PROCEEDINGS
Thirty-ninth Annual Meeting
of the
United States Live Stock Sanitary Association

HOTEL LA SALLE, CHICAGO, ILL.
December 4-6, 1935
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United States Live Stock Sanitary Association

Reprint from Journal of the American Veterinary Medical Association,

HOTEL LA SALLE, CHICAGO, ILL.

December 4-6, 1935
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WEDNESDAY MORNING, DECEMBER 4, 1935

The opening session of the thirty-ninth annual meeting of the United States Live Stock Sanitary Association, held at the Hotel La Salle, Chicago, Ill., December 4-6, 1935, convened at 11:00 a.m., Dr. Edward Records, Reno, Nevada, president of the Association, presiding.

PRESIDENT RECORDS: The thirty-ninth annual meeting of the United States Live Stock Sanitary Association will please come to order.

The Chair will entertain a motion to suspend the regular order of business so we may proceed as per the printed program with such variations as are necessary; or, if there are no objections, we will proceed without a motion.

We are honored this morning, by having with us Dr. Paul R. Cannon, of the University of Chicago, who will address us in an illustrated talk on "Some Recent Trends in the Study of the Mechanisms of Immunity." (Applause.)

. . . Dr. Cannon read his prepared address. . . . (Applause.)

SOME RECENT TRENDS IN THE STUDY OF THE MECHANISMS OF IMMUNITY

By PAUL R. CANNON, Chicago, Ill.

Professor of Pathology, The University of Chicago

Infectious disease has been aptly likened to warfare in that the contenders are engaged in a biological conflict, the result of which depends upon the relative superiority of invader or invaded. In acute septicemia, for example, the outcome is decided quickly either by the overwhelming virulence of the invaders or the marked superiority of the defensive mechanisms. Such an engagement may be thought of as a short but decisive skirmish. In chronic disease, such as tuberculosis, syphilis or leprosy, on the other hand, the slow but persistent aggression of the invaders occasions a more prolonged struggle with in-
tervening periods or remission or truce. In either type of infection the struggle advances or recedes from time to time and the battlefields change correspondingly from place to place. In periods of apparent superiority of the invaders, the entire body is the battle front, as in typhoid fever, undulant fever or streptococcic septicemia; when resistance is higher, local organs are the most active sectors, as in carbuncle, mastitis or pneumonia. The big problem in infectious disease is to determine the nature and significance of these changing elements of the host-parasite relationship.

Knowledge of general principles of infectious disease has developed along broad lines. In the earlier stages, etiological agents were diligently searched for and, when discovered, were classified as to form and function. A little later, their abilities to enter the body and establish a foothold were examined. This knowledge soon stimulated study of the biological reactions which restrain bacterial growth or tend to mitigate its harmful effects. As information concerning invader and invaded accumulated; application was rapidly made to the immediate problems of prevention and cure of infectious disease. The summation of these general methods of approach has eventuated in the remarkable advances of the past few decades, yet the need for more information is strikingly revealed in the program of this very meeting with its emphasis on Bang's disease, transmissible diseases of swine, control of tuberculosis, etc. I have chosen as the main theme of my paper, therefore, the subject of some recent trends in the study of general mechanisms of immunity.

I restrict the discussion in this way because the scope of the subject prevents emphasis on many phases at a time. Although it is unfortunate that one must approach a broad problem in a limited way, this restriction is not a serious matter if one keeps informed of advancing knowledge all along the line. There are many active trends in the study of the mechanisms of immunity at the present time and unusually satisfactory progress is being made along certain lines. I refer particularly to the problems of immunological specificity, chemistry of antigens, the general nature of antigen-antibody reactions, the mechanism and significance of bacterial dissociation, the nature of the immunology of parasitic infections, etc. The newer knowledge of these processes is throwing broad beams of light into many of the obscurities of infectious disease as a whole.

The phase of the subject which I shall discuss this morning may be thought of as the anatomical or morphological approach
to immunology. The morphological analysis of disease, by providing a clearer picture of the elements involved, helps to suggest a way or ways whereby the harmful effects of infection may, to some extent, be modified or controlled.

The similarity of infectious disease and warfare suggests that, just as the topographical study of battlefields is useful to the military tactician, so is the morphological study of the tissues in the biological conflict of value to the student of disease. Analysis of battlefields with consideration of both their strong and weak points has played an important rôle in the development of military theory. This method, although well adapted to single battlefields, is not so suitable for battlegrounds, over which armies have fought and refought. Modern tacticians, therefore, utilize experimental manoeuvres or "war games," thus analyzing the offensive and defensive potentialities of the military terrain with the manoeuvres in progress. The biological battlefields may similarly be studied and the defensive potentialities of various organs or tissues observed during or at the end of an infection. This is the purpose of the necropsy, whereby the organs most affected are examined in an attempt to evaluate the relative importance of the different defensive elements of the biological conflict. This method becomes less useful when the prolonged struggle of chronic disease has left the battlefield hopelessly scarred. The more modern way of studying the changing processes in the earliest stages is by the experimental production of infectious disease in normal and immune animals in order that the affected tissues may be examined pathologically. By this method, particularly, much valuable information has been secured.

The defensive reactions may be observed in at least two ways: (1) through the experimental production of generalized infections by injecting living bacteria into the blood-stream and determining the fate of the microorganisms in the body as a whole, or (2) by the production of local infection in both susceptible and immune animals, with sequential pathologic examination of the infected tissues. I shall now describe a few of the facts brought out by this kind of approach and shall then attempt to analyze the mechanism of the phenomena. The sequence of events in experimental bacteremia is as follows: (1) Living bacteria, when introduced into the blood-stream of a normal animal, soon leave the blood and become concentrated in certain organs. This happens regardless of microbial virulence, although it is probably less rapid and complete with the more virulent varieties.
If the animal is insusceptible to the microorganisms injected, the latter are soon destroyed. Pathological examination points to the liver and spleen as the two organs most responsible for the phenomenon of bacterial blood clearance. This fact is generally admitted and can be easily verified by determining the simultaneous germ content of different organs of the same animal after intravenous injection of living microorganisms. (2) Living bacteria, when injected intravenously into immune animals, leave the blood more rapidly and are destroyed more quickly in the liver and spleen. This fact also has been determined by several groups of observers. It is evident, therefore, that immunization heightens the efficiency of the body as a whole in ridding the blood-stream of infectious agents, and increases the bactericidal potency of certain organs. Morphological examination helps to explain some of the phenomena observed.

The reasons for these varying localizing potentialities of organs become clearer when the problem is approached from the pathologic point of view. Its solution may be indicated in a preliminary way by the artificial device of vital staining. This consists in the intravenous injection into normal animals of so-called vital dyes such as trypan blue, carbon, etc., with subsequent observation of the fate of the dye particles. These particles resemble many of the common types of pathogenic bacteria, particularly in size, and may appropriately be thought of as artificial bacteria. As they leave the blood-stream, they color the organs which remove them from the blood, thus enabling one to observe the organs most effective in this respect. Only two organs, the liver and the spleen, are conspicuous in removing the particles of vital dye; many organs remain practically colorless unless enormous amounts of dye are injected. It becomes of interest, therefore, to determine the cause of this selective activity of organs and tissues in the removal of particles from the blood-stream.

The anatomical approach to the problem provides a rational answer. The liver and spleen differ from other organs in two important particulars; first, their type of blood supply, by means of so-called sinusoids through which the blood flows slowly through dilated spaces and, second, the macrophage lining of these sinusoids. This combination of slow blood flow and abundance of phagocytic cells provides conditions optimal for phagocytosis as foreign particles run a veritable gauntlet in their slow passage through these spaces.

Bacteria in the blood-stream, whether living or dead, are similarly engulfed by the phagocytes of these organs. It is also
significant that in actual septicemia the liver and spleen are the
two organs most likely to show hyperplasia or parenchymatous
degeneration. In military parlance, therefore, the liver and
spleen are the two most active sectors of the battle front.

In contrast to the marked localizing potentialities of the liver
and spleen is the lack or any notable tendency of other organs
and tissues to become infected during a generalized blood-stream
invasion. Why is it that hematogenous thyroiditis, pancreatitis,
meningitis or encephalitis are so uncommon? In septicemia,
countless numbers of bacteria circulate through many or all
organs or tissues of the infected body. Some biological device
evidently exists whereby vital organs and tissues are protected
from the usual hazards of generalized infection. Here again,
vital staining suggests a clue in pointing out the true nature of
the endothelial wall of blood-vessels.

Vital staining, be it recalled, affects but a few organs and
tissues, and the ordinary endothelium of capillaries, veins and
arterioles is singularly unaffected under the usual conditions of
blood flow. Histological examination suggests the probable
reason. The ordinary endothelial cell is a flat, squamous element
with an elongated nucleus and a scanty amount of cytoplasm. It
is difficult to see how such a cell could be particularly phagocytic
even under favorable circumstances, and these do not exist be-
cause of the rapid circulation of blood through the capillaries.
This endothelium, however, interposes a living cellular barrier
between the circulating blood and the surrounding tissues, a
blood-tissue barrier as effective under some circumstances as a
concrete wall on a battle line. This barrier, although im-
permeable to bacteria, allows oxygen and carbon dioxide, nutri-
tive materials and metabolic waste products to pass back and
forth. The tissues are nourished, therefore, while being pro-
tected against passing infection, and bacteria in the blood may
continue to circulate until, upon passing through the liver and
spleen, they are removed, and if not too virulent are eventually
destroyed.

What a marvelous device for shielding the vital organs from
infection, and yet how simple in form! Imagine what might
happen if conditions were otherwise and ordinary endothelium
were highly phagocytic. Potentially pathogenic bacteria enter
the blood-stream not infrequently and pass, presumably, through
many organs. If ordinary endothelium were highly phagocytic,
bacteria would no doubt frequently be removed by endothelial
cells in many vital organs and would, at times, continue to grow
either into the vessel lumen or into the surrounding tissues. If such were the case, symptoms of encephalitis, meningitis, pancreatitis, myocarditis and the like would surely be much more common than they are.

It is obvious, however, that no anatomical system is completely effective under all conditions, and disturbance of the normal integrity of tissues, as by trauma, vascular spasm or toxic injury may make the blood-tissue barrier imperfect. Furthermore, infected emboli in the blood-stream may lodge and be followed by bacterial growth through the endothelial barrier. Thus one may explain the metastatic infections of pyemia, of trauma and of bacterial intoxication. Such an explanation accords better with the objective evidence than do such intangible suggestions as variations in microbic tissue affinity, altered tissue susceptibility or vulnerability, occurrence of areas of lowered resistance, or elective localization of bacteria. I do not imply, however, that the anatomical explanation is the sole one, although it does account for many of the localized lesions which accompany or follow general infections.

Another recent trend in the study of immune phenomena has emphasized the importance of vascular reactions, particularly changes in capillary permeability and the effects of such changes upon bacterial localization and antibody concentration in the tissues. Here, too, vital staining has yielded useful information. If, while the dye is circulating in the blood-stream, a chemical injury is induced, as by the application of xylol or chloroform to the skin, the dye will leave the capillaries in the area of injury because of increased permeability of the injured endothelium and will be "fixed" in the area of inflammation. Menkin has shown that living bacteria or protein solutions introduced into the blood-stream will also tend to concentrate in such an area of inflammation. This phenomenon suggests that the occurrence of osteomyelitis after trauma, of cutaneous abscesses after local injury, or of the development of typhoid or pneumococcal abscesses at the point of hypodermic medication in patients with typhoid fever or pneumonia, may be an effect of bacterial localization because of increased capillary permeability in the region of trauma. This same phenomenon, on the other hand, may be useful in that the increased blood-vessel permeability in an area of inflammation may enable antibodies in the blood to concentrate in the infected area, thus exerting a more beneficial effect. These studies in capillary permeability, therefore, offer
encouragement for the more general and intensive use of antiserums in actual infection.

Another trend in the morphological approach to immunity is the sequential study of local inflammatory lesions by histological examination. This method is especially valuable in observing the fate of virulent microorganisms injected simultaneously into the skin of susceptible and immune animals. If one can assume that the most critical period of an infection is in the early stages of the lesion, while the microorganisms are becoming adjusted to their new environment, the study of the course of events at this time should be particularly instructive.

If living bacteria are injected into the skin of a susceptible animal, they tend to be carried by tissue fluids until they reach the lymphatics and the blood. If the microorganisms are sufficiently virulent, the animal will succumb to the septicemia. Microscopical study of the local lesion reveals the bacteria disseminating through the tissue spaces as the inflammatory reaction is developing. The outcome depends upon several variables, such as inherent invasiveness of the bacteria, their necrotizing effect, rapidity of the inflammatory response and the presence and availability of immune substances in the tissues. Opinion differs as to both the relative and sequential importance of the various factors concerned, but all workers are agreed that the more speedily and more effectively bacterial localization occurs, the more favorable will be the effect upon the host.

What factors or reactions may help to secure an early "fixation" or localization of bacteria entering the skin? One must consider (1) the problem of stability of bacterial suspensions in the tissues, (2) the ability of bacteria to persist or grow in such tissues, (3) the presence of antibodies in the tissues and (4) the rapidity and nature of the inflammatory response to their entrance.

