amniocallantoic fluid of relatively avirulent Newcastle virus and applied to five chicks, 29 days old, on May 27, 1947. On the same day each of five chicks of the same age was given 0.2 cc of the same Newcastle strain intramuscularly. Following a mild reaction, all chicks recovered and there were no deaths or cases of paralysis during the twenty-five day period of observation. Three of the five birds that received the combined viruses were bled on the day of vaccination and a pooled serum failed to neutralize a single fatal embryo dose of virus. The same birds were again bled June 17, that is, 22 days post-vaccination and the pooled serum neutralized more than 1000 fatal embryo doses of virus. A pooled preinjection serum sample of three birds that received the Newcastle virus intramuscularly neutralized one fatal embryo dose of virus, whereas the 22 day post-vaccination sample neutralized 10,000 fatal embryo doses.

On this limited evidence, it would therefore seem possible to combine Newcastle disease and pigeon pox viruses for vaccination and ensure adequate production of neutralizing antibodies for Newcastle disease and probably adequate pox immunity as well, judged from the swelling of the follicles produced. But even though this combination does not have the disadvantage of producing a severe shock, as would simultaneous Newcastle disease and fowl pox vaccination, the combination is not advisable as a routine procedure. As previously mentioned, for the surest protection, Newcastle vaccination should be practiced at four to five weeks of age and
at this age the majority of chicks are very poorly feathered and therefore good pigeon pox "takes" are not obtainable. Since the degree of immunity in pox is proportionate to the number of follicles infected, the degree of protection is apt to be too low. However, if Newcastle vaccination has been delayed to the age when birds are well feathered and therefore good subjects for pigeon pox vaccination, there would be no objection to simultaneous vaccination because pigeon pox virus produces no systemic reaction.

**Newcastle and Laryngotracheitis:**

The literature reveals no reports on the results of a combination of Newcastle and laryngotracheitis viruses, but we are aware that poultrymen are already practicing simultaneous vaccination. On the basis of their reports, no bad results have come to our notice. Nevertheless, the problem should be studied in the laboratory before the practice is recommended. It might be pointed out, however, that laryngotracheitis—like pigeon pox virus—produces no systemic reaction to compare with that caused by fowl pox, and therefore untoward results would not be anticipated. Moreover, laryngotracheitis virus remains localized at the point of application. If simultaneous vaccination is possible, the laryngotracheitis virus could be applied to the cloacal mucosa as usual or actually combined with Newcastle virus for feather follicle application. The combination of the two viruses for application by the "stick" method would not be advisable, because the degree of immunity produced against laryngotracheitis would probably be deficient.

**Newcastle and Bronchitis:**

Again, the literature records no combination of Newcastle and bronchitis viruses but in the few areas where a crude bronchitis vaccination is in vogue, poultrymen can be depended on to conceive such an idea. In bronchitis immunization a fully virulent virus is merely used to produce the natural disease during the growing period, at which time age precludes any appreciable mortality and no disturbance to production. Basically, a combined vaccine or simultaneous immunization would appear to be highly inadvisable for the reason that both viruses produce a systemic reaction and since both are respiratory diseases the Newcastle component would very likely exaggerate the loss.

Consideration should be given to the time interval between the application of various vaccines, and the interval should be adjusted to the duration of the reaction set up by the first vaccine applied. Thus, if Newcastle vaccine is applied first, then at least ten days to two weeks should expire before fowl pox virus is applied. If, on the other hand, fowl pox vaccine has been applied first, then at least three weeks should elapse before Newcastle vaccine is used and then only if the flock has fully recovered. For maximum protection, however, Newcastle vaccine should be applied at four to five weeks of age, where this is possible, and followed by fowl pox or pox and laryngotracheitis at a later date. In broiler areas pox is rarely a problem, but Newcastle and laryngotracheitis are; therefore, Newcastle vaccination should be done at four to five weeks of age—for the present at least—and laryngotracheitis about ten days later.
CONCLUSIONS

On the basis of its past history, Newcastle disease is very likely to become more widespread than it now is, and the mortality rate is also likely to increase. Eradication by slaughter is out of the question and embargoes and other restrictive measures as well as preventive measures practiced by the poultryman have not materially reduced the rate of spread in the United States. Prophylactic vaccination would seem to be the only measure left to decrease the rate of spread and reduce the mortality of the disease.

Of the vaccines available, only the active (live or modified) virus types fulfill the requirement, namely, that a single administration produce a durable immunity in every bird. There is reason to believe that such birds, if used as breeders, will transmit to the chicks a parental immunity, which will, in turn, protect them to an age when they can be vaccinated to complete the cycle of immunity.

The use of an active virus vaccine admittedly sets up in the flock a mild infection which may be considered as a source of a mild infection for non-vaccinated birds for a period of about three weeks. But if a flock in an enzootic area is not vaccinated, it is almost certain to contract the disease naturally. In this case, the flock is also a source of infection for what is likely to be a far more pathogenic strain of virus and for a far more protracted period. In this event, the poultryman has suffered a loss proportionate to the virulence of the strain involved. Considered on this basis, there can be no sound argument against live virus vaccination.

Granted, many flocks are sufficiently isolated to preclude the likelihood of an outbreak and, if these are not supplying hatching eggs or chicks for infected areas, vaccination is not justified. On the other hand, there is at least one large area of extensive poultry farming devoted almost exclusively to the business of supplying broiler chicks to a distant area. Presently, at least, the disease is not prevalent in the supply area and so vaccination cannot be justified on the basis of prevalence of the disease. However, vaccination is justified because the parental immunity which is so badly needed in the broiler area can be furnished by this means alone. The book-minded, inexperienced person might make the seemingly sound suggestion that the broiler-chick producer sell his chicks to clean areas and that the broiler grower purchase his from areas where the natural disease is common enough to insure parental immunity. But the fact is that this volume of susceptible chicks cannot be sold elsewhere, and even more impossible is a source of supply of parentally immune chicks in the volume required by a broiler producer.

Undoubtedly some regulatory measures are needed to prevent abuses in the use of a live virus vaccine. These should not be so restrictive, however, as to deny a poultryman the benefit to be had from judicious use of a vaccine. In the event of an outbreak, for example, permission to vaccinate should not have to await a definite diagnosis based on isolation of the virus or some serological test, because by this time the disease will have become too advanced.

It would appear far wiser to formulate regulations that are realistic rather than some that are so restrictive as to encourage disregard and circumvention. The simple fact is that few poultrymen will stand the loss exacted by Newcastle disease when they know this can be prevented by vaccination.

Actually, the most fertile field for development is that of educating poultrymen
in what constitutes wise use of vaccination. Such an educational program will be most effective in areas where the industry is intensive and primary, and less effective in areas where raising chickens is secondary to other phases of agriculture.

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THE USE OF LIVE NEWCASTLE VIRUS VACCINE FROM THE VIEWPOINT OF A STATE VETERINARIAN

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We are all more or less familiar with the literature concerning Newcastle disease since its identity was established in California and I think we will all agree that its distribution over the United States—some areas being more heavily infected than others—has constituted one of the major problems of the poultry industry. Many questions as to the means of spread, the viability, and the pathogenicity of the virus, etc. have been answered. There are still other questions to be answered before we can feel sure that we have all the facts in the case. As Newcastle disease was reported and became more prevalent in some of the other states, we began to wonder when it would be reported or located in North Carolina. The first outbreak reported and confirmed in the laboratory was in May, 1947. Following this, there have been sporadic outbreaks until to date we have had approximately 35 outbreaks in North Carolina. I might mention that with the exception of three instances, these outbreaks have been confined to individual flocks. Also, that approximately 75 per cent of these outbreaks were traced directly to importations of either baby chicks or birds from other states.

A control program, consisting of quarantine and slaughter of infected flocks, combined with a supervised thorough disinfecting of the premises, including incubators, coops, egg crates, etc., was inaugurated when the first outbreak of Newcastle was confirmed. While we realize that these were somewhat drastic measures, they seemed to be the best policy at the time. We were fortunate in that the infection was confined to the individual premises of each outbreak and spread to other flocks or premises did not occur under the above program. I think that in all probability this picture could have been somewhat different if our percentage of infection had been greater.

This group is more or less familiar with what has happened in the use of other live vaccines for the control of diseases, namely: hog cholera virus and Bang’s vaccine, and while we all realize the value of these two products when properly used, we realize the damage that has been done by the improper and promiscuous use of them. We definitely know that by the proper use of hog cholera virus, we can control hog cholera. Likewise, the proper use of Bang’s vaccine can be of immense benefit in the control of Bang’s disease; yet we have all seen many cases where these products have been improperly used, resulting in a failure to control disease and often resulting in the spread of same. Our experience with these products should make us cautious in handling Newcastle live virus vaccine, and it should remain under strict supervision while we are securing additional information from research and experience.

When the live virus Newcastle vaccine was offered for sale in 1948, we wondered if this were the answer to the problem for the control of this disease. As the problem became more complex, we began securing information from a number of research
workers and others. As a result of the information gained, it was decided to permit the use of this live virus vaccine in North Carolina on a limited basis and under controlled conditions, and on the 13th of July, 1948, the North Carolina State Board of Agriculture approved a regulation presented to them for the control of this product in North Carolina. This regulation specifies that the sale, distribution and use of this live virus vaccine shall be under the direct supervision of the State Veterinarian, and requires permission in writing from that official prior to the sale of this vaccine in North Carolina.

Does the possibility exist of conditions occurring that would step up the virulence of present vaccine strains to a danger point, or could these same vaccine strains be reduced to the point that they would have no immunizing value?

For a number of reasons we have not been in favor of the widespread use of Newcastle virus vaccine in North Carolina. We began receiving requests for information from hatcherymen and producers, but mostly from hatcherymen, as to the effectiveness of this live virus vaccine as a control agent. A relatively high percentage of the agitation for vaccination came from hatcherymen who wished to supply baby chicks with parental immunity to out-of-state customers, and as a result wished to vaccinate all their supply flocks, irrespective of the presence of Newcastle. While I feel that the live vaccine unquestionably has merit and may be the control agent we all wish for, I do not think it wise to permit its promiscuous use, especially in states that have a low incidence of infection. On the other hand, I think its use should be restricted to areas where Newcastle is prevalent. I think there are still many questions to be answered. I understand that there may be at times unexplained severe reactions from the use of this product.

In regulatory work, we can only follow or put into practice substantiated findings of research workers. If we are somewhat cautious concerning the use of this live virus vaccine, it can be attributed to a number of factors, some of them already mentioned:

1. The low incidence of Newcastle infection in North Carolina at the present time.
2. A desire for an evaluation, over a period of time, of the merits, advantages and disadvantages of this product under field conditions.
3. Hesitation in the use of any product containing a live virus until we are satisfied of the necessity and safeness of using such an agent.

We have done a limited amount of Newcastle vaccinating in my state, primarily in infected flocks on infected premises, or where infection has occurred.

I might mention here that the poultry industry of North Carolina is a 70 million dollar industry, with approximately 235 operating hatcheries having an annual output of something over 50 million chicks and that now, instead of being an importing state, we actually export more baby chicks than are imported.

Each state has its individual problems and the chief livestock sanitary official will, in my opinion, work out these problems on the basis of available information and according to conditions existing in his respective state. With the added information from this year's experience of the use of this vaccine in the various states under field conditions, we will be in a much better position to amend our policy for the next season, if need be.
THE PLACE OF SANITATION IN THE MODERN CONTROL OF
POULTRY DISEASES

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According to the dictionary the word sanitation means: a rendering sanitary-science of sanitary conditions; use of sanitary measures; hygiene. If you search an unabridged dictionary you will be unable to find the word unsanitary, although occasionally it is found in the literature and press. Insanitary is the correct word, but as we see the term unsanitary used more and more perhaps the dictionaries and teachers of English will accept it.

Sanitation on a poultry farm really is a problem. Unlike larger animals which have their stalls or pens cleaned daily, the chicken is lucky to have an annual house cleaning. Some poultrymen clean house as you might say, only when some disease or parasitic infestation hits them. Others have a definite program whereby brooder houses are cleaned and disinfected between broods, while others use the same litter throughout the brooding season unless some disease or parasite problem arises. Some even go so far as to use brooder house litter as a starter for a built-up litter in the laying house. In some cases litter is reused; i.e., laying house litter which is dry is used as a basis for the so-called built-up litter, and new litter is added from time to time until a depth of 6-8 inches is reached. In a properly ventilated poultry house litter of this kind will remain dry throughout the season.

The use of hydrated lime in the litter helps to maintain dryness. This is usually added at the rate of 1 pound per bird or 1 pound per 4 square feet of floor space. Lime should be added in the fall rather than waiting until the litter becomes damp or caked later in the winter or early spring. Some poultrymen add lime at 6-8 weeks’ intervals if necessary. The lime adds to the fertilizer value of the poultry manure as well as helping to keep the litter dry.

We, in Massachusetts, have been emphasizing proper litter management together with several other points in poultry sanitation and disease prevention. In fact, we have worked up a 10-point program for poultry disease prevention, and I plan to discuss each of these briefly.

Getting back to dry litter, it is a known fact that disease germs and parasites require moisture for development; therefore, I believe we cannot emphasize this point too much. We, in disease work, probably frown on the reuse of litter. Experience has shown that where no serious diseases or parasites were present, the practice of using old material as a basis for the built-up litter, no untoward results were observed.

In addition to the possibility of using dry or old litter from a sanitation standpoint, research workers in Ohio have proven that there is a dietary factor in built-up floor litter which has to do with growth and hatchability.

Therefore, let me again emphasize that litter management is of prime importance in relation to poultry sanitation and disease control.

Other points in our program include:

Proper manure disposal, proper dead bird disposal, rodent control; vaccination and inoculation; proper rearing of replacements; cleaning and disinfecting; consideration of visitors, secondhand feed bags, egg cases and chicken crates; depopulation and culling, and finally the consideration of laboratory help if disease should appear.