A popular explanation, based essentially upon the ancient belief in the effectiveness of the pyogenic membrane in restricting bacterial spread, is that the inflammatory reaction itself is the immediate restraining influence which ensures a prompt and effective bacterial localization. This view assumes that bacteria entering a tissue engender an inflammatory response, particularly by blood-vessel injury, which leads to the immediate deposition of fibrin around the area and the building of a mechanical wall around it. According to this view, the speedier the reaction, the more effective the bacterial localization. Allergic inflammation, therefore, should be especially effective in this respect.
Such a hypothesis would be readily acceptable if one could be sure that inflammation occurs quickly enough to prevent bacteria from entering lymphatics and blood, and invariably enough to constitute a general type of response. Several workers, however, have observed sharp and immediate bacterial localization in tissues in which no deposition of fibrin or thrombosis of lymphatics is present. It is evident, therefore, that such a simple mechanism as the immediate building up of a mechanical wall around the entering microorganisms does not explain all types of bacterial localization.

The problem may be approached by injecting suspensions of living bacteria into normal and immune animals and actually seeing what happens to the bacteria within the fluids or tissues. This type of experiment has been performed by several observers, using different bacteria and different species of animals, but with surprisingly uniform results. These results indicate that the most striking and immediate difference between a normal and an immune animal is in the tendency of the bacteria in the latter to remain near their place of artificial deposition because of a surprising tendency for them to stick to one another and to the surrounding tissues. This indicates an antigen-antibody reaction \textit{in vivo} which manifests itself essentially as an agglutinative and opsonizing reaction, whereby both bacterial localization and ultimate digestion by phagocytes are more effectively ensured. Furthermore, this reaction may occur in the complete absence of fibrin, thrombosis of lymphatics, or even of leukocytes. These elements, however, may be present in later phases of the inflammatory reaction and obviously are important in ensuring the continued localization of bacterial incitants. Here again the morphological method enables one to observe the process objectively and to deduce therefrom that the primary reaction is fundamentally an immune phenomenon whereby immune bodies in the tissues tend to restrict the spread of bacteria toward the lymph and blood and so promote early localization and prepare the way for their later disposal.

In conclusion, I may say that the facts and experiments which I have cited are important only if they offer a clearer and more complete explanation for the mechanism of some of the immune phenomena. Advances in the immunologic handling of infectious disease must necessarily be dependent upon the proper understanding of the problem as a whole, and the morphologic approach is one way which may help us to attain a more adequate understanding of the problem.
President Records: I am sure we very much enjoyed Dr. Cannon's very interesting presentation, and on behalf of the Association, I wish to extend to him an invitation to be with us during all of our sessions here this year. I hope he will feel at liberty to take part in our discussions.

Dr. A. T. Kinsley: I move we extend a rising vote of thanks to Dr. Cannon.

... The motion was regularly seconded, put to a vote and carried.

... The members rose and applauded.

President Records: The next order of business is the address of the President.

... President Records read his prepared address. ... (Applause.)

THE ADDRESS OF THE PRESIDENT

By Edward Records, Reno, Nevada

University of Nevada

Custom and the by-laws of this Association decree that there shall be a presidential address. I shall, however, try not to impose on your good nature or unduly try your endurance. Any message can be brief even if not instructive or entirely to the point.

Through the efforts of Dr. Dyson and the various committee chairmen, a comprehensive and well balanced program has been prepared for you. Practically the whole field of active present interest in applied live stock sanitation and contributory research will be covered. Anything I might say along these lines would be, at best, repetition.

Tuberculosis eradication has made more than gratifying progress during the last year. The goal of the whole United States as Modified Accredited Free Area appears to be well in sight. It is an interesting side-light on our economic topsy-turvy that this work has been speeded up and may even be completed during a so-called depression after languishing more or less during a period of alleged prosperity.

Thanks to a liberal supply of funds from various federal sources, supplemented in variable degrees by different states, plus an aroused public interest, the preliminary work looking to the control of Bang's disease by the test-and-slaughter method is well under way. While there may still be pessimists among us, I venture to predict that in a surprisingly short time this disease will be a comparative rarity instead of a great economic and public health menace.

Flare-backs of infection into clean herds do not appear to have developed to the extent feared. As this work develops on an area,
state and nation-wide basis, there will obviously be even less trouble from this source. It is gratifying to note that several states have already formulated plans looking to a state-wide test and the elimination of all reactors within two years.

Leaving the more detailed consideration of accomplishments and work in progress to others on our program, I should like to call your attention to some of the many problems which still confront us.

**HOG CHOLERA**

President Robinson, in his address last year, recommended that some committee of this Association make a careful study of the hog cholera situation and recommend a definite program. This recommendation was approved by the Executive Committee and referred to the Committee on Unification of Laws and Regulations. As I do not know what action this Committee has taken or what it will report, I am speaking at this time purely on my own responsibility and stating merely personal views.

Economically, hog cholera is undoubtedly the most serious livestock disease on which no concerted and logical attack on a nation-wide basis has been made or planned to date. I believe it is more than time that this situation was faced squarely and considered without regard to any of the selfish interests involved.

When the discovery of the serum-virus method of immunization against hog cholera was announced, it was hailed as a Godsend. Perhaps, according to the concepts of contagious disease control of that time, it was such to the individual hog-owner. By conscientiously and intelligently following this method of immunization year after year, the hog-owner can protect himself against major losses from hog cholera.

He does this, however, at a considerable overhead expense to himself and contributes little or nothing to the general good. As Doctor Kinsley* so ably pointed out in his paper, "A Century of Hog Cholera," in 1933, 25 years after the discovery of serum-virus immunization, the net national progress in the control of hog cholera was just about nil.

It is not impossible that, if this method had never been developed, we would have eradicated hog cholera in self-defense as was done with contagious bovine pleuro-pneumonia once and foot-and-mouth disease several times, by crude, if you will, but at least effectual methods. This is, however, merely idle speculation. It is the future which concerns us.

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With all due respect to the veterinary profession, of which I am a member, I do not hold with those who claim that the limitation of the use of hog cholera virus to licensed graduate veterinarians would solve the problem. Such a plan might help but it would not control or eradicate hog cholera. Given proper support and cooperation from the livestock sanitary authorities and other interested agencies, the veterinary profession can control and eventually eradicate hog cholera but not by merely perpetuating in their hands wholesale immunization by the serum-virus method, with its constant hazard of accidents and leaks leading to the perpetuation and spread of infection.

**Virus Must Be Outlawed**

Hog cholera will never be conquered as long as any virus capable of producing the disease is allowed at large. It matters not in this instance whether such virus is in the body of an infected hog, the carcass, dressed or otherwise, of a dead one, or in the bottles of a licensed biologic laboratory. The virus must be outlawed and destroyed except for such quantity as may temporarily be safely confined in laboratories, as other public enemies are destroyed or securely confined in selected jails.

In short, the only plan which appears to offer any hope of eliminating hog cholera is that of rigid quarantines, the slaughter and proper disposal of diseased hogs and the serum-alone treatment of exposed ones.

This method has proven eminently successful in Canada for many years and there seems to be no logical reason why it should not succeed in the United States if we had the courage to try it on a comprehensive scale.

Boynton and his associates have developed what they believe to be a satisfactory modified virus type of hog cholera vaccine. Plans are, I understand, underway for its rather large-scale production and trial under field conditions. If it can be proved that this product solidly and uniformly immunizes and is under no combination of circumstances capable of producing or spreading hog cholera, it might have a place in an eradication campaign. If this cannot be proved, it should not be allowed to complicate the picture further and delay the goal of eradication.

Much of the above is but a repetition of what Dr. Kinsley said in his masterly review of this subject already referred to, which we might all reread from time to time to advantage. With only
one of Dr. Kinsley's major conclusions do I disagree at this time, namely, that there is not veterinary personnel available for a successful eradication campaign and that the cost would be prohibitive. Experience with tuberculosis eradication, Bang's disease control, and drouth work during the last two years has shown the veterinary profession to be almost unbelievably elastic in meeting new needs. The cost would probably be low compared to that incident to even another ten years of hog cholera under the present system.

This Association has taken an active part in launching or carrying on most of the major drives against live stock disease in North America. Should we not then try and launch with all possible speed a real campaign against hog cholera and this without undue haggling over nonessential details? In many ways the time seems most propitious. The hog population is at a low ebb, prices are high and will probably remain so for a reasonable time, the tuberculosis and Bang's disease campaigns have accustomed our farmers and stock raisers to such cooperative efforts, and the AAA has more or less organized and regimented a large number of our hog-raisers.

NEW FACTORS IN DISEASE SPREAD

One of the fascinations of any worthwhile pursuit is the surmounting of new and unexpected obstacles as they arise, and live stock sanitation is no exception to this rule. During recent years, the economic shake-up, the rapid increase of so-called community sales, and the general use of trucks have produced a very extensive movement and interchange of live stock on a local or semi-local basis. Many observers think this is also resulting in an increased dissemination of some diseases.

Interstate regulations can do little to control this situation even if they could be enforced in the necessary detail, as interstate movement, in the majority of cases, is not involved. The prohibition of any movement of live stock off of the owner's premises for any purpose without inspection and certification would be commercially impractical and in any event unenforceable under our conditions.

Much could probably be done to better conditions by the providing of some system of frequent inspection of all live stock and the correction of any dangerous condition found. In other words, reaching the objective of reducing miscellaneous infec-
tious and contagious diseases to the irreducible minimum can probably never be left to the initiative of the individual live stock owner.

If such a system would involve what is now popularly discussed as "state medicine," let us accept it as that. The movement for some system of "state medicine" in both human and veterinary fields is apparently rapidly gaining momentum in any event. As far as it affects the field of live stock sanitation, therefore, we had probably better be prepared to help guide it into safe and useful channels than to ignore or oppose it.

**Meat Inspection**

Much the same condition prevails in connection with our dressed meat supply. That portion which enters the trade through establishments under the actual supervision of the U. S. Bureau of Animal Industry is undoubtedly as wholesome and safe as it is humanly possible to make it under practical commercial conditions. The balance of our supply, estimated at not less than fifty per cent of the total, is as a whole open to question. Some, dressed and distributed under state, county or municipal supervision, compares well with the federal standard and some apparently does not. Still another large percentage receives no inspection at all.

This situation is obviously unfair to the producer of healthy live stock, the slaughterer and distributor operating under adequate inspection, and the consuming public. Meat inspection is primarily a public health measure, though of considerable indirect benefit to live stock sanitation and capable of being made more so. The fact that a man may be a producer or kill and market on a small scale gives him no moral right to distribute unwholesome meat or endanger healthy live stock by his operations. By the same token it should no longer give him the legal right to do so either through lack of adequate legislation or any system of exemptions.

Your Committee on Meat and Milk Hygiene will probably deal with this matter more in detail. It is my purpose merely to suggest that you get vigorously behind what is now apparently an active movement to get an adequate standardized system of meat inspection which will cover all dressed meat offered for public sale in the United States.

After fourteen years of outstandingly conscientious and successful work in that capacity, Dr. O. E. Dyson, also a past presi-
dent of this Association, has felt impelled to relinquish his duties as our Secretary-Treasurer. I am sure that I only reflect the sentiment of one and all of you in expressing the most profound regret at the loss of Dr. Dyson’s services and counsel. All who are familiar with the history of our Association know how much its present effectiveness and sound economic position are due to his efforts and judgment. The Executive Committee is now faced with the task of filling this vacancy. May wisdom guide their counsels to the selection and appointment of a worthy successor to Dr. Dyson.

In conclusion, I wish to express to you as best I may, even though feebly, my deep appreciation of being allowed to serve as president of this Association. No one realizes more that this honor, entirely undeserved in this instance, is the highest that can be conferred on anyone in our field of endeavor. Again, I also wish to extend my thanks and appreciation to my fellow officers, committeemen and members who have so wholeheartedly cooperated in the conduct of Association affairs during the last year.

PRESIDENT RECORDS: I have a communication here that I just received this morning, addressed to me, but really only in my care, as it is intended for the body of the Association.

... President Records read a communication from Dr. O. E. Dyson. ...

801 Second Avenue, North, St. Petersburg, Florida, December 2, 1935.

Dr. Edward Records, President, U. S. Live Stock Sanitary Association, Hotel La Salle, Chicago, Ill.

Greetings to all members of the U. S. Live Stock Sanitary Association upon the opening day of the 39th annual meeting.

During the entire life of the Association it has well served as an open forum for authoritative expression of the last word in all matters pertaining to live stock sanitation. I am therefore positively convinced that nothing can stay the continued march of progress that has been made toward the ultimate solution of many problems now confronting practically every live stock producer in the matter of prevention and control of infectious diseases of live stock, with which he has to contend, and with which, he, as an individual, must necessarily depend for guidance upon the veterinary profession at large.