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Another point to consider in a sanitary program is the disposal of poultry litter and manure. This material, if used on a poultry farm, should be spread in a thin layer on land not to be used as a poultry range. In this way, sunlight and air can get to the disease-producing agents and parasite eggs and destroy them. Poultry manure should not be left around in piles to be used as rat harbors or breeding places for flies. Flies in manure piles can be controlled to a certain extent by adding material which is poisonous to fly larvae. Work done at the Vermont Experiment Station shows that either boric acid at the rate of 2 1/2 to 3 pounds per ton of manure, or borax at the rate of 3 to 5 pounds per ton can be used to advantage. It is claimed that more than the above amounts would be injurious to crops if more than 10 tons per acre of poultry manure were used.

Disposal of dead birds on a poultry farm presents a problem. Many are left around for rats, dogs, cats, and birds to feast on and perhaps perpetuate the diseases on the home farm or spread it to other premises. Carcasses should be deeply buried, incinerated or disposed of in a burial pit. Dead birds should not be fed to pigs, the reason being that some diseases might be transmitted to pigs. Then again, if the pigs do not clean up the material readily, rats and birds might get hold of the leftover material, thus causing a continuance of the disease on the home farm or even transmitting it to other nearby poultry farms.

Incinerators are preferred by some, but incineration and burying just constitute another chore on the poultry farm, and when we are trying to save labor we emphasize the use of a burial pit. Many State Experiment Stations and Extension Services have plans available for the building of these pits. These burial pits are available summer and winter, present no rat or fly problem, and last several years unless some epidemic hits a flock.

It is a known fact that rats can carry certain poultry diseases and parasites and still not have them themselves. In most states there are Federal rodent control agents whose duty it is to assist persons having a rat problem. Probably their first suggestion is—to build rats out (ratproofing of buildings); in other words, eliminate their shelter and eliminate their food, and you have your problem practically under control. Besides being disease carriers, rats, as you know, are destructive and wasteful of feed. They destroy feed bags, kill young chicks, and even adults, as well as destroy buildings, foundations and improper electric wiring.

A formula by which farmers can estimate how many rats live on their farms is offered by Michigan State College Extension Specialists:

If you never see rats, but see signs of rats and damage, there are 1 to 100 rats on the farm.

If you see rats now and then at night, there are 100 to 500.

If you see rats every night and occasionally in daytime, there are from 500 to 1,000.

If you see lots of rats at night and several everyday, you are probably host to from 1,000 to 5,000.

Community rat campaigns are needed if a disease, such as fowl typhoid or fowl cholera, occurs in certain localities. If we keep rats down to a minimum, diseases will also be at a minimum.

When talking about poultry sanitation and disease prevention, we must consider vaccination and inoculation, although specifically they would not come under the heading of sanitation.
There are four virus diseases of poultry which can be prevented by vaccination and inoculation: fowl pox, infectious laryngotracheitis, infectious bronchitis and Newcastle disease. I simply mention this part of a disease control program as it is one point in our Massachusetts 10-point program.

The rearing of replacements on a poultry farm presents a problem. However, if young stock is raised at a sufficient distance from the adult birds, little carryover of disease should occur. If possible, there should be a separate attendant for the young stock. If this is not possible, separate overshoes and/or clothes should be worn in the brooder house or on the range.

Several years observation at Cornell University indicates that young stock reared at least 150 feet from adults at least for a few weeks tended to lower the incidence of fowl paralysis or the leucosis complex.

Some poultrymen even go so far as to have a second or separate farm on which to do their brooding and rearing which, we believe, is a step in the right direction of raising disease-free birds.

Traffic between these two farms should be kept at a minimum. Each unit should have its own attendant, feed house, trucks, crates and other equipment, and under no condition should be traded back and forth. Exception would be equipment and crates which are thoroughly disinfected before transfer.

Too much emphasis cannot be put on an annual clean-up and disinfecting program on a poultry farm. Removal of all manure and organic matter by scraping, scrubbing, water under pressure or hot water and steam from portable steam generators is essential before any scrubbing with lye water or disinfectant is attempted. The use of lye, one can (12 ounces) to 10 to 12 gallons of water aids materially in a clean-up program. It can be applied with an old broom or brush, care being taken to keep it off one's hands and face as it is very caustic in the above percentage solutions.

Disinfectants should be used according to the manufacturer's specific directions. Do not try to improve on their recommendations by using double or triple strength because this is likely to cause an unbalance of the active chemicals.

Most creolin or cresylic disinfectants are used in a 3 to 4 per cent solution; i.e., approximately 4 ounces of disinfectant to one gallon of water or 1 gallon of disinfectant to 30 gallons of water.

Carbolineum and mite paints are not disinfectants. They are wood preservatives and mite repellants. Care should be used in their use, in that birds are not exposed to their fumes and action as carbolineum poisoning will result. Use them 2 to 3 weeks before the birds are housed to allow the material to dry thoroughly. If it is necessary to place chicks in a brooder house soon after the application of mite paints it might be advisable to start the brooder stove one or two days earlier to thoroughly dry out the material.

We know that visitors or persons who track from one premise to another can carry poultry diseases; therefore, it is advisable to keep visitors outside the range or pens. Poultry tours should be frowned upon except where street clothes and disinfected rubbers are worn and persons kept out of yards and houses.

Poultry crates should not be exchanged with neighbors or poultry meat buyers. It is good practice to have a set of crates which can be kept clean and only used on the home farm.
A neutral yard or zone should be provided for live poultry dealers, trucks and crates. Birds can then be brought to this area from the houses and ranges by the owner’s trucks and crates and put into the buyer’s crates, thus eliminating a possible avenue of infection.

If secondhand egg cases are used on a breeding farm, they should be thoroughly cleaned and fumigated before hatching eggs are placed in them.

A strict culling and a good replacement program is essential to keep a flock in the best of health. If it is desirable to introduce new blood through purchased males, buy chicks or hatching eggs so that the birds are reared with the home flock. Don’t buy cockerels in the fall unless the disease status and vaccination program of the flock is identical with the home flock.

Poultrymen should cooperate to their fullest extent with county agents, feed servicemen and the state laboratory when disease appears in their flock. Early diagnosis and a complete history is essential in combating a disease outbreak. Sick live birds should not be shipped by express as this might expose other birds, chicks or hatching eggs traveling in the same express car to possible infection.

It is much easier to prevent poultry disease outbreaks by observing some or all of our 10 points, than it is to treat them after they have occurred. Therefore, it will be of advantage to poultrymen to take every precaution possible to prevent outbreaks.

A poster outlining these 10 points, together with a score sheet, has been prepared for poultrymen and copies can be obtained if desired. We have also developed a unique KEEP OUT sign that is being used and, I think, to good advantage.

PLEASE
HELP OUR DISEASE
CONTROL PROGRAM

Do Not Enter

Essex County Poultry Association
1. **Proper Manure Disposal**
   Immediate removal to field not used for poultry and spread in thin layer. Storage pit or sheds.

2. **Proper Dead Bird Disposal**
   Use of burial pit—incinerator—or deep burying. Not left lying around or fed to pigs.

3. **Rodent Control**
   Rat proof buildings—poisoning and trapping campaigns. Feed storage on racks. Cats.

4. **Vaccination and inoculation**
   Preventive measures for fowl pox, infectious laryngotracheitis, infectious bronchitis, and Newcastle disease.

5. **Litter management**
   Deep built up litter. Agitated, no wet spots or dampness allowed to accumulate.

6. **Rearing replacements away from adults**
   At least 150 ft. distant. Separate attendants if possible. Separate over-shoes and/or clothes.

7. **Cleaning and Disinfecting**
   Annual clean-up program. Use of lye, disinfectants and mite paints. Fumigation.

8. **Visitors—Used crates, feed bags and egg cases**
   No admittance signs. Tracking on ranges. New or cleaned crates, bags and cases.

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**TEN POINTS FOR POULTRY DISEASE PREVENTION**

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Town</th>
<th>County</th>
<th>Score</th>
<th>Poor 0-4</th>
<th>Fair 5-7</th>
<th>Good 8-10</th>
</tr>
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9. Depopulation and Culling
Depopulation of pens or units in case of serious disease. Strict culling and good replacement program.

10. Early correct diagnosis if disease appears
Cooperation with diagnostic laboratory and county agents. Complete bird, egg and mortality records.

Total Score
THE IMPORTANCE OF THE VARIANT PROBLEM IN PULLORUM DISEASE CONTROL

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In 1939 Younie (1), in Canada, found that several outbreaks of pullorum disease had occurred in broods of chicks derived from parent stock which contained no reactors to the standard tube agglutination test. The following year there was an increase in the number of such breaks. These could not be explained on the basis of hatchery or farm contamination, and a retest of some of the parent stock disclosed an insignificant number of reactors. Suspicion was then directed toward the possibility that strains of *Salmonella pullorum* differing antigenically from those used in the production of antigens for routine agglutination testing of hatchery supply flocks might be responsible through failure to detect all infected carrier birds. In 1941, Younie (1) reported his investigational work and announced the isolation of an *S. pullorum* variant. This marked an important milestone in the control and eradication of pullorum disease. Younie's (1) findings have been confirmed by investigators in Canada and in the United States. The disease caused by the strain of *S. pullorum* identified by Younie has become known as Canadian, variant, or x pullorum.

Another significant development with respect to our knowledge of *S. pullorum* came in 1946 when Edwards and Bruner (2) reported to this organisation the results of their serologic studies of standard and variant strains of the organism. These investigators state that the antigenic formula of *S. pullorum* is IX, XII, XII, XII. The essential difference between the standard and variant strains is based on the form variation of Kauffman. In the case of *S. pullorum*, this involves the XI1, and XI2, antigenic factors. The variation is generally expressed as the relative amounts of these factors in a culture at a given time. Apparently the power of form variation diminishes or is lost so that cultures may become stabilized in either the standard or variant forms. The majority of *S. pullorum* cultures contain a large proportion of the XI1, factor and a minimal proportion of the XI2, factor, and are regarded as standard forms. In variant types the proportions are reversed. According to Edwards and Bruner, variant forms of *S. pullorum* do not constitute special strains but may arise from any culture by stabilization into the variant type. Since variant forms have been identified among recent *S. pullorum* isolates, smooth-rough variation apparently plays no part in their production.

The knowledge that there are standard and variant *S. pullorum* types has a practical and possibly a far-reaching significance. According to Wright (3), a testing program with antigens produced from the standard strains did not suffice to control pullorum disease in Canada. In the province of Ontario, in consequence of the use of both standard and variant type antigens, there was an increase (from 1.3 per cent in 1940 to 4.3 per cent in 1944) in the number of pullorum disease reactors among birds officially tested. Many of the reactors were completely negative to the standard antigens but positive to antigens produced from variant strains. Bacteriological examination of such birds frequently yielded variant *S. pullorum*.

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Beginning with the 1943–44 pullorum testing season, Canada has adopted a compulsory program of double-testing all breeding flocks, that is, testing with an antigen produced from the standard tube-test strains 17, 19 and 20, followed by, or in conjunction with, testing with an antigen produced from variant strains. Previous experimental work had indicated that a composite tube antigen prepared by the mixing of the two types was unsatisfactory. Despite the added burden upon the laboratories conducting the test, the program has been amply justified by the reduction in the number of pullorum disease reactors to the lowest level in 19 years of testing. Of even greater significance in this respect is the very marked reduction in the number of *S. pullorum* isolations from chicks submitted to bacteriological diagnostic laboratories.

The variant type of *S. pullorum* is not confined to Canada. In 1944, Wright (4) reported at the Northeastern Conference of Laboratory Workers in Pullorum Disease Control that he had found variants among cultures examined from 14 of the 16 Conference States. Edwards and Bruner (2), in 1946, reported that approximately $\frac{1}{2}$ of the *S. pullorum* cultures isolated in Kentucky were classified as variants. These investigators stated that the isolations were not confined to chicks from any particular hatchery, but were widely distributed. Furthermore, standard strains and variant strains were sometimes present in the same lot of chicks. In Minnesota, Pomeroy (5) has ascertained that there, too, approximately $\frac{1}{2}$ of the *S. pullorum* isolates from chicks and breeding birds submitted to the diagnostic laboratory are of the variant type. In 1947, Garland and Winter (6) reported that they had isolated *S. pullorum* from a bird in Ohio that reacted to variant but not to standard antigens.

Several years after the variant type of pullorum disease was reported from Canada, reports were received by the Bureau of Animal Industry from several States that birds were being encountered that reacted to polyvalent antigens comprised of standard and variant strains, but not to standard approved antigens. This finding led to a number of requests that the Bureau make available polyvalent antigens for official testing under the provisions of the National Poultry Improvement Plan. Evidence was not submitted, however, that these birds were infected with *S. pullorum*. The Bureau also communicated with leading poultry pathologists regarding the status of variant infection in this country. No evidence was obtained that variants were a factor in pullorum disease control. In view of the lack of concrete evidence that variant infection was a significant problem, and aware of the difficulties encountered in Canada with respect to work carried out with variant antigens, the Bureau was reluctant to approve, at that time, antigens which it was felt could cause only confusion and possibly upset the orderly and progressive advance that was being made in pullorum disease control.

In 1947, the Bureau received reports, from some of the States, of pullorum disease breaks in broods of chicks derived from parent stock which contained no reactors to the agglutination test with the standard antigens T. G. and K. Hatchery or farm contamination did not appear to be a factor in causing these losses. A retest of some of the parent stock with a commercially produced polyvalent antigen and with standard antigens frequently disclosed positive and suspicious reactions to the polyvalent antigens. Most of such reports came from Indiana, Kentucky, Minnesota, and Ohio.
In October, 1947, field investigations with respect to *S. pullorum* variant as a disease control problem were initiated by the Bureau. Veterinarians were sent to the aforementioned States to observe, under field conditions, the pullorum testing of hatchery supply flocks in which variant pullorum had been reported. In each State birds were found that failed to react to T. G. or K. antigens, but gave positive or suspicious reactions to antigens comprised of standard and variant strains. Accordingly, 117 of such birds were purchased and shipped to the U. S. Animal Disease Station at Beltsville, Maryland for retesting with a variety of antigens and for postmortem examination.