With kindest regards and best wishes to all, I am

Sincerely yours,

(Signed) O. E. Dyson, Ex-Secretary-Treasurer.
PRESIDENT RECORDS: In the absence of Dr. Dyson, Dr. Wisnicky will present the Secretary-Treasurer's report.

DR. WALTER WISNICKY: I have here a communication from Dr. O. E. Dyson which arrived prior to the one that was just read, and I believe it would be best for me to read that communication, which does refer to the financial report, and then proceed with the financial report.

. . . Dr. Wisnicky read the communication from Dr. Dyson. . .

Rushville, Ill.
Nov. 20, 1935.

Dr. Walter Wisnicky, Chairman,
Executive Committee,
U. S. Live Stock Sanitary Association.

Dear Doctor Wisnicky:

Since 1905 I have been a member of the U. S. Live Stock Sanitary Association. Up to this date I do not recall having missed attending a single annual meeting. In 1915 I was highly honored by the Association by being elected President, and for the past fourteen years I have been elected annually as Secretary-Treasurer.

When first elected to the office I now hold, I was well aware of the fact that the Association was confronted by a deficit. The first step taken to overcome the handicap of a deficit was to balance the budget. This was accomplished by cutting out all unnecessary expenses, and by placing all memberships upon a strictly cash basis, this being done by giving notice to all members delinquent after each annual meeting, "that the number of printed copies of the current annual meeting would be limited to the number of paid-up memberships, and that if a copy of the proceedings of the meeting just concluded was desired, a prompt remittance of the annual dues would be necessary." That policy firmly established the Association upon a strictly cash basis of operation which has been continued up to date. The result has been evidenced by the financial statements which have been submitted annually.

On August 28, having reached the age of seventy years, I was automatically retired from Bureau service. Up to this date I have established no permanent residence. Therefore, I hereby tender my resignation as Secretary-Treasurer of the Association.

During many years past, after the adjournment of each annual meeting, I have looked forward with pleasure to the coming of the next. In the meantime it has been my privilege and practice to indulge in retrospective meditation by recalling to mind many old-time members, who have long since passed on to their great reward, and also to many others who continue to contribute to the success of each succeeding meeting.

In this connection I desire to assure the members of the Executive Committee and all other members of the Association, that I shall always cherish a vivid memory of my having had the pleasure of associating for many years with the members of the U. S. Live Stock Sanitary Association.

With kindest personal regards and best wishes to all, I am,

Sincerely yours,

(Signed) O. E. DYSON.

. . . Dr. Wisnicky read the financial report. . .
### FINANCIAL STATEMENT

**O. E. DYSON, Secretary-Treasurer**

**RECEIPTS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Membership dues</td>
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</tr>
<tr>
<td>179 @ $2.00</td>
<td>$358.00</td>
</tr>
<tr>
<td>State memberships (1935)</td>
<td>$875.00</td>
</tr>
<tr>
<td>35 (see list) @ $25.00</td>
<td>$875.00</td>
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<tr>
<td>State memberships (1936)</td>
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<tr>
<td>3 (see list) @ $25.00</td>
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<td>Postage and express</td>
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<tr>
<td>Clerical hire</td>
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<tr>
<td>Tuberculosis Committee</td>
<td>$105.50</td>
</tr>
<tr>
<td>Printing and stationery</td>
<td>$34.65</td>
</tr>
<tr>
<td>State memberships</td>
<td>$25.00</td>
</tr>
<tr>
<td>(1935)</td>
<td>$25.00</td>
</tr>
<tr>
<td>(1936)</td>
<td>$25.00</td>
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<tr>
<td>Reports sold</td>
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</tr>
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<td>U. S. B. A. I.....$75.00</td>
<td>$75.00</td>
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<tr>
<td>miscellaneous expenses of President Robinson, 1934</td>
<td>$15.00</td>
</tr>
<tr>
<td>miscellaneous expenses of President Robinson, 1934</td>
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<tr>
<td>Salary, Sec'y-Treas., '34</td>
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<tr>
<td>Interest on U. S Bonds and Treas. Certificates</td>
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<tr>
<td>U. S. Bond, 4th—4½, called Oct. 1, 1935...</td>
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<tr>
<td>Total disbursements</td>
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<tr>
<td>Cash balance, Nov. 13</td>
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<tr>
<td>Total receipts</td>
<td>$2,129.21</td>
</tr>
<tr>
<td>Cash balance, Dec. 1, 1934</td>
<td>$545.49</td>
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**Total receipts** $2,129.21

**CURRENT ASSETS**

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<tr>
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<td>U. S. Treasury Certificates</td>
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<tr>
<td>U. S. Bonds*</td>
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<td>Cash balance in bank</td>
<td>$1,917.43</td>
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<td>$7,117.43</td>
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**LIABILITIES**

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<tr>
<td>Printing 38th annual report of proceedings</td>
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<tr>
<td>Programs for 39th annual meeting</td>
<td>$31.10</td>
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<td></td>
<td>$310.10</td>
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**STATE MEMBERSHIPS (1935)**

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<thead>
<tr>
<th>State</th>
<th>Local Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td></td>
</tr>
<tr>
<td>California</td>
<td></td>
</tr>
<tr>
<td>Colorado</td>
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<td>Connecticut</td>
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<tr>
<td>Delaware</td>
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<tr>
<td>Florida</td>
<td></td>
</tr>
<tr>
<td>Indiana</td>
<td></td>
</tr>
<tr>
<td>Iowa</td>
<td></td>
</tr>
<tr>
<td>Idaho</td>
<td></td>
</tr>
<tr>
<td>Kansas</td>
<td></td>
</tr>
<tr>
<td>Kentucky</td>
<td></td>
</tr>
<tr>
<td>Maryland</td>
<td></td>
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<tr>
<td>Massachusetts</td>
<td></td>
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<tr>
<td>Minnesota</td>
<td></td>
</tr>
<tr>
<td>Mississippi</td>
<td></td>
</tr>
<tr>
<td>Missouri</td>
<td></td>
</tr>
<tr>
<td>Montana</td>
<td></td>
</tr>
<tr>
<td>Nevada</td>
<td></td>
</tr>
<tr>
<td>New Hampshire</td>
<td></td>
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<tr>
<td>New Jersey</td>
<td></td>
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<tr>
<td>New Mexico</td>
<td></td>
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<tr>
<td>North Carolina</td>
<td></td>
</tr>
<tr>
<td>North Dakota</td>
<td></td>
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<tr>
<td>Ohio</td>
<td></td>
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<td>Oklahoma</td>
<td></td>
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<tr>
<td>Pennsylvania</td>
<td></td>
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<tr>
<td>Pennsylvania</td>
<td></td>
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<tr>
<td>South Carolina</td>
<td></td>
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<tr>
<td>Tennessee</td>
<td></td>
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<tr>
<td>Texas</td>
<td></td>
</tr>
<tr>
<td>Utah</td>
<td></td>
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<tr>
<td>Vermont</td>
<td></td>
</tr>
<tr>
<td>Virginia</td>
<td></td>
</tr>
<tr>
<td>Wisconsin</td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td></td>
</tr>
</tbody>
</table>

Los Angeles County, Calif.

U. S. Bureau of Animal Industry

Canada Department of Agriculture

**STATE MEMBERSHIPS (1936)**

<table>
<thead>
<tr>
<th>State</th>
<th>Local Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td></td>
</tr>
<tr>
<td>Louisiana</td>
<td></td>
</tr>
<tr>
<td>South Dakota</td>
<td></td>
</tr>
<tr>
<td>November 13, 1935</td>
<td></td>
</tr>
</tbody>
</table>

*200.00 above par.
†State warrant received, but not collected.
The next order of business is the annual memorial service. I will ask Dr. Kinsley to take the chair for that purpose.

CHAIRMAN KINSELEY: Gentlemen: In accordance with our usual custom, we will pause in our deliberations to pay our respects to those members who have, in the past year, gone to their final reward, and to extend our sympathy to their families. May I ask you all to rise and bow your heads for a moment in silent prayer.

Silent prayer.

CHAIRMAN KINSELEY: I am going to ask Dr. J. L. Axby, of Indiana, to continue the program further.

Dr. Axby read the memorial service.

Mr. Chairman and Members:
The following names comprise the list of sanitarians who have been called, during the past year, to that bourne whence no traveler ever returns:

Dr. C. A. Cary, Auburn, Alabama.
Born, Nov. 27, 1861, Millersburg, Iowa.
Died, April 23, 1935, Auburn, Alabama.
Age—74 years.

Dr. Marion Dorset, Washington, D. C.
Born, 1872, Columbia, Tennessee.
Died, July 14, 1935, Washington, D. C.
Age—63 years.

Dr. William Henry Welch, Lexington, Illinois.
Born, May 7, 1871, Bloomington, Illinois.
Age—64 years.

The name of some person may have been omitted that deserves inclusion in the list; if such be the case, it is not intentional, as we must be guided by our sources of information.

It is with a spirit of humbleness and inadequacy that I perform this duty, keenly recognizing that the best anyone can do must needs be done with earthly instrumentalities, reconciling them with the spiritual, the omnipotent, which, at best, cannot be expressed otherwise than in terms of the standard of faith in things unseen.

True it is they had to do with or for God's lower animals, and from this association they learned:

In the world's broad field of battle,
In the bivouac of life,
Be not like dumb, driven cattle,
Be a hero in the strife.

As heroes they stood for right as against wrong, weaving into the warp and woof of their lives an obvious, predominating thread of practical idealism, friendliness and thoughtfulness, deserving of emulation.

Well do I know that sorrow tarries in the wake of their passing, and to those who sorrow we extend our sincere sympathy. We again note
it follows as the inevitable flight of years, that their fate is the common fate of all, and while what we may say will soon be forgotten, their lives and the service they rendered will live long after them.

They accepted duties, caring and providing for their dependents, and were never known to violate holy vows. They rendered ready assistance in dispelling the forces of intolerance and bigotry, demonstrating by their daily conduct the beauty and serenity of an ideal home-life.

In their work and in their play they practiced the Golden Rule, and thus made it self-evident to all with whom they came in contact, that theirs was a belief in the brotherhood of man and common fatherhood of God.

Acting on these unalterable principles, they left a civilization advanced and bettered, because of having built a life in accordance with the plans fate laid out for them upon the trestle-board of human relations.

While their lives are ended, posterity of all present and future time will have been ennobled and enriched by their having passed this way. Thus we do eulogize and revere their memory, happy in the assurance that their memory will become more hallowed as the years roll by.

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DR. AXBY: Mr. President, I move that a copy of this eulogy be spread upon the permanent records of the Association, and a copy be sent to the family of each deceased member.

. . . President Records resumed the chair. . . .

PRESIDENT RECORDS: If there are no objections, this will be done. There are no objections, and it is so ordered.

There are several announcements to be made.

. . . Miscellaneous announcements. . . .

PRESIDENT RECORDS: Are there further announcements? If not, and if there are no objections, we will stand adjourned until 1:30.

. . . The meeting recessed at 12:25 p. m. . . .

RECESS

WEDNESDAY AFTERNOON, DECEMBER 4, 1935

The second session convened at 2:00 p. m., President Records presiding.

PRESIDENT RECORDS: Please come to order, gentlemen. The first offering of the Bang's disease symposium will be a presentation by Dr. A. F. Ranney, on "The Significance of Low-Titre Agglutination."

. . . Dr. Ranney presented his prepared address. . . .

(Appause.)

THE SIGNIFICANCE OF LOW-TITRE AGGLUTINATION

By A. F. RANNEY, Montpelier, Vt.

Director of State Bang's Disease Laboratory

The significance of low agglutination titres is of vital importance to those allied with Bang's disease testing. This is especially true of those of us who are associated with field work, and are continuously called on to answer questions put to us by the
intelligent breeder. Field workers are being asked the ever-
recurring questions: “What should I do with my suspects?”
“Will they react on the next test?” “Are they dangerous to the
rest of my herd?” “Why are these animals repeatedly called
suspects, when most of my new reactors are animals that were
negative on previous tests?”

In order to familiarize ourselves with the exact changes that
take place in the agglutination titre on successive tests of the
same individuals, and to see what eventually happens to animals
showing a low titre on initial tests, a procedure of formulating
individual titre records with the use of a punch-card machine
was inaugurated. These records have proved to be most inter-
esting, and will become of even greater value when continued
over a longer period of time on a larger number of animals.

When an animal is tested, a card bearing the tag number of
the animal, the date of test, and the agglutination titre is made
out. This record card is punched according to code numbers. On
each retest the date and titre record of the retest are recorded
and punched, which gives us the complete test history of each
animal on one card. These cards may be sorted in a punch-card
machine and assembled in groups as desired, then counted by a
tabulator. This system has proved invaluable in compiling
records of titre changes of individual animals on successive tests.

A little over a year ago the Vermont Department of Agricul-
ture agreed to cooperate with the program of Bang’s disease
testing made possible by the federal government under emergency
appropriations. Previous to this time, there was no state Bang’s
disease program, due to the lack of legislative support.

On the beginning of this program, the State proclaimed the
tube method as the official agglutination test, and set up a labora-
tory primarily for the testing of federal samples. The procedure
of testing samples in dilutions of 1:25, 1:50, 1:100 and 1:200
was adopted as a routine.