Of the 117 birds in the experimental variant flock, 75 have been subjected to bacteriological examination. *S. pullorum* was recovered from 26 of the 75; *S. gallinarum* from one. Of 16 recovered isolates submitted for typing, 15 were classified as variants. The isolation of the organism from only 26 of the 75 birds designated as reactors by means of the agglutination test represents a rather low percentage of recoveries. Many of the birds, however, gave only weak or partial reactions. With a single exception, the birds from which *S. pullorum* was isolated exhibited strong reactions. The failure of 49, or about 65 per cent, of the birds to reveal *S. pullorum* on autopsy may be an indication that variant or polyvalent antigens appear inclined to yield nonspecific reactions.

In a comparable investigation of the variant problem, Edwards and co-workers of the University of Kentucky (7) found that of 39 hens which reacted to polyvalent whole-blood antigens but not to standard antigens, 18 yielded *S. pullorum* on bacteriological examination. All recovered isolates were of the variant type. These investigators state, "it seems probable that all birds which react to polyvalent antigens as they are now prepared are not carriers of *S. pullorum*.”

There is thus ample evidence that there are breeding birds in our hatchery supply flocks that are carriers of the variant type of pullorum disease. The extent of such infection is not known. It does, however, appear to be much greater in some regions than in others, particularly in the Midwestern States from which most of the trouble thus far has been reported. It was disclosed at a recent conference of laboratory workers in pullorum disease that in the New England States variant infection does not appear to constitute a serious problem at this time.

The results of a recent survey, conducted by the Bureau, of testing methods used to detect pullorum disease disclosed that variant or polyvalent antigens are used in only 10 States. The extent of infection with variant pullorum in these States ranged, according to the survey, from "a few questionable birds to 65 per cent of the flocks." The survey also revealed that in only 2 States (Minnesota and Kentucky) are all *S. pullorum* isolates routinely typed to differentiate between standard and variant forms. The real distribution of variant infection is thus known in only 2 States.

On the basis of our present knowledge, variant infection is a factor that must be considered in pullorum disease control work. It is evident that by the use of the standard antigens alone we fail to remove all carriers of *S. pullorum* from certain flocks. The Bureau of Animal Industry has officially recognized this fact and is now approving individual lots of polyvalent antigens for pullorum testing under the provisions of the National Poultry Improvement Plan. Evidence thus far
submitted with respect to the importance of the problem does not justify abandon-
ment of the standard antigens in favor of polyvalent antigens. The evidence
does indicate, however, the desirability of the use of polyvalent plate antigens or
variant tube antigens whenever there is reason to suspect the presence of the variant
type of pullorum infection.

REFERENCES
   Workers in Pullorum Disease Control, 1944.
   38: 257, (1948).
REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY


The year 1948 has witnessed notable advances in the study and control of transmissible diseases of poultry. Among the outstanding events the practical application of the knowledge on pullorum variants and the advent of live Newcastle virus vaccination are discussed in preceding papers. This report aims to present a brief review of progress in the field of transmissible diseases of poultry during the current year.

PULLORUM DISEASE

It appears to be the consensus of opinion that sulfonamides decrease the rate of mortality in chicks and poults (Roberts et al., 1948) (Pomeroy et al., 1948) but fail to influence the disease in adult birds (Geurden, 1948). The presently used test and slaughter program remains to be the control method of choice.

Statistics. Through the courtesy of Dr. L. C. Heemstra (1948), Veterinary Coordinator, National Poultry Improvement Plan, Washington, D. C., data were obtained on the progress of the national pullorum eradication program.

The number of chickens officially tested during the five year period 1943 to 1947 amounted to over 132 million with a decreasing percentage of first test reactors from 2.3 to 1.18; the corresponding figures for turkeys were 8.8 million with a decrease in per cent reactors from 2. to 0.75. The details are presented in table 1.

Hatchery participation in the National Poultry Improvement Plan increased almost consistently during the last five fiscal years 1943/44 to 1947/48 from 3,080 to 4,378 while the approximate percentage of hatchery classification changed during the same period for U. S. pullorum tested from 65 to 15 per cent, for U. S. pullorum controlled from 24 to 51, for U. S. pullorum passed from 2 to 18, and for U. S. pullorum clean from 9 to 16 per cent. Although comprehensive figures for participating and nonparticipating hatcheries are not available, the data presented indicate the remarkable progress of the program. The details are presented in table 2.

Bacteriology of reactors. Since the confirmation of serologic reactors by the isolation of Salmonella pullorum forms the basis for the classification of a flock in the National Poultry Improvement Plan, the need is obvious for the standardization of postmortem bacteriology of reactors. A committee to study this problem has been appointed at the 1948 Meeting of the Northeastern Conference of Laboratory Workers in Pullorum Disease Control. In a recent study of 102 bacteriologically confirmed reactors by Burr et al. (1945b) the causative organisms were obtained from single organs in 65 cases (63.7%), among them from ovary in 33 and gall bladder in 19 cases, and from more than one organ in 37 cases (36.3%). Edwards

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et al. (1948a) likewise found the gall bladder, either alone or in combination with other organs, to yield the organism in about one half of serologic reactors.

**Fig. 1.**—Official control of Pullorum disease, in chickens, in the United States

**Variant problem.** Basic information on form variation in Salmonella pullorum has been presented previously to this Association by Edwards and Bruner (1946). In continuing these studies on field specimens Edwards et al. (1948a) pointed out
that the standard whole blood test may be unsatisfactory to eliminate reactors if
variant pullorum strains have become established in the flock. Of 39 hens reacting

with polyvalent but not standard whole blood antigen, 18 yielded \textit{S. pullorum}, all
of the variant type. The occurrence of variant strains has been confirmed in several
states, for example Connecticut to the extent of 6.8% in serologic reactors and

\textbf{TABLE 1.---Chickens and turkeys officially tested for pullorum disease, number
and percentage of reactors, 1943-47}

| YEAR BEGINNING JULY | STATES REPORTING
<table>
<thead>
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<tbody>
<tr>
<td></td>
<td>NUMBER REPORTING</td>
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<tr>
<td></td>
<td>CHICKENS TESTED</td>
</tr>
<tr>
<td></td>
<td>REACTORS</td>
</tr>
<tr>
<td></td>
<td>STATES REPORTING</td>
</tr>
<tr>
<td></td>
<td>TURKEYS TESTED</td>
</tr>
<tr>
<td></td>
<td>REACTORS</td>
</tr>
<tr>
<td>1943</td>
<td>47</td>
</tr>
<tr>
<td>23,817,732</td>
<td>547,039</td>
</tr>
<tr>
<td>2.30</td>
<td>35</td>
</tr>
<tr>
<td>982,269</td>
<td>19,609</td>
</tr>
<tr>
<td>2.00</td>
<td>11.55</td>
</tr>
<tr>
<td>1944</td>
<td>47</td>
</tr>
<tr>
<td>21,098,026</td>
<td>422,900</td>
</tr>
<tr>
<td>2.00</td>
<td>38</td>
</tr>
<tr>
<td>1,839,143</td>
<td>34,242</td>
</tr>
<tr>
<td>1.86</td>
<td>14.83</td>
</tr>
<tr>
<td>1945</td>
<td>47</td>
</tr>
<tr>
<td>27,003,930</td>
<td>495,644</td>
</tr>
<tr>
<td>1.84</td>
<td>41</td>
</tr>
<tr>
<td>2,768,838</td>
<td>40,454</td>
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<tr>
<td>1.46</td>
<td>19.609</td>
</tr>
<tr>
<td>1946</td>
<td>47</td>
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<tr>
<td>30,329,608</td>
<td>543,194</td>
</tr>
<tr>
<td>1.79</td>
<td>41</td>
</tr>
<tr>
<td>2,031,583</td>
<td>24,552</td>
</tr>
<tr>
<td>1.22</td>
<td>9.469</td>
</tr>
<tr>
<td>1947</td>
<td>47</td>
</tr>
<tr>
<td>29,912,918</td>
<td>353,975</td>
</tr>
<tr>
<td>1.18</td>
<td>40</td>
</tr>
<tr>
<td>1,257,368</td>
<td>9.469</td>
</tr>
</tbody>
</table>

\textbf{TABLE 2.---Summary of hatchery participation in the National Poultry
Improvement Plan, 1943-44 to 1947-48, inclusive
(Preliminary for 1947-48)}

<table>
<thead>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Hatcheries</td>
<td>3,080</td>
<td>3,181</td>
<td>3,952</td>
<td>4,496</td>
<td>4,378</td>
</tr>
<tr>
<td>Hatching Egg Capacity</td>
<td>189,756,009</td>
<td>206,259,311</td>
<td>269,452,943</td>
<td>325,633,235</td>
<td>326,444,880</td>
</tr>
<tr>
<td>Per cent Increase or Decrease</td>
<td>+12.9</td>
<td>+3.3</td>
<td>+24.2</td>
<td>+13.8</td>
<td>-2.67</td>
</tr>
<tr>
<td></td>
<td>+27.0</td>
<td>+8.7</td>
<td>+25.7</td>
<td>+25.5</td>
<td>+.25</td>
</tr>
<tr>
<td>U. S. Pullorum-Tested</td>
<td>No.</td>
<td>1,552</td>
<td>1,360</td>
<td>1,253</td>
<td>1,044</td>
</tr>
<tr>
<td></td>
<td>Cap.</td>
<td>123,752,805</td>
<td>118,528,979</td>
<td>107,802,209</td>
<td>91,989,623</td>
</tr>
<tr>
<td></td>
<td>Per.</td>
<td>65.22</td>
<td>57.47</td>
<td>41.55</td>
<td>28.25</td>
</tr>
<tr>
<td>U. S. Pullorum-Controlled</td>
<td>No.</td>
<td>782</td>
<td>971</td>
<td>1,505</td>
<td>1,880</td>
</tr>
<tr>
<td></td>
<td>Cap.</td>
<td>45,899,483</td>
<td>58,573,200</td>
<td>105,374,650</td>
<td>159,111,585</td>
</tr>
<tr>
<td></td>
<td>Per.</td>
<td>24.19</td>
<td>28.40</td>
<td>40.62</td>
<td>48.86</td>
</tr>
<tr>
<td>U. S. Pullorum-Passed</td>
<td>No.</td>
<td>106</td>
<td>180</td>
<td>374</td>
<td>576</td>
</tr>
<tr>
<td></td>
<td>Cap.</td>
<td>3,557,007</td>
<td>8,649,496</td>
<td>19,501,590</td>
<td>36,294,307</td>
</tr>
<tr>
<td></td>
<td>Per.</td>
<td>1.87</td>
<td>4.19</td>
<td>7.55</td>
<td>11.15</td>
</tr>
<tr>
<td>U. S. Pullorum-Clean</td>
<td>No.</td>
<td>640</td>
<td>670</td>
<td>820</td>
<td>998</td>
</tr>
<tr>
<td></td>
<td>Cap.</td>
<td>16,546,714</td>
<td>20,507,636</td>
<td>26,684,494</td>
<td>38,237,820</td>
</tr>
<tr>
<td></td>
<td>Per.</td>
<td>8.72</td>
<td>9.94</td>
<td>10.28</td>
<td>11.74</td>
</tr>
</tbody>
</table>
23.8% in diagnostic specimens (Burr et al., 1948a), Kentucky 33% (Heemstra 1948), Michigan 15% (Bivins 1948), and Minnesota 33% (Heemstra 1948).

A survey of official testing methods conducted by the Bureau of Animal Industry disclosed that both standard and variant strain antigens were used in 10 states, which reported an apparent variant incidence from few to 65% while routine typing of *Salmonella pullorum* isolations was conducted in only two states (Kentucky and Minnesota). A National Poultry Improvement Plan Committee on Standardization of Antigens recommended the continued use of the present official pullorum strains and the additional use of variant antigen in states known to have variant infection (Heemstra, 1948).

**Other salmonella infections.** Edwards et al. (1948b) studied 6387 paratyphoid cultures isolated from 4245 avian outbreaks, as to type and species distribution. The mortality produced by various types—60 in all—varied from 5 to 100 per cent. There was no definite correlation of mortality with the type involved except that *S. typhi-murium*, *S. oranienburg*, *S. montevideo*, *S. bareilly*, and *S. newport* were associated with higher mortality than other types. *Salmonella pullorum* comprised 50 per cent of the cultures. Of the remaining ones *S. typhi-murium* made up about 22 per cent for all species, but 48 per cent for turkeys alone. Organisms of group C prevailed in chickens to the extent of 44, in turkeys of 14, per cent. Two or more salmonella types were found in the same flock in 165 instances, in individual birds in 51 instances. According to the authors the bacteriologic examination should include cultures on intestinal scrapings or feces in 1:100,000 brilliant green tetrathionate-broth followed by plating on brilliant green-phenol red agar.

**THERAPY**

Advances in chemotherapy and antibiotic treatment are of interest to this Association, particularly with respect to their ultimate epizootiologic implications. Failure of sulfonamides to eradicate pullorum disease has already been cited.

Fowl cholera and anatipestifer infections in ducks have been treated successfully with sulfamethazine or chlorosulfadiazine either in the feed or provided as the sodium salt in the drinking water, according to Hilbert and Kiser (1948). In four Illinois outbreaks of fowl cholera in turkeys, Alberts and Graham (1948a) observed mortality from 17 to 68 per cent and considered (Alberts and Graham 1948b) 0.5 per cent sulfamerazine in the feed to be an effective treatment, without however, preventing the recurrence of the disease in affected flocks. McNeil and Hinshaw (1948) found streptomycin to be inhibitory *in vitro* of fowl cholera organisms in concentrations of 1 microgram per ml. Mortality of experimentally infected turkeys was prevented by 25000 micrograms per kilo body weight, if given before or at the time of inoculation while delay of treatment resulted in joint-involvement and carriers.

Coccidiosis in chickens could be controlled effectively in lots of about 10,000 birds by continuous all-mash feeding of sulfaquinoxaline at the rate of 0.0125 per cent, according to Grumbles et al. (1948). If raised on dirty litter the mortality was 0.84 per cent, on clean litter 1.20 per cent, in comparison with 17.42 per cent for nonmedicated controls. Drug concentrations of 0.01 to 0.02 per cent in the food did not influence growth rate and feed efficiency of chicks in the experience of Singsen et al. (1948).
TURKEY SINUSITIS

Although turkey sinusitis has been known as an infectious and transmissible (Hart, 1940) disease of world wide occurrence and economic importance, its etiologic resolution has not been in sight until recently.