In classifying reactions to the agglutination test, the State
agreed with the U. S. Bureau of Animal Industry in accepting
the interpretations made by the Bang’s Disease Committee of
the U. S. Live Stock Sanitary Association in 1931.

To date, 7,942 cattle have been tested in 255 herds, distributed
over the state. My records have been compiled from the retests
of animals in these herds. No special herds or animals have been
selected for this report, as records have been made up as the
animals were tested in our routine. It has been our policy to
retest infected herds in approximately 60 days. Non-infected
<table>
<thead>
<tr>
<th></th>
<th>Neg.</th>
<th>P 1:25</th>
<th>+ 1:25</th>
<th>P 1:50</th>
<th>+ 1:50</th>
<th>P 1:100</th>
<th>Reactors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titre readings on 6581</td>
<td>3771</td>
<td>460</td>
<td>491</td>
<td>225</td>
<td>212</td>
<td>60</td>
<td>1362</td>
</tr>
<tr>
<td>animals on first test</td>
<td>57.3%</td>
<td>6.9%</td>
<td>7.4%</td>
<td>3.4%</td>
<td>3.2%</td>
<td>.9%</td>
<td>20.6%</td>
</tr>
<tr>
<td>Retest of 2809 animals</td>
<td>2462</td>
<td>122</td>
<td>104</td>
<td>16</td>
<td>25</td>
<td>11</td>
<td>69</td>
</tr>
<tr>
<td>negative on first test</td>
<td>87.6%</td>
<td>4.3%</td>
<td>3.7%</td>
<td>.5%</td>
<td>.8%</td>
<td>.3%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Retest of 388 animals</td>
<td>251</td>
<td>47</td>
<td>53</td>
<td>13</td>
<td>6</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>P at 1:25 on first test</td>
<td>64.6%</td>
<td>12.1%</td>
<td>13.6%</td>
<td>3.3%</td>
<td>1.5%</td>
<td>.7%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Retest of 387 animals</td>
<td>149</td>
<td>56</td>
<td>108</td>
<td>32</td>
<td>20</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>+ at 1:25 on first test</td>
<td>38.5%</td>
<td>14.4%</td>
<td>27.9%</td>
<td>8.2%</td>
<td>5.1%</td>
<td>1.2%</td>
<td>4.3%</td>
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<tr>
<td>Retest of 186 animals</td>
<td>54</td>
<td>22</td>
<td>59</td>
<td>20</td>
<td>21</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>P at 1:50 on first test</td>
<td>29%</td>
<td>11.8%</td>
<td>31.7%</td>
<td>10.7%</td>
<td>11.2%</td>
<td>2.1%</td>
<td>3.2%</td>
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<tr>
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<td>14</td>
<td>12</td>
<td>39</td>
<td>35</td>
<td>43</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>+ at 1:50 on first test</td>
<td>8.2%</td>
<td>7%</td>
<td>22.9%</td>
<td>20.5%</td>
<td>25.2%</td>
<td>5.8%</td>
<td>10%</td>
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<tr>
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<td>3</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>21</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>P at 1:100 on first test</td>
<td>5.7%</td>
<td>5.7%</td>
<td>7.6%</td>
<td>1.9%</td>
<td>40.3%</td>
<td>7.6%</td>
<td>30.7%</td>
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<tr>
<td>Titre readings on 3992</td>
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<td>262</td>
<td>367</td>
<td>117</td>
<td>136</td>
<td>37</td>
<td>140</td>
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<tr>
<td>animals on second test</td>
<td>73.4%</td>
<td>6.5%</td>
<td>9.1%</td>
<td>2.9%</td>
<td>3.4%</td>
<td>0.9%</td>
<td>3.5%</td>
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<tr>
<td>Retest of 1104 animals</td>
<td>953</td>
<td>40</td>
<td>63</td>
<td>10</td>
<td>9</td>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>negative on second test</td>
<td>86.3%</td>
<td>3.6%</td>
<td>5.7%</td>
<td>.9%</td>
<td>.8%</td>
<td>.2%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Retest of 139 animals</td>
<td>69</td>
<td>19</td>
<td>30</td>
<td>8</td>
<td>2</td>
<td>11</td>
<td>7.9%</td>
</tr>
<tr>
<td>P at 1:25 on second test</td>
<td>49.6%</td>
<td>13.6%</td>
<td>21.5%</td>
<td>5.7%</td>
<td>1.4%</td>
<td>7.9%</td>
<td></td>
</tr>
<tr>
<td>Retest of 171 animals</td>
<td>57</td>
<td>20</td>
<td>61</td>
<td>16</td>
<td>6</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>+ at 1:25 on second test</td>
<td>33.3%</td>
<td>11.6%</td>
<td>35.6%</td>
<td>9.3%</td>
<td>3.5%</td>
<td>1.1%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Retest of 57 animals</td>
<td>12</td>
<td>5</td>
<td>13</td>
<td>16</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>P at 1:50 on second test</td>
<td>21%</td>
<td>8.7%</td>
<td>22.8%</td>
<td>28%</td>
<td>12.2%</td>
<td>1.7%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Retest of 69 animals</td>
<td>8</td>
<td>5</td>
<td>14</td>
<td>15</td>
<td>13</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>+ at 1:50 on second test</td>
<td>11.5%</td>
<td>7.2%</td>
<td>20.2%</td>
<td>21.7%</td>
<td>18.8%</td>
<td>8.6%</td>
<td>11.5%</td>
</tr>
<tr>
<td>Retest of 15 animals</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>P at 1:100 on second test</td>
<td>6.6%</td>
<td>13.3%</td>
<td>6.6%</td>
<td>40%</td>
<td>13.3%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

P = Partial or incomplete agglutination in the dilution indicated.
+ = Complete agglutination in the dilution indicated.
herds have been retested in about six months, whenever possible, without interfering with retests of infected herds.

All blood samples have been tested in the one official State laboratory, and, with few exceptions, one individual has made the test readings.

The size of the state and the number of herds being tested have made it possible for the state and federal officials of Vermont to review quite carefully the questions and problems of herd-owners. It has been my experience that breeders as a whole have quite a varied opinion relative to what may happen to individual animals on a retest following the removal of reactors. Many seem to assume that an animal showing a titre comparable to our interpretation as suspicious would be expected to react in the future, and are greatly surprised when they learn that many and sometimes the only reactors on retests are animals that showed a negative titre previously. It appears that many cattle-owners are being misinformed from various sources as to the titre changes that may be expected to take place on successive tests of the same individual.

Table I shows the exact titre changes that have taken place in our routine retests. Tables II and III reveal a record of the
## Table II—Summary of results of retest as compared with previous test.

<table>
<thead>
<tr>
<th></th>
<th>Same Titre on Retest</th>
<th>Lower Titre on Retest</th>
<th>Higher Titre on Retest</th>
<th>Negative Class on Retest</th>
<th>Suspect Class on Retest</th>
<th>Reacting Class on Retest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>2809 animals negative on first test</td>
<td>2462</td>
<td>87.6</td>
<td></td>
<td></td>
<td>347</td>
<td>12.3</td>
</tr>
<tr>
<td>1104 animals negative on second test</td>
<td>953</td>
<td>88.3</td>
<td></td>
<td></td>
<td>151</td>
<td>13.6</td>
</tr>
<tr>
<td>269 animals negative on third test</td>
<td>237</td>
<td>89.1</td>
<td></td>
<td></td>
<td>32</td>
<td>11.8</td>
</tr>
<tr>
<td>Total tests in three retests—4182</td>
<td>3652</td>
<td>87.3</td>
<td></td>
<td></td>
<td>530</td>
<td>12.6</td>
</tr>
<tr>
<td>388 animals P at 1:25 on first test</td>
<td>47</td>
<td>12.1</td>
<td>251</td>
<td>64.6</td>
<td>90</td>
<td>23.1</td>
</tr>
<tr>
<td>139 animals P at 1:25 on second test</td>
<td>19</td>
<td>13.6</td>
<td>69</td>
<td>49.6</td>
<td>51</td>
<td>36.6</td>
</tr>
<tr>
<td>29 animals P at 1:25 on third test</td>
<td>8</td>
<td>27.5</td>
<td>14</td>
<td>48.2</td>
<td>7</td>
<td>24.1</td>
</tr>
<tr>
<td>Total tests in three retests—556</td>
<td>74</td>
<td>13.3</td>
<td>334</td>
<td>60.0</td>
<td>148</td>
<td>26.6</td>
</tr>
<tr>
<td>387 animals + at 1:25 on first test</td>
<td>108</td>
<td>27.9</td>
<td>205</td>
<td>52.9</td>
<td>74</td>
<td>19.1</td>
</tr>
<tr>
<td>171 animals + at 1:25 on second test</td>
<td>61</td>
<td>35.8</td>
<td>77</td>
<td>45.0</td>
<td>33</td>
<td>19.2</td>
</tr>
<tr>
<td>62 animals + at 1:25 on third test</td>
<td>15</td>
<td>24.1</td>
<td>39</td>
<td>62.9</td>
<td>8</td>
<td>12.9</td>
</tr>
<tr>
<td>Total tests in three retests—620</td>
<td>184</td>
<td>29.6</td>
<td>321</td>
<td>51.7</td>
<td>115</td>
<td>18.5</td>
</tr>
</tbody>
</table>
TABLE II—Summary of results of retest as compared with previous test—continued.

<table>
<thead>
<tr>
<th></th>
<th>SAME TITRE ON RETEST</th>
<th>LOWER TITRE ON RETEST</th>
<th>HIGHER TITRE ON RETEST</th>
<th>NEGATIVE-CLASS ON RETEST</th>
<th>SUSPECT CLASS ON RETEST</th>
<th>REACHING CLASS ON RETEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>186 animals P at 1:50 on first test</td>
<td>20</td>
<td>10.7</td>
<td>135</td>
<td>72.5</td>
<td>31</td>
<td>16.6</td>
</tr>
<tr>
<td>57 animals P at 1:50 on second test</td>
<td>16</td>
<td>28.1</td>
<td>30</td>
<td>52.6</td>
<td>11</td>
<td>19.2</td>
</tr>
<tr>
<td>31 animals P at 1:50 on third test</td>
<td>8</td>
<td>25.8</td>
<td>20</td>
<td>64.5</td>
<td>3</td>
<td>9.6</td>
</tr>
<tr>
<td>Total tests in 3 retests—274</td>
<td>44</td>
<td>16.0</td>
<td>185</td>
<td>67.5</td>
<td>45</td>
<td>16.4</td>
</tr>
<tr>
<td>170 animals + at 1:50 on first test</td>
<td>43</td>
<td>25.2</td>
<td>100</td>
<td>58.8</td>
<td>27</td>
<td>15.8</td>
</tr>
<tr>
<td>69 animals + at 1:50 on second test</td>
<td>13</td>
<td>18.8</td>
<td>42</td>
<td>60.8</td>
<td>14</td>
<td>20.2</td>
</tr>
<tr>
<td>21 animals + at 1:50 on third test</td>
<td>4</td>
<td>19.0</td>
<td>17</td>
<td>80.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total tests in 3 retests—260</td>
<td>60</td>
<td>23.0</td>
<td>159</td>
<td>61.1</td>
<td>41</td>
<td>15.7</td>
</tr>
<tr>
<td>52 animals P at 1:100 on first test</td>
<td>4</td>
<td>7.6</td>
<td>32</td>
<td>61.5</td>
<td>16</td>
<td>30.7</td>
</tr>
<tr>
<td>15 animals P at 1:100 on second test</td>
<td>2</td>
<td>13.3</td>
<td>10</td>
<td>66.6</td>
<td>3</td>
<td>20.0</td>
</tr>
<tr>
<td>7 animals P at 1:100 on third test</td>
<td></td>
<td></td>
<td>3</td>
<td>42.8</td>
<td>4</td>
<td>57.1</td>
</tr>
<tr>
<td>Total tests in three retests—74</td>
<td>6</td>
<td>8.1</td>
<td>45</td>
<td>60.8</td>
<td>23</td>
<td>31.0</td>
</tr>
</tbody>
</table>

Negative class—Negative at 1:25, P at 1:25, + at 1:25.
Suspect class—P at 1:50, + at 1:50, P at 1:100.
Reactor class—+ at 1:100 and higher.
same animals as shown in table I. Table II assembles the animals according to their upward or downward titre change, as a result of retests of the same groups as in table I. It will be noted that a high percentage of animals revealed no change in titre from the previous tests. Animals are also grouped according to their classification: negative, suspects and reactors. Table III reveals the titres of 213 animals on the test previous to their showing a reacting titre.

While these records have been taken from our routine testing of field herds, one should not lose sight of the fact that herds containing infection, as revealed by previous tests, are retested much more frequently than are those not showing infection. Thus a very high percentage of the animals retested are in herds previously infected.

Some writers seem to place considerable stress on the fact that low-titre cows subsequently react, forgetting that the same is true of animals that are completely negative.

In studying these tables carefully, one can not help but notice that there is a very strong tendency for the agglutination titre of non-reacting animals to subside as herds are retested and reactors removed. Judging from these data, which were carefully compiled from our records, it appears that low agglutination titres usually have very little significance relative to the titre expected on subsequent tests.

The findings, as revealed by our records, might warrant close study by the various live stock officials in the hope of determining whether or not a herd should be certified as Bang’s disease-free, after repeated tests reveal the titres of a few animals within the range of our suspicious class. It would seem from our findings, which indicate that a very high percentage of animals show a lower titre on subsequent tests, that those animals with a titre of 1:50 or below need not be carried as suspects and thereby defer the certification of the herd as Bang’s disease-free.

While this work covers a comparatively short period, and might be more conclusive if a larger number of animals could have

<table>
<thead>
<tr>
<th>Table III—Titres of reacting animals on test immediately preceding the one on which they were diagnosed as reactors.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Number............</td>
</tr>
<tr>
<td>Per cent...........</td>
</tr>
</tbody>
</table>
been included, I am convinced that the limits of our so-called suspicious class are altogether too wide.

I might add in closing that the breeders in Vermont are cooperating quite readily in the Bang's disease work and the state as a whole is gaining the benefits of a well-organized program.

**THE GENERAL PROGRESS OF THE COOPERATIVE BANG'S DISEASE PROJECT**

*By A. E. Wight, Washington, D. C.*

*Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, U. S. Department of Agriculture*

In outlining the progress made in the Bang's disease project among cattle in the United States, it will be impossible within the time allotted to cover the different phases to any great extent, but it will be the purpose of this paper to bring out some of the more important features that have developed, chiefly within the last year.

About a year ago much interest was displayed by cattle-owners in having their herds tested for Bang's disease. This did not apply generally throughout the United States, but it did occur in several important cattle-raising states. This sentiment made it advisable to allot to the project additional federal funds from an appropriation already made by Congress. The last Congress appropriated $10,000,000 for cattle disease work. This amount, in addition to any unexpended balance of 1935 funds, was made available for the year ending June 30, 1936.

Early in the calendar year 1935, consideration was given to some changes in the agreement between herd-owners and the Department of Agriculture that would be beneficial to the elimination of Bang's disease from herds of cattle, and later suitable action was taken. This change required additional care on the part of the owner. On June 10, 1935, the new agreements became effective, and the maximum payment for grade cattle was increased from $20 to $25, but no change was made in the maximum payment for purebred cattle, which remained at $50. In this new agreement it was provided that not more than four tests should be applied by the Bureau of Animal Industry to any one
herd. In October, 1935, the situation was such in connection with this project that it was deemed advisable to increase the number of tests that might be applied to any given herd, provided the owner filed a supplement to the original agreement. This action met with favor among the herd-owners who were anxious to eliminate the disease from their herds.

SOME OF THE RESULTS

Up to November 1, 1935, reports to the Bureau on this project indicated that under the cooperative plan agglutination blood-tests for Bang's disease had been completed on approximately 5,125,700 cattle contained in 339,500 herds, and that about 531,000 cattle gave positive reactions to the test. This report also indicated that about 35.0 per cent of the herds that were tested showed some infection. The total number of cattle under supervision on November 1 was about 3,868,000 head contained in 279,000 herds. In many of the states the reports indicate that there are considerable numbers of owners of untested cattle who have applied for the Bang's disease test, and such cattle are carried on what is known as the waiting list. On November 1, this total was about 500,000 cattle.

On November 1, 1935, a compilation of the data concerning indemnity claims in the Bang's disease project since the work began in July, 1934, showed that the average appraisal was about $61, the average salvage, $22, and the average federal payment, $25. Sixteen per cent of all the cattle contained in the claims submitted up to that time were registered purebred animals. On claims received in October, 1935, the average appraisal was $71.59, the average salvage, $25.70, and the average federal payment, $27.15. Twelve per cent of all the cattle contained in these claims were registered purebred animals. The owner continues to receive the net salvage in addition to the federal payment. In the states of Maine and New Hampshire, he receives an additional payment from the State, but in no case does the owner receive from all sources more than the appraised value. Arrangements have been made in Virginia and Delaware to make state payments for cattle to owners under certain conditions in the Bang's disease project.

In a project of this nature there is considerable variation in the volume of work done in the various states. In some parts of the United States very much more preliminary work and actual testing of herds of cattle have been taken up than in others. In Oregon, for example, it is estimated that about 90 per cent of all the dairy cattle located in what is known as the "dairy counties"
of the state have been tested for Bang's disease and the reactors removed. A large volume of work has been done in this project since July, 1934, in many of the states, but it will be noted from the statistical report given out, to be available at this meeting, that the total number of cattle under supervision in the project was the largest in Wisconsin, with Minnesota second, Oklahoma third, Oregon fourth, and Ohio fifth.

More tests were made in October, 1935, than in any other month since the work was begun. Records indicate that during that month agglutination tests were completed on approximately 38,000 herds containing approximately 568,000 cattle. Of this number, about 44,500 cattle were found to be positive reactors to the test. Among this large number of herds there were, of course, many that had received a previous test.

**RETESTING OF SUSPECTS**

In classifying the results of the agglutination blood-test, it is, of course, well known that in some cases a positive or negative reaction cannot be obtained and they are called "suspicious" and held for a retest. As a result of applying a retest to 32,965 suspects, 6,684 were positive, 18,891 negative, and 7,390 remained suspects. Reports of retesting 1,219 cattle that were suspicious twice show that out of that number of cases 294 were positive, 412 negative, and 513 remained suspects. Results of retesting 182 cases that were classified as suspects on two successive tests were 55 positive, 47 negative, and 80 still in the suspicious class.

Some records have been kept to indicate the results of retesting herds that contained no reactors on the last previous test, and a report on about 336,000 cattle contained in 21,000 herds showed that approximately 18 per cent of these herds contained either reactors or suspects. The number of reactors found, however, was comparatively small and amounted to only 0.9 per cent. The number of suspicious was about 1.2 per cent. We will be privileged today to hear the report of the results of Bang's disease work in Minnesota, where the results of a large amount of work of retesting herds has been compiled; therefore, this subject will not be further discussed at this time.

**GROUP TESTING UNDER THE AREA PLAN**

The testing of all cattle within a given area such as a county, in connection with Bang's disease work, has been given consideration for some time, and the plan has been put into effect in several localities. Thus far, results are proving quite satisfactory. The degree of infection among all the cattle tested in counties
under the group plan is considerably less than that found in the individual herd testing, which is accounted for by the fact that in some cases the herds contain but few cattle and in other localities the more heavily infected herds had already been tested and reactors removed. We shall no doubt hear some discussion on this subject here today from officials directly connected with these projects.

PERSONNEL

The United States Bureau of Animal Industry has continued to employ temporarily quite a large number of veterinarians to assist in this work. Some are employed full time and others on a per diem basis. The Bureau also employs, in many instances, persons to supervise and assist in the laboratory testing of blood samples. In many of the states some local laymen are employed to assist the veterinarians with the work in connection with obtaining blood samples and other features of the field activity.

AGGLUTINATION BLOOD-TESTS

Most of the testing of the blood samples takes place in the official laboratory of the state, but in some states there are especially trained veterinarians who are permitted to use the plate method of blood-testing and are not required to send all the samples to the laboratory. However, duplicate samples are forwarded to the laboratory from time to time for comparison. The official testing in the laboratory is conducted by either the tube or the plate method, using serum.

During the past year, some experimental work has been carried on in the field with a stained antigen, and this material is used in testing samples of whole blood instead of samples of serum. In this project the samples of serum from the cattle that were being tested experimentally in the field were forwarded to the laboratory for comparison. From a preliminary survey of the results on tests of about 9,000 cattle, it appears that the results are quite encouraging. Further experimental work with the stained antigen may be carried on in the field during the coming year.

FURTHER STUDIES OF VACCINATION

The Bureau is continuing its experiments on vaccination against Bang's disease and is conducting a number of projects in the field in order to determine what may be the result of the use of such vaccine on calves from the ages of about five to nine months under field conditions. The vaccine is prepared from a special strain of *Brucella abortus* furnished by the Animal
Disease Station of the Bureau of Animal Industry at Beltsville, Maryland.

CONCLUSION

The federal funds provided for this work are to be available under the present law until June 30, 1936, and while it is impossible to predict the volume of work that will be conducted during the next six months, it is believed that there will be sufficient federal funds available to render service to all the cattle-owners who wish to take part in the project. However, no promise can be made for this. Some of the states have provided funds for the Bang's disease project, and the cooperative spirit between the states and federal government in this work has been very satisfactory during the past year. The work to be carried on after June 30, 1936, by the federal government will, of course, depend upon action of the next Congress.

The opportunity to appear on this program today before an audience displaying so much interest has been a very great pleasure, and I desire to thank you for your kind attention.

PRESIDENT RECORDS: The next paper in this symposium is "Bang's Disease Control in Oregon," by Dr. S. B. Foster, federal inspector in charge of the work in that state.

. . . Dr. Foster read his address . . . (Applause.)

BANG'S DISEASE CONTROL IN OREGON

By S. B. Foster, Salem, Ore.
Inspector-in-Charge, U. S. Bureau of Animal Industry

In reviewing or even commenting on the present status of the Bang's disease campaign in Oregon, it seems quite proper first to emphasize the major reasons for its spontaneous success. We can, without doubt, give full credit to the previous tuberculosis eradication work, which has developed a receptivity and confidence in the minds of the people to any movement along live stock sanitary lines.

The tuberculosis eradication campaign has not only had the desired psychological effect on the people but it has developed a permanent well-trained and organized local resident field force which can direct its activities to any important veterinary problem on short notice and become immediately operative.

At the beginning of the Bang's disease campaign, we found ourselves able to begin operations with our already established force, subject to only minor delays in the matter of supply distribution.
Whatever is said of influences aiding our federal program, we must recognize with special distinction the most helpful and conscientious cooperation of our State Veterinarian and the Extension Service.

Our Bang's disease work was started with an appreciation that there were two basic factors involved and that these two factors must be made to enmesh in a perfect synchronization of effort. One of these factors is our field organization. This consists of practically the same personnel as used in the tuberculosis eradication work and consists of recruits among resident veterinarians who are judged to be professionally and temperamentally suited to public sanitary work. Experience shows that temperament is just about as important as professional qualifications. The resident veterinarians form the nuclei of the county operating units which, in many cases, are augmented by especially appointed outside veterinarians.

All routes and farm locations are beforehand available and well known to the testers. Helpers are not furnished from any central station but are selected from among local residents, who can further aid in itinerary arrangements through their familiarity with the local territory.

REACHING THE CATTLE-OWNERS

After a field organization is equipped to begin operations, we have to deal with the second major factor, namely, the cattle-owners, for if they are not ready and receptive to the idea, no organization can make satisfactory progress in the elimination of any disease, and in respect to this fact it has been our fixed policy to have the cattle-owner just as well informed and prepared to receive the test as the veterinary force is prepared to apply it.

Prior to any actual testing work, the county involved is segregated into convenient groups of school districts, in which preliminary meetings are held, designed to inform the people interested as to the nature of Bang's disease, especially along the lines of its destructive effect on the dairy industry and the incident actual loss to the individual owner of affected cows.

Speakers are secured from the State College, veterinary fraternities, bankers, business organizations, direct representatives of the dairy industry and women's organizations.

An especially designed feature of every talk is to dispel the many foolish and erroneous conceptions about Bang's disease harbored by a surprisingly large number of cattle-owners. We have found that such personal contacts have secured an accept-
ance of the federal program to an extent which we believe would otherwise have been impossible.

With field organization complete and a clientele more eager for the test than we are physically able to apply it, we have at this time completed more than 330,000 tests, which represents exactly 50 per cent of our total testing-age cattle population and 87 per cent of our dairy type cattle. Last October included 34,540 and November 32,517 tests under the federal program in Oregon.

The Oregon campaign has been conducted with the full appreciation of the necessity of caution and care in herd management following tests. In the larger dairies in and near Portland, there is in operation an isolation scheme which is made mandatory through cooperation of the City Health Department, under which authority is required the construction of isolation quarters of a character to meet the Grade A regulations for all newly-added cows, where they are retained for 60 days and are subjected to a retest before admittance to the main herd. The noticeable success in reducing reinfection is making this feature increasingly popular.

**BEEF BREEDERS MORE ENTHUSIASTIC**

Much more enthusiasm is shown by beef breeders in the Bang's disease work than was shown by them in the initial stages of the tuberculosis eradication project. There are at this time over 25,000 range animals listed for tests, with nearly this number already tested. Range testing progresses more rapidly than the dairy herd testing, as some of the beef herds comprise over 1,000 head, and up to 2,200 head per herd. With every facility in the way of chutes and other restraining equipment, our daily test is about 430 animals per man with this class of cattle.

Horseback travel to almost inaccessible places is hazardous and expensive but no applicants are ignored, wherever their situation. In Wallowa County we test cattle in the deepest canyon in the world, up to peaks of 5,000 feet, with a general monthly average of 2,500 head per man.