In 1944, Minard and Jungherr reported the isolation of an apparently new agent from a case of air sac infection in turkeys. Bacteriologically sterile material injected into chicks or poults by the intramuscular or intracerebral route induced a condition characterized by depression and torticollis after about 11 days, by gross enlargement of the spleen and microscopically by reticulocytic foci in the liver and endarteritis and secondary malacia in the brain. The agent could be propagated on the chorioallantois and in the yolk sac of developing chicken embryos. In 1948, Groupé, Winn and Jungherr isolated an agent from a case of turkey sinusitis which could be propagated in the yolk sac, where it produced in later passages, lymphogranuloma-psittacosis-like bodies, was nonfilterable except through Berkefeld V candles, and was capable of reproducing turkey sinusitis, followed by air sac infection. Injection of the sinusitis agent into chicks produced the same basic pathology as the agent previously isolated from air sac infection (Jungherr, 1948). Delaplane (1948) isolated a virus from a chronic respiratory disease in chickens which when injected into mature turkeys, produced sinusitis and central nervous system disturbance.

Jerstad and Hamilton (1948) considered the causative agent a virus which could be cultivated in developing chicken eggs, was occasionally present in the eggs of affected turkey hens; chickens, pheasants and mice proved refractory. Hitchner (1948) passaged a sinusitis agent through 22 generations of 11-day-old embryonating chicken eggs. It induced distention of sinuses, enlargement of Harder's gland, partial consolidation of lungs, and caseous air sac infection.

Beaudette and Hinshaw (1948) likewise indicated the isolation of a virus-like agent.

Prier and associates (1948) studied a respiratory disease of turkeys characterized by inflammation of the trachea and the thoracic air sacs, which could be passaged intranasally in poults and chicks and in embryonating eggs. The agent did not pass Seitz-EK pad but two of three Berkefeld N filtrates were active.

While all these reports are of a preliminary nature, isolations of nonbacterial etiologic agents related to turkey sinusitis have now been reported by seven experiment stations, namely California, Connecticut, Illinois, New Jersey, Rhode Island, Virginia and Washington. Comparative studies are urgently needed.

According to present knowledge the following criteria should be helpful in establishing similarities and differences among the various agents observed: 1) Growth in extraembryonic membranes or cavities; 2) regular filterability through Seitz EK and Berkefeld N filters; 3) ability to produce lymphogranuloma-psittacosis-like bodies in yolk sac membranes; 4) transmissibility to chicks by nasal and/or parenteral routes; and 5) specific microscopic pathology in chicks and poults.

NEWCASTLE DISEASE

Deviation from the usually nonfatal character of the disease in adult birds was reported in Southern New Jersey by Goldhaft and Wernicoff (1948), who observed
an outbreak in 25 pullet flocks, associated with hemorrhagic tracheitis and a mortality of 3620 out of 59753 birds.

The importance of airborne transmission of Newcastle disease was emphasized by the recovery of the causative virus from poultry house dust, in studies of DeOme and associates (1948).

Formalin fumigation of incubators, as recommended in the control of pullorum disease, was found quite effective in destroying Newcastle virus in studies by P. D. Beamer and A. K. Sutherland, according to Graham (1948).

In the serologic diagnosis of Newcastle disease the yolks of unincubated eggs were found to be suitable for hemagglutination-inhibition tests after extraction with certain fat solvents, by Schmittle and Millen (1948).

Virus isolation from respiratory exudates was facilitated by the use of antibiotics (1948a) and succeeded from spleen in 50%, from brain in 19.6%, and from respiratory tract exudate in 31.25%, of the cases studied (1948b) by Beaudette and associates.

Systemic pathogenicity of Newcastle disease virus to man was suggested by the work of Howitt and her associates (1948). The "Newcastle disease syndrome", according to these authors, was associated in children with poliomyelitis-like symptoms of short duration without residual paralysis, and in adults with influenza-like symptoms of sudden onset and short-duration, accompanied by fever, vomiting, headache, chill and general malaise. Affected persons usually gave a history of association with chickens and showed a significant rise in neutralizing antibodies for Newcastle virus, but not for other known neurotropic viruses. Although the causative agent was not isolated the authors entertained the possibility of airborne spread of Newcastle virus from fowl to man and man to man.

The principal advances have been made in the field of immunization and have progressed to the point that at present 3 killed and 3 live commercial Newcastle vaccines are available under limited licenses.

Schoening et al. (1948) reported a recent field trial with formalin-inactivated commercially produced Newcastle virus vaccine, on 37,000 broiler chicks, using an additional 20,000 as unvaccinated controls. The results indicated that vaccination did not entirely prevent the disease but enabled the birds to withstand a severe infection with relatively small losses as compared with the unvaccinated controls. In this instance vaccination allowed the owner to make a profit whereas the unvaccinated controls were a financial loss.

Live Newcastle virus vaccine, modified by adaptation to hamsters (1948a) was shown to reduce mortality from subsequent challenge, as compared with that of unvaccinated controls, by Reagan et al. (1948b).

In a comparative field vaccination study in Palestine of the Mukteswar strain modified by serial passage in embryonating chicken eggs, and the Haifa strain modified by serial passage in duck eggs, Komarov and Goldsmit (1947) found the latter to cause a much milder reaction and nervous involvement in only 0.05 per cent, as compared with 4.6 per cent for the Mukteswar strain.

A live virus vaccine obtained by duck embryo passage of the Massachusetts MK-107 strain of Newcastle virus was tested in laboratory experiments by Clancy et al. (1948). This vaccine applied by wing-web puncture was well tolerated by
birds of four weeks or older and enabled the birds to withstand intramuscular challenge with relatively large doses of virulent virus two weeks following vaccination. In field trials with the same vaccine by Markham et al. (1948) on about 32,000 birds and 5000 controls no evidence was obtained of a higher mortality among unvaccinated contacts than vaccinated birds, but following vaccination hemagglutination-inhibition tests became strongly positive and representative groups of birds withstood 10,000 MLD of challenge virus 5 to 6 weeks later.

Immunization with live Newcastle virus of low chicken-pathogenicity, applied by wing-web puncture, was first reported in this country by Van Roekel and his associates (1948). Almost all birds exhibited “takes” at the site of inoculation on the 4th and 5th day post-vaccination. Respiratory symptoms were not noted and only one case of nervous involvement was recorded among 11,642 vaccinates. Immature birds showed a slight decline in feed consumption, laying birds an adverse effect on egg production, as in a natural outbreak. These workers suggested the feasibility of combining Newcastle and fowl pox viruses for simultaneous vaccination by the stick method. Beaudette and coworkers (1948c) selected one vaccine strain from among 105 strains screened on the basis of causing very low morbidity and mortality on intramuscular injection of 5-week-old chicks. In the laboratory so vaccinated birds were resistant to challenge with virulent virus. Field trials were conducted with this vaccine virus, by applying it intramuscularly at the rate of 0.2 ml. of a 1:100 dilution of chorioallantoic fluid, to a total of about 65,000 birds. Vaccination at the age of 4 to 9 weeks, averaging 5 weeks, resulted in reduced feed consumption for about two days beginning with the third to fifth day post-vaccination. Occasionally a few birds exhibited mild respiratory symptoms, losses from death and paralysis incident to injection have been about 1 per cent. Vaccination of laying birds at the beginning of production caused drop in egg production within 5 to 8 days and return to production in 14 days, while higher production at time of vaccination was followed by greater and longer depression of production.