The percentage of reactors in Oregon is 6.76 per cent, with about 2.92 per cent suspects. From comparative figures this may be considered low and should be supplemented with the information that this percentage represents a considerable volume of retests and the further fact that the Bang's disease control work was in progress, at least to a limited extent, prior to the federal program.

At the end of this year, it is reasonably certain that all the western Oregon owners will have tested 90 per cent of their cattle. On October 1, there were tested over 27,000 herds, of
which 21,800 were clean, leaving to date 5,637 herds containing one or more reactors or suspects.

The relatively high voluntary sign-up has doubtless been influenced to a degree by the Compulsory Bang's Disease Test law which was passed at the January, 1935, session of the legislature. This law does not become operative until January 1, 1937. It has a contingent provision whereby it would have become operative January 1, 1936, had not the federal cooperative program been carried into 1936.

STATE AND FEDERAL PLANS SYNCHRONIZED

Thus, it is seen that the compulsory Bang's disease test law, because it did not make provision for indemnity, served to impress upon dairy-owners the wisdom of having their herds tested and reactors disposed of under the now-existing federal indemnity provisions. This state compulsory test legislation was somewhat ingeniously framed in that it would synchronize, so to speak, with the federal plan. Oregon has several counties that are predominantly range cattle counties in their make-up, hence, there were necessarily provisions whereby these counties were exempted, but whereby they could come under the compulsory provisions of the test law by filing with the county court a petition signed by the owners of 60 per cent or more of the cattle of the said county as shown by the assessor's records. Conversely, provisions also were made, if it is desired to discontinue the Bang's disease control work in any county coming under the provisions of the act, that by filing a petition with the county court, signed in a similar manner, the compulsory test work will be discontinued.

This law makes further provision whereby if federal indemnity is available in the approximate amounts of $20.00 plus the salvage for grade cattle and $50.00 plus the salvage for purebred cattle, the compulsory slaughter of Bang's disease reacting cattle must be carried out, provided that in the event of the discontinuance of federal indemnity payments the option shall then be allowed the owner of keeping the Bang's disease reactor animals as long as he will follow the rules and regulations as prescribed by the Oregon State Department of Agriculture for building up a Bang's disease-free herd. Provision is made whereby it is unlawful to hold or pasture a quarantined Bang's disease reactor within six feet of any neighboring cattle-owner's property line enclosing any Bang's disease tested and free or susceptible cattle.

At the present time the retest and follow-up work is being carried out; retests of reactor and suspect herds show upwards
of 60 per cent being clean. Such retests as have been made have comprised the smaller herds averaging from two to 20 cattle. We are conscious of the fact that the larger herds will not show the high percentage of apparent control. It is obvious that success may be had in the larger herds only by removing both the reactors and the suspects. The suspects are to be held for later testing and held under observation, although it is my personal belief that our program would be aided through the initial elimination of 1:50 suspects.

In the larger commercial raw milk herds that must depend upon outside breeders for their replacement animals, the problem is most difficult and will be until a larger reservoir of cattle become available from Bang's disease accredited herds. The owner's belief in and willingness to rigorously abide by the rules will largely be the determining factor in the success of the undertaking and we believe that a large majority of Oregon cattle-owners are in such frame of mind.

**SUMMARY**

As a summarization of the pivotal features which I believe have been responsible for a wide acceptance and a probable permanency of Bang's disease program in Oregon are:

1. The previous experience that both veterinarians and cattle-owners acquired in the tuberculosis eradication campaign.
2. The dissemination of uniform propaganda. All speakers were familiar with the outline, the topics of which being deemed pertinent by a conference of cooperating agencies.
3. The selection of veterinarians and helpers from residents of the respective counties. The quality of their work in this program will largely determine their future livelihood.
4. The organization of a field force with uniform ideas and technic.
5. The organization of the cattle-owners prior to contact with the operating force.
6. The anticipation of a compulsory state testing law without indemnity provisions.

State accredited herd certificates are now about to be issued to 20,000 herds, and we anticipate with certainty that the Bang's disease testing program will be as fixed and permanent in Oregon as the cattle industry itself.

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**PRESIDENT RECORDS:** The next paper is "The Results of Retests in the Federal Bang's Disease Project in Minnesota," by Dr. C. P. Fitch.

. . . Dr. Fitch read his paper. . . .
THE RESULTS OF RETESTS IN THE FEDERAL BANG'S DISEASE PROJECT*

By C. P. Fitch, Saint Paul, Minnesota
University of Minnesota

The AAA program of cattle reduction on the basis of Bang's disease was started in Minnesota approximately August 1, 1934. The project has developed, as the work has continued, until it is no longer a cattle reduction project but is one tending towards the proper control of this insidious disease of cattle. It is now known as the federal Bang's disease project.

The work is carried on cooperatively in Minnesota under the direction of Dr. W. J. Fretz, federal Inspector-in-Charge; Dr. C. E. Cotton, secretary and executive officer of the State Live Stock Sanitary Board, and myself, in charge of the laboratories located at the University of Minnesota in Saint Paul.

Testing for Bang's disease has been carried on in Minnesota for 20 years. It was not, however, until 1928 that a satisfactory plan was adopted to carry out this activity. Prior to that time, anyone desiring blood samples tested for Bang's disease would submit them to the laboratory at University Farm where they would be tested and the results reported. This led to some rather awkward situations. If an owner wished to determine whether Bang's disease was present in his herd, it was very easy for him to submit samples of blood from the respective animals to the laboratory and when the results were returned, he would be at perfect liberty to dispose of any reacting animals in any way he desired. Oftentimes the infected individuals found their way into herds otherwise free of the disease and started an active infection. We decided that instead of aiding in the control of Bang's disease, this method actually led to the spread of the disease. We terminated this plan. Rules and regulations were adopted by the State Live Stock Sanitary Board which provided that owners could have their animals tested only when they had signed a contract with the above Board for the proper care or disposal of infected animals. Plans A, B and C were adopted. These were graded in accordance with conditions on the respective farms. Plan A provided for an accredited herd, plan B for an approved herd and plan C for a cooperating herd. The owner agrees before the animals are tested not to dispose of reacting animals except under permit from the Board. All reactors are properly tagged.

*Paper No. 1403 of the Journal Series of the Minnesota Agricultural Experiment Station.

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These plans have been popular in Minnesota and many thousand animals have been tested. The ground work had been laid for building the much more extensive testing program under the AAA and the federal Bureau of Animal Industry.

The set-up for the federal Bang's disease project which we have in Minnesota differs somewhat from that of other states. As initiated, all the tests were carried on by the test-tube method in the laboratory in the Veterinary Division at University Farm. The progress of the work indicated that it would be impossible to carry out in the laboratory the number of tests deemed necessary to get a satisfactory number of animals tested in this state. During the past years, practitioners of veterinary medicine in Minnesota have had the opportunity of coming to the laboratory and receiving instruction in the plate method for conducting the agglutination test for Bang's disease. Over a hundred men have taken advantage of this opportunity and have carried on the plate test in the field for animals intended for interstate shipment to those states accepting the results of this test.

The individuals who have qualified in the laboratory receive additional instruction in the field from the supervising veterinary inspectors of the federal force. These inspectors in turn have received intensive instruction over a period of two weeks at the laboratory. The supervisors go around with the veterinarian, bleed the cattle and bring the blood back to the office or wherever the veterinarian desires to carry on the actual work in conducting the test. The tests are then run in duplicate, one group by the veterinarian and one by the supervisor, and the results carefully checked and compared. In this way it is possible to ascertain the need of further instruction on the part of the veterinarian and give the most efficient advice to carry out the details of the test properly.

After the supervisor is satisfied that the veterinarian has adequate knowledge and experience, he instructs him to send in to the laboratory for check-testing the results and the blood sera from at least the first four herds examined. These samples in turn are carefully tested in the laboratory and compared with the results obtained by the practitioner and returned to him with the necessary advice or explanation. Veterinarians are further advised to send in samples for check-testing at the laboratory at frequent intervals. This is carried out.

The publicity work and the education carried out under the state plans had their effects. When the federal program was presented to the cattle-breeders of the state through veterinarians,
county agricultural agents and the farm press, the response was immediate. Signed contracts swamped us. It was impossible to carry out our part of the program in time to meet the demands of the cattle-owners. However, we did the best we could.

The practicing veterinarian has been used, in so far as possible, in carrying on this activity in his immediate locality. Dr. Fretz has placed on his force a number of what may be called mobile veterinarians who have carried out the necessary field work in those portions of the state not having a sufficient veterinary personnel to take care of the contracts signed by the cattle-breeders in the immediate locality.

The months of August and September, 1934, had the additional activity of drouth relief. This work required the services of a large number of veterinarians under the supervision of Dr. Fretz. The Bang's disease project really did not start in earnest until October, 1934, and it was not until November and December, 1934, that the work progressed beyond its initial status. Our set-up was such, however, that it immediately expanded and we have tested up to five thousand animals a day in the laboratory. A lesser number have been tested by the plate method by the veterinarians in the field.

All antigen used in the laboratory and by veterinarians in the field for conducting the plate test is prepared in the Veterinary Division. The production of plate antigen entails a large amount of work and very careful laboratory procedures. It is an expensive and difficult matter to produce satisfactory plate antigen for conducting the Bang's disease agglutination test. We have been very fortunate in manufacturing an antigen which has proved satisfactory up to the present time.

Veterinarians conducting the plate test are located largely in the southern, western and southwestern portions of the state. The charts will show that the percentage of infection is much higher by the plate method than by the tube method. This percentage has no relation whatever to the method used, but does have relation to location of the infection in the state. The tube test has been utilized largely in testing the animals in the northern part of the state. In this location the number of infected animals is much less than in the southern counties.

We are attempting to carry out the work as thoroughly as possible. All charts are checked with previous tests. When the charts come in, they are assigned an accession number. This number is used for filing purposes only. The tubes of blood are taken out of the can and the label carefully checked with the
numbers appearing on the chart. The numbers on the chart are ranged from one to a thousand and each is assigned to a tag number or other identification of a particular animal. The tubes, in addition to carrying the serial number, are initialed by the veterinarian drawing the blood samples. Careful checking indicates that this method of labelling tubes is both expeditious and accurate.

The blood clot is broken up, the sample centrifuged and the proper amount of serum added to the test-tubes. The antigen is placed in the tube with an automatic pipetting machine and the test placed in the incubator at 37° C. for 48 hours. In the meantime, as stated above, the chart is checked, and the results of any retest conducted on the animals in the herd are noted. We occasionally find difficulty in checking herds when handling this large number. Duplications of names and numbers are not infrequent but more particularly is noted the misspelling of proper names. We are, however, constantly rechecking our lists and weeding out duplications. All herds are listed on a 3 x 5 index card on which is placed the name of the owner, his address, county, township, date and the results of the test, namely 12 negative, 3 positive, 1 suspicious, and whether the test was plate or tube.

The charts with the results of the previous tests on it are available to the individual reading the tests and making the diagnosis. All tests are read without reference to previous reactions. The diagnosis, however, is made only after a careful study of previous tests both as regards individual animals and herds. We believe that this latter procedure is very necessary in order that accurate and reliable diagnoses can be made. This is especially true when dealing with suspects.

**Table I—Results of testing for Bang's disease in Minnesota under the federal Bang's disease project, November 1, 1935.**

<table>
<thead>
<tr>
<th></th>
<th><strong>Test-Tube Method</strong></th>
<th><strong>Plate Method</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Number</strong></td>
<td><strong>Per Cent</strong></td>
</tr>
<tr>
<td>Animals tested once</td>
<td>327,131</td>
<td>10.3</td>
</tr>
<tr>
<td>Animals tested two or more times</td>
<td>68,286</td>
<td>21,409</td>
</tr>
<tr>
<td>Animals positive (first test)</td>
<td>33,602</td>
<td>10.3</td>
</tr>
<tr>
<td>Animals negative (first test)</td>
<td>288,442</td>
<td>88.1</td>
</tr>
<tr>
<td>Animals suspicious (first test)</td>
<td>5,087</td>
<td>1.6</td>
</tr>
<tr>
<td>Herds tested once</td>
<td>20,964</td>
<td>1.6</td>
</tr>
<tr>
<td>Herds tested two or more times</td>
<td>4,426</td>
<td>41.2</td>
</tr>
<tr>
<td>Herds with no infected animals on first test</td>
<td>15,320</td>
<td>73.1</td>
</tr>
</tbody>
</table>
Table I shows the amount of work completed to November 1, 1935, by the test-tube and plate methods. Ten per cent of the positive animals have been found by the tube method and 16 per cent by the plate method; 73.1 per cent of herds were negative by the tube method out of 20,964 herds tested and only 41.2 per cent negative herds by the plate method from 5,990 herds tested. A total of 459,599 animals (table II) have been tested up to the present time in 26,954 herds. The average percentage of infection by both methods of test is 12. We have retested 101,726 animals in 6,148 herds. The infection on the retest has been reduced to 6 per cent, and 56.2 per cent of the herds have been negative on the second test. Most of these had positive animals on the first test.

The results of the retest have been divided on the basis of additions to the herd. It is difficult to make accurate determinations, even by careful checking, to learn definitely whether additions have been made to a herd. In case of doubt we always refer back to the veterinarian or to the herd-owner. Additions are computed on the basis not only from without the herd but from within the herd. Calves under six months of age are not tested in accordance with the federal plan. Calves are often added to the herd which have not been tested. We have adopted an arbitrary plan by which we call an animal an addition to the herd in case it is one year or more of age and was not previously tested. Aged bulls are not included as additions. In almost all instances, male animals are tested before entering the herd.

Table III shows the results of retests of infected herds only to which there were additions having positive animals. It is

<table>
<thead>
<tr>
<th>Total animals tested, both methods (first test)</th>
<th>Number</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total herds tested, both methods (first test)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of positive animals, both methods (first test)</td>
<td>55,011</td>
<td>12.0</td>
</tr>
<tr>
<td>Herds with no infected animals, both methods (first test)</td>
<td>17,791</td>
<td>66.0</td>
</tr>
<tr>
<td>Total number of animals tested two or more times, both methods</td>
<td>101,726</td>
<td></td>
</tr>
<tr>
<td>Total number of herds tested two or more times, both methods</td>
<td>6,148</td>
<td>6.0</td>
</tr>
<tr>
<td>Total number of animals positive on second test, both methods</td>
<td>6,133</td>
<td>6.0</td>
</tr>
<tr>
<td>Total number of herds negative on second test, both methods</td>
<td>3,452</td>
<td>56.2</td>
</tr>
</tbody>
</table>

TABLE II—Summary of work conducted to November 1, 1935.
TABLE III—Retests of infected herds to which there were additions having positive animals.

<table>
<thead>
<tr>
<th>Method</th>
<th>Herds</th>
<th>ANIMALS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>Positive</td>
<td>Negative</td>
<td>Suspicious</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Test-</td>
<td>607 (1st</td>
<td>15,108</td>
<td>4,427</td>
<td>29.3</td>
<td>10,050</td>
</tr>
<tr>
<td>tube</td>
<td>test)</td>
<td></td>
<td>1,953</td>
<td>16.1</td>
<td>9,651</td>
</tr>
<tr>
<td></td>
<td>607 (2nd</td>
<td>12,147</td>
<td>2,749</td>
<td>33.7</td>
<td>4,989</td>
</tr>
<tr>
<td></td>
<td>test)</td>
<td>7,918</td>
<td>941</td>
<td>14.3</td>
<td>5,295</td>
</tr>
<tr>
<td>Plate</td>
<td>277 (1st</td>
<td>8,164</td>
<td>2,749</td>
<td>33.7</td>
<td>4,989</td>
</tr>
<tr>
<td></td>
<td>test)</td>
<td></td>
<td>941</td>
<td>14.3</td>
<td>5,295</td>
</tr>
<tr>
<td></td>
<td>277 (2nd</td>
<td>6,584</td>
<td>2,749</td>
<td>33.7</td>
<td>4,989</td>
</tr>
<tr>
<td></td>
<td>test)</td>
<td>1,977</td>
<td>941</td>
<td>14.3</td>
<td>5,295</td>
</tr>
</tbody>
</table>

Of the herds in the first group (test-tube method), 195 (32%) had reactors only among the additions.

Of the herds in the second group (plate method), 75 (27%) had reactors only among the additions. This group comprises 12 per cent of the total herds retested.

noted that, in 607 herds tested by the tube method the infection was reduced on the second test from 29 per cent to 16 per cent. In 277 herds tested by the plate method, the infection was reduced from 33 per cent to 14 per cent. This entire group comprises 12 per cent of the total herds retested. You will note also that the percentage of reduction of disease is essentially the same by both methods of testing, but it is not a satisfactory reduction.

Table IV gives the results of the retests of infected herds to which there were additions all of which were negative. It will be noted that by the test-tube method in 1,676 herds the infection was reduced from 22 per cent to 3 per cent and by the plate method in 659 herds, the infection was reduced from 22 per cent

TABLE IV—Retests of infected herds to which there were additions all of which were negative.

<table>
<thead>
<tr>
<th>Method</th>
<th>Herds</th>
<th>ANIMALS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>Positive</td>
<td>Negative</td>
<td>Suspicious</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Test-</td>
<td>1,676 (1st</td>
<td>34,554</td>
<td>7,578</td>
<td>22.0</td>
<td>25,879</td>
</tr>
<tr>
<td>tube</td>
<td>test)</td>
<td></td>
<td>981</td>
<td>3.5</td>
<td>26,126</td>
</tr>
<tr>
<td></td>
<td>1,676 (2nd</td>
<td>27,366</td>
<td>3,629</td>
<td>22.4</td>
<td>11,833</td>
</tr>
<tr>
<td></td>
<td>test)</td>
<td></td>
<td>390</td>
<td>3.1</td>
<td>12,285</td>
</tr>
<tr>
<td>Plate</td>
<td>659 (1st</td>
<td>15,108</td>
<td>3,629</td>
<td>22.4</td>
<td>11,833</td>
</tr>
<tr>
<td></td>
<td>test)</td>
<td></td>
<td>390</td>
<td>3.1</td>
<td>12,285</td>
</tr>
<tr>
<td></td>
<td>659 (2nd</td>
<td>12,955</td>
<td>3,629</td>
<td>22.4</td>
<td>11,833</td>
</tr>
<tr>
<td></td>
<td>test)</td>
<td></td>
<td>390</td>
<td>3.1</td>
<td>12,285</td>
</tr>
</tbody>
</table>

The herds in this group comprise 32.5 per cent of the total herds retested. There were no reactors on the second test of 1,557 (66%) of these herds.
to 3 per cent. These are satisfactory results. It is also seen that this group comprises 33.5 per cent of the total herds retested.

Table V shows the results of the retests of infected herds with no additions. In 1,488 herds tested by the tube method 19 per cent had infection on the first test. On the second test this was reduced to 6 per cent. In 453 herds 17 per cent had infection on the first test, which was reduced, as shown by the plate method, to 4 per cent on the second test. Again it is noted that the results obtained by both methods are equally satisfactory. This group comprises 31.6 per cent of the total herds retested. Furthermore, over 65 per cent of these herds had no reactors on the second test.

This chart shows that the average time elapsing between the first and second tests of 1,000 herds is 177.6 days, or nearly six months. This is altogether too long a time between tests.

Table VI shows the results of the retests of negative herds. In 623 negative herds that have been retested, 13.5 per cent have shown infection. This should, however, be compared to the number of animals showing infection. This is only 1.9 per cent. This group comprises 10 per cent of the total herds retested. These figures on retests of negative herds are similar to those presented by Dr. Wight. I believe the explanation is pretty largely through pasture infection. Infection is starting in these negative herds due largely to poor associates. This group above all others needs frequent retests in order that the spread of the disease may be quickly checked.

We have accounted for approximately 90 per cent of the herds retested in Minnesota. The other 10 per cent will not be shown. The reason is that they were tested alternately by one or the

**Table V—Retests of infected herds with no additions.**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>HERDS</th>
<th>ANIMALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOTAL</td>
<td>POSITIVE</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Test-tube</td>
<td>1,488 (1st test)</td>
<td>25,370</td>
</tr>
<tr>
<td></td>
<td>1,488 (2nd test)</td>
<td>18,845</td>
</tr>
<tr>
<td>Plate</td>
<td>453 (1st test)</td>
<td>9,797</td>
</tr>
<tr>
<td></td>
<td>453 (2nd test)</td>
<td>7,676</td>
</tr>
</tbody>
</table>

The herds in this group comprise 31.6 per cent of the total herds retested. There were no reactors on the second test of 1,259 (65%) of these herds. Average time between first and second tests of 1,000 herds is 177.6 days, or 5.9 months.
TABLE VI—Report of retests for Bang's disease in Minnesota (negative herds only, first test).

<table>
<thead>
<tr>
<th>METHOD</th>
<th>TEST</th>
<th>TOTAL</th>
<th>POSITIVE</th>
<th>NEGATIVE</th>
<th>SUSPICIOUS</th>
<th>TOTAL</th>
<th>ANIMALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>Test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test-tube</td>
<td>1st</td>
<td>547</td>
<td>0</td>
<td>547</td>
<td>100.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>547</td>
<td>71</td>
<td>475</td>
<td>86.8</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Plate</td>
<td>1st</td>
<td>76</td>
<td>0</td>
<td>76</td>
<td>100.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>76</td>
<td>13</td>
<td>59</td>
<td>77.8</td>
<td>4</td>
<td>5.0</td>
</tr>
<tr>
<td>Both combined</td>
<td>1st</td>
<td>623</td>
<td>0</td>
<td>623</td>
<td>100.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>623</td>
<td>84</td>
<td>534</td>
<td>85.7</td>
<td>5</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Twelve of these 623 herds had reactors at the time of the second test only among the additions. This group comprises 10 per cent of the total herds retested.
**TABLE VII—Report of retests for Bang's disease in Minnesota (infected herds tested three times).**

<table>
<thead>
<tr>
<th>Method</th>
<th>Test</th>
<th>Herds</th>
<th>Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Test-tube</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>Test-tube</td>
<td>516</td>
<td>98</td>
</tr>
<tr>
<td>2nd</td>
<td>Plate</td>
<td>516</td>
<td>68</td>
</tr>
<tr>
<td>3rd</td>
<td>Both combined</td>
<td>516</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7,689</td>
<td>5,926</td>
</tr>
<tr>
<td></td>
<td>Plate</td>
<td>2,994</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Both combined</td>
<td>4,457</td>
<td>5,312</td>
</tr>
<tr>
<td></td>
<td></td>
<td>788</td>
<td>521</td>
</tr>
<tr>
<td></td>
<td></td>
<td>788</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td></td>
<td>788</td>
<td>326</td>
</tr>
</tbody>
</table>

These data include reacting animals that were additions to these herds.
TABLE VIII—Report of retests for Bang's disease in Minnesota (infected herds tested four times).

<table>
<thead>
<tr>
<th>METHOD</th>
<th>TEST</th>
<th>No.</th>
<th>%</th>
<th>No.</th>
<th>%</th>
<th>No.</th>
<th>%</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-tube</td>
<td>1st</td>
<td>48</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,355</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>48</td>
<td>54</td>
<td>18</td>
<td>38.0</td>
<td>4</td>
<td>8.0</td>
<td>1,262</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>48</td>
<td>62</td>
<td>18</td>
<td>38.0</td>
<td>0</td>
<td>0</td>
<td>1,190</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>4th</td>
<td>48</td>
<td>23</td>
<td>36</td>
<td>75.0</td>
<td>1</td>
<td>2.0</td>
<td>1,012</td>
<td>4</td>
</tr>
<tr>
<td>Plate</td>
<td>1st</td>
<td>40</td>
<td>95</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
<td>2.5</td>
<td>1,178</td>
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</tr>
<tr>
<td></td>
<td>2nd</td>
<td>40</td>
<td>65</td>
<td>6</td>
<td>15.0</td>
<td>8</td>
<td>20.0</td>
<td>873</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>40</td>
<td>77</td>
<td>6</td>
<td>15.0</td>
<td>3</td>
<td>8.0</td>
<td>811</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4th</td>
<td>40</td>
<td>30</td>
<td>28</td>
<td>70.0</td>
<td>0</td>
<td>0</td>
<td>885</td>
<td>5</td>
</tr>
<tr>
<td>Both combined</td>
<td>1st</td>
<td>88</td>
<td>98</td>
<td>1</td>
<td>1.0</td>
<td>1</td>
<td>1.0</td>
<td>2,533</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>88</td>
<td>59</td>
<td>24</td>
<td>27.0</td>
<td>12</td>
<td>14.0</td>
<td>2,135</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>88</td>
<td>69</td>
<td>24</td>
<td>27.0</td>
<td>3</td>
<td>4.0</td>
<td>2,001</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>4th</td>
<td>88</td>
<td>26</td>
<td>64</td>
<td>73.0</td>
<td>1</td>
<td>1.0</td>
<td>1,897</td>
<td>4</td>
</tr>
</tbody>
</table>

These data include reacting animals that were additions to these herds.
### Table IX—Report of retests for Bang's disease in Minnesota (infected herds tested five times).

<table>
<thead>
<tr>
<th>METHOD</th>
<th>TEST</th>
<th>HERDS</th>
<th>ANIMALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Test-tube</td>
<td>1st</td>
<td>5</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>5</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>5</td>
<td>100.0</td>
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<tr>
<td></td>
<td>4th</td>
<td>5</td>
<td>20.0</td>
</tr>
<tr>
<td></td>
<td>5th</td>
<td>5</td>
<td>60.0</td>
</tr>
<tr>
<td>Plate</td>
<td>1st</td>
<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>4th</td>
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<tr>
<td></td>
<td>5th</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>Both combined</td>
<td>1st</td>
<td>6</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>6</td>
<td>83.3</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>6</td>
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</tr>
<tr>
<td></td>
<td>4th</td>
<td>6</td>
<td>16.6</td>
</tr>
<tr>
<td></td>
<td>5th</td>
<td>6</td>
<td>50.0</td>
</tr>
</tbody>
</table>

These data include reacting animals that were additions to these herds.
RETESTS IN BANG'S DISEASE PROJECT

other test. In other words, first by the tube method and then by the plate method, or vice versa. We attempt to avoid this in so far as possible. Either test will do a satisfactory job of ridding a herd of infection. It is not wise to “mix them.” Rarely you will find animals which do not give the same reaction to both tests. Apparently the reaction depends upon varied concentrations of the same or different substances in the serum. These variations do not occur frequently, but when they do happen, they sometimes are very disconcerting.

Table VII shows the results of testing infected herds three times. In 516 herds tested by the tube method the percentage of infection was reduced from 100 to 36 and by the plate method to 51. The percentage of positive animals dropped from an average of 25 to 6 in the three tests.

Table VIII shows the results of testing infected herds four times. There is, however, but a small group of herds in this lot. Most of these herds are those in which trouble was rampant and retests were desired. It will be noted that herd infection has dropped to 25 in the aggregate and the number of infected animals from 24 per cent to 4 per cent. This table, as well as the one to follow, represents too small a number of herds from which general conclusions can be drawn. They are merely interesting to indicate the progress of the work up to the present time.

Table IX shows results of testing five herds five times. Here, too, is a group of herds in which infection was dominant. The chart shows there has been considerable variation in the number of positive animals and the number of positive herds in the various tests. Deductions should not be drawn, as stated above, on the results reported in tables VIII and IX.

DISCUSSION

We believe that the progress of the work indicates: (1) That Bang's disease can be eliminated from herds by the application of the agglutination test. (2) Results obtained by the plate method and the tube method of testing, when satisfactory antigens are used and the work carried out by competent individuals, are equally satisfactory. (3) Additions to tested herds are a serious problem. A single agglutination test of an individual animal is not always a satisfactory basis to insure against
infection. Some additions are not tested at all. Greater care must be devoted to the problem presented by animals added to a herd. (4) Retests of infected herds should be conducted at frequent intervals. It is recommended that they occur not earlier than 30 days nor later than 60 days apart. These retests should continue until at least two negative tests have been obtained. (5) Non-infected herds should be carefully guarded to prevent the entrance of infection. Retests of these herds should occur at as frequent intervals as possible, especially when the proximity of infection is evident.

DISCUSSION

PRESIDENT RECORDS: These four papers are now open for discussion and questions.

DR. LEO F. RETTGER: I think the question of number of suspects is a very important one. That is why I wanted to have shown the column showing the percentage of suspicious reacting animals. I recall on the earlier charts there were percentages of suspicious reactions which were around twice as much for the plate method as for the tube method. I do not want to offer that as a criticism. I thought Dr. Fitch might want to comment on that. Here is where the pivot of the whole solution is going to be. How wide shall the borderline be between the two methods? I am not standing for either method, but I do believe we have to go further than comparing the positives and negatives against each other. We must compare the suspicious animals by different methods, with each other. While I think Dr. Fitch has made a case of what he has attempted to present here, I do not think we can accept these results as final over as short a period as he has had in the work which he is reporting.

DR. FITCH: I sincerely hope they are not final. I should have said something about the difference that Dr. Rettger points out in the two tests as between suspects. A veterinarian in the field does not have the opportunity of comparing the previous titres of these animals. He does not keep the records, or if he does have them, he does not have them in front of him when he is making the second, third or fourth test of those herds. Criticism that may originate here to the contrary notwithstanding, we have not hesitated with animals incomplete at 1:50, or occasionally a positive at 1:60, with no other indications of infection, to call that animal negative to the tube test. We have done it repeatedly, and we are continuing to do it.

DR. RETTGER: I want to ask Dr. Fitch if it is fair to the test and to the system to know at the time of testing what the previous results have been.

DR. FITCH: The tests are read, Dr. Rettger, before the results are compared. It has no influence on the reading at all, but certainly should have an influence on the diagnosis.

DR. W. H. HENDRICKS: In our state we are conducting tests similar to the plan outlined today. One of our problems is in regard to percentage of suspects. Of course in the dairy section that does not cause as much difficulty as in the sections where we are testing a number
DISCUSSION OF BANG'S DISEASE

of range cattle. Three to four per cent suspects means something to us where we have a large herd. I wonder if there is any practical way in the interpretation of our tests, by which suspects might be reduced to a narrower margin. Three per cent, of course, is a high proportion of suspects, and it is giving us much trouble in our work. It creates doubt in the minds of the cattle-owners, and makes a lot of work. I wonder if our present method of determining those suspects could be improved.

DR. FITCH: Would you repeat your question?

DR. HENDRICKS: Is it practical or feasible in any way to the interpretation of the test to cut down the percentage of suspects? I am speaking from a practical standpoint of eradicating the disease by the area method.

DR. FITCH: On the first test?

DR. HENDRICKS: Yes.

DR. FITCH: I do not think you can reduce it below 2 or 3 per cent on the first test. After that, I think it is quite possible to lower it materially.

DR. WALTER WISNICKY: I am much interested in the report which Dr. Fitch made. We have had communications throughout the past year on the work in Minnesota and Wisconsin, and we followed the results with considerable interest because our method of procedure in Wisconsin is not identical with that in Minnesota, but in comparing results, we find that they are, to all practical purposes, parallel. Our percentage of infection and the percentage of reduction between the various tests are very much alike, and that is interesting when we take all factors into consideration.

On this point of suspects, we are not troubled a great deal. We try to keep the herd-owner properly informed as to the exact situation in connection with these suspects. Just as a safety precaution, these animals are treated as suspects.

Where we do differ with the report of Dr. Fitch is that our percentage of suspects is a little higher than in Minnesota. It runs to about 5 per cent, but we caution our men and instruct them not to be afraid to designate animals as suspects on the basis of the reactions they give, because the farmers know that these suspects do not necessarily mean infection. It is easier for us to deal with the suspect problem by leaning in the direction of taking anything that gives any reaction and calling it a suspect.

Where our difficulty does come in is when animals are negative on the first test and later give reactions which are positive. Then the herd-owner raises the question as to the entire procedure. If we have them built up as suspects on the initial test, the herd-owner takes the situation with more complacency than if the entire herd were negative.

We find on the first retest of suspects, about two-thirds of them go negative, and one-third remain as suspects or go into the positive class. That is information we compiled practically in the same ratio as information which we compiled here about two years ago on experiences we had on testing at that time. I do not think the suspect problem is one we should worry a great deal about, or be alarmed if the percentage of suspects is relatively high.

I think that particularly in the early stages of this program, it is more essential to play on the safe side, rather than take chances and
draw in and take the position that we will have a small percentage of suspects rather than a large percentage. I think the margin of suspects now is not a serious problem; at least, it isn't with us. We would just as soon leave it there, and play on the safe side rather than take chances and have situations arise which would be more difficult to deal with later or leave infections in the herds.

**Dr. H. L. Gilman:** If the results of Dr. Ranney are general for the country as a whole, with respect to the fact that our reactors on retests are just as liable to come from the negative animals as from the suspicious animals, I wonder whether anything is to be gained by having this wide band, we will say, of suspects.

These animals that are classified as suspects are left in our negative herds. Everyone does that, and they are retested. They are treated as negative animals unless they react. I am inclined to agree with Dr. Ranney. As you know, we use that system in New York State, and a lot of these 1:25 and 1:50 animals are better left as negative animals if they stay that way, and do not later react. I do not see why we should leave this comparatively large percentage of suspicious animals in the minds of others. I do not think there is anything to be gained, if the results of Dr. Ranney are comparable throughout the country, if the reactors are to come from the negative animals, as well as from the so-called suspects.

**Dr. M. F. Barnes:** This subject of suspects has been a very important one in Pennsylvania for a long time. Previously we classified our suspects into highly suspicious and slightly suspicious. By slightly suspicious, we meant those animals that had a partial reaction in the 1:25 or 1:50 dilution. If on retest they remained only partial, we considered them negative until the next retest. If, on the other hand, they were highly suspicious, complete in 1:25 or 1:50 or higher dilutions, we would consider them as highly suspicious, and handle them as belonging to the class of suspicious animals.

We have been successful by that method. Dr. Gilman stated that he would not regard those animals as dangerous if they remained suspicious, and do not react. Neither would we, if they remain suspicious for six months, but on a single repeated test, at 30 days, you are not safe in considering them negative animals and leaving them in the herd.

There is a difference in suspicious animals, whether you are dealing with a herd that has chronic reactors, or whether you are dealing with a re-infection in a herd which has once been free. In the November issue of the Journal of the A. V. M. A., we reported on animals which were suspicious, which showed a partial reaction in the 1:25 and 1:50 dilutions. In following repeated tests over a period of time up to six months, 75 per cent of those animals later became positive, and 75 per cent of the ones which became positive aborted. I think it makes a difference whether you are dealing with a herd which represents reinfection, or a herd where there are chronic reactors which reacted because of previous vaccination. I think the most important part of our control work is the proper handling of the suspicious animal. (Applause.)

**Dr. Fitch:** May I second what Dr. Barnes said? I thoroughly agree. Here is a case, gentlemen, where you cannot have a rule of thumb to divide those animals into positive, negative and suspects. That is why we have in front of us every bit of evidence we can secure before we make a disposition of that group of animals. You cannot always say that an animal in this group is positive, negative or suspi-
cious, until you know something about the individual, the age of the animal, the type of herd which she is in, her previous titre, and every speck of information you can get, particularly as Dr. Barnes has told you, in regard to the type of infection that is in that herd.

DR. GILMAN: If I understand you correctly, Dr. Barnes, if the agglutination titre is the same all along, at one time you might classify an animal as suspicious, and the next time negative, with the same titre.

DR. BARNES: You understood me to say, Dr. Gilman, that if an animal shows a partial agglutination in a 1:50 or a 1:25 dilution, by our previous method of classifying reactions, we classify this group as slightly suspicious. If, on a subsequent test, it remains slightly suspicious or becomes negative, we consider it negative until the next retest. If, on the other hand, we would classify that animal as highly suspicious, representing complete agglutination in the 1:25 and 1:50 dilutions, we considered it positive, and handled it accordingly. This is the method under the cooperative plan, and we advise our people according to that plan.

MR. J. H. MERCER: I should like to ask what restrictions Dr. Fitch places on these suspicious cases, restrictions with the owner in respect to the cattle. Suppose half of the herd is suspicious. Do you hold those cattle in quarantine or do you permit the owner to sell the cattle?

DR. FITCH: They are not all quarantined, but the positives are.

PRESIDENT RECORDS: If there are no further questions, we will proceed to the report of the Committee on Bang's Disease, to be given by Dr. Fitch, who is Chairman.

DR. FITCH: I will read the report of your Committee on Bang's Disease.

REPORT OF COMMITTEE ON BANG'S DISEASE

DR. C. P. FITCH, Chairman, Saint Paul, Minn.

Dr. W. E. Cotton, Beltsville, Md. Dr. T. E. Munce, Harrisburg, Pa.
Dr. H. C. Givens, Richmond, Va. Dr. A. E. Wight, Washington, D. C.

Interest in Bang's disease during the past year has been confined largely to the federal program for combating the malady. Details of the progress of the undertaking have already been given you by Dr. Wight. The result of these activities, when assembled and analyzed, should furnish much information which will be useful in controlling the disease. Your Committee recommends that the cooperative federal Bang's disease program be continued.

Area Bang's disease eradication has been undertaken in a few states. This work will be watched with interest and the results should supply information that will be of service in determining its adaptability and practicability.

We desire to call to your attention that your Committee on Bang's Disease for 1933 presented rules as a guide for a Bang's disease-free herd and the official designation for such a herd. A considerable number of states have already adopted this or a similar plan. This Committee recommends these plans for consideration by the other states.

Several years ago this Association, on the recommendation of its Committee on Bang's Disease, adopted a uniform technic for conducting the tube agglutination test. This has been of great assistance in promoting uniformity. The plate or so-called rapid agglutination test
is gradually being used more widely. The need for a uniform technic and especially for a uniform antigen for use with this test is very apparent. The Conference of Official Research Workers in Animal Diseases is giving attention to this problem. A definite report should soon be available. Those interested in this problem can refer to this Conference for the progress that has been made in this field.

Approximately 9,000 whole-blood, stained-antigen tests have been made in one experimental project in the field during the past year. The results of these indicate that the whole-blood method may prove to compare favorably with the serum-plate and serum-tube methods. However, it is believed that considerable more experimental testing should be done before the test is accepted for general use. If found to be satisfactory, the method should prove to be especially useful.

Your Committee recommends that retests of infected herds be carried out at frequent intervals. We believe that the first retest should occur not earlier than 30 nor later than 60 days following the initial test in which infection was disclosed. Additional retests should be spaced in accordance with the progress of the infection in the herd. It is extremely unwise to allow long intervals to elapse between the tests of a herd in which infection has been found.

Studies should be continued in efforts to develop a satisfactory allergic test for Bang's disease. Up to the present time the results following the use of such tests have not been dependable. However