While these reports give rise to justifiable optimism for the ultimate control of Newcastle disease by immunization, insufficient time has elapsed since the introduction of the new Newcastle virus vaccines to permit a long range appraisal of their efficacy. Under practical conditions a problem of misuse, through attempts at stretching dosages further than specified on the label, has already been brought to the attention of the Committee (Rosenwald, 1948). While it has been true that dosages on fowl pox vaccines referred to the feather follicle method and permitted vaccination of a greater number of birds than stated, by the stick method, a similar calculation with Newcastle vaccines could lead to disastrous results and should be vigorously cautioned against.

REFERENCES


TRANSMISSIBLE DISEASES OF POULTRY


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REPORT OF COMMITTEE


REPORT OF THE NOMINATING COMMITTEE

PRESIDENT KNAPP: Dr. Wilkins will make the report of the Nominating Com-
mittee.

DR. WILKINS: Your Nominating Committee after considerable deliberation
makes the following report: Dr. T. O. Brandenburg, President; Dr. C. P. Bishop,
First Vice President; Ferd E. Mollin, Second Vice President; C. E. Fidler, Third
Vice President. Mr. Chairman, I move that the names of men just read be placed
in nomination.

Dr. Smith: Mr. Chairman, I move that the report be accepted and that our
Secretary be instructed to cast one ballot for the officers as nominated and read by
the Chairman of our Nominating Committee.

PRESIDENT KNAPP: Dr. Smith, it is the usual custom to ascertain whether there
are other nominations, so I will declare you out of order and ask if there are nomi-
nations from the floor. There appear to be none. Your motion, if you make it,
will be accepted.

DR. SMITH: I move that our Secretary be instructed to cast one ballot for the
list of officers as nominated.

... The motion was seconded ...

PRESIDENT KNAPP: It has been moved and seconded that the Secretary cast the
unanimous ballot for the officers as reported by the Nominating Committee. All
in favor of that motion sign by the usual sign. (ayes) Opposed? (no response)
It is unanimous. Mr. Secretary, will you cast the unanimous ballot for the officers
as reported?

SECRETARY HENDERSHOTT: As instructed by the house it is my privilege to cast
the unanimous ballot of this Association for the election of the following men to
their respective positions which I do at this time: For President, Dr. T. O. Branden-
burg, North Dakota; for First Vice President, Dr. C. P. Bishop of Harrisburg,
Pennsylvania; for Second Vice President, Ferd E. Mollin of Denver, Colorado;
and for Third Vice President, C. E. Fidler, State Veterinarian of Illinois.

PRESIDENT KNAPP: Thank you, Mr. Secretary. Will Dr. Brueckner please es-
cort the President to the stand? Dr. Green, will you lead the neophyte president
to the stand?

Is Mr. Mollin in the room? Is Dr. Fidler in the room? It now becomes
my particular privilege to charge these gentlemen with their duties and re-
sponsibilities for the ensuing year. To this man on my right, who stated last year
that he would stand by to come here in the event of my sickness or death, I ap-pre-
ciate the offer of service that this man extended. It has been by the grace of Our
Lord above that I was able to come and be here and take part for which I am very
thankful. To you, Dr. Brandenburg, President-Elect, I charge you with accom-
plishing the duties of carrying on the activities of this Association to the best of
your ability. You have a responsible position with reference not only to this Asso-
ciation but to the industry which this Association serves in these United States and
our neighboring country, Canada on the north, our possessions, and perhaps we can
extend to our neighbor on the South, Mexico. Yours will be the job and the oppor-
tunity and responsibility of leading this Association in its thinking and in its policies,
and in its actions in what it accomplishes during the coming year. I know you can
do that. I know you will obtain a great measure and satisfaction in it.
It is something that you will treasure. It is something that will give you some trouble in time and effort to accomplish. I present to you gentlemen your President for the ensuing year, Dr. T. O. Brandenburg of North Dakota. Dr. Brandenburg.

Dr. Brandenburg: Thank you, Dr. Knapp. In going over the records of this Association I find that North Dakota seems to have the unique presidential background that Ohio has in selecting Presidents for the United States. I notice, as I told you last year, that Dr. Brown, who unfortunately had to serve this Association for two terms, later on Dr. VanNess, now of Lincoln, Nebraska, became Chairman of this organization I believe later on Dr. Shaw. I feel rather humble beside these men who have served before me and represented my State, and I feel very grateful to you gentlemen for this honor.

However, with our good Secretary here I feel that we at least can do our best to carry on the policies and the high standards that this Association has set. Thank you.

President Knapp: Thank you, Dr. Brandenburg. I know that the Association will go ahead and do a magnificent job. This gentleman over here, a portly fellow from Pennsylvania, is Charlie Bishop. He is a Dutchman and a good scout. It will be his duty to support the President in all of his responsibilities. He will be here as my friend was here to back me up. He will be here to back Dr. Brandenburg. This is a responsible type of gentleman as you all know. He is built like a percheron, and he can take a lot of responsibility. So, he should be on a lot of committees where he can assist the President. It gives me considerable pleasure to present to you Dr. Bishop as your First Vice President. Dr. Bishop.

Dr. Bishop: Thank you, Dr. Knapp. I sincerely appreciate this honor to serve as First Vice President of this Association, and I know it will be not only a pleasure but a real privilege to assist the President and to serve with the other officers of the Association to promote the best interest of the organization, and I would like to say that we have had a grand convention, and we all appreciate the efforts put forth by our President and our good Secretary and our Local Committees and especially Dr. Gow and all those who had a part in making this convention a success. We have had a grand time, and it was very profitable and pleasant, and we will see you at Columbus next year. Thank you.

President Knapp: Thank you, Dr. Bishop. I am the only fellow that is not serious any more. I again want to tell you chaps that I have thoroughly enjoyed this experience. It has been a pleasure. It has been a lot of hard work and a lot of times we didn’t know what was going to happen, not as it was yesterday but a lot of other ways. There is nothing that is so past president as a past president, and there is just a word between that past and myself at the moment. Is there any other business to come before this meeting? I present you then your President for this year, Dr. T. O. Brandenburg.

President-Elect Brandenburg: Gentlemen, I didn’t know that I would have to make two speeches, and I haven’t got the second one prepared. However, I want to assure you that I will be very humble, and I only hope that we will have as good a time at Columbus next year as we have had at Denver.

If there is no other business to come before the Association, you may stand adjourned. Thank you.
FIFTY-THIRD
ANNUAL MEETING

NEIL HOUSE
Columbus, Ohio
October 12, 13, 14, 1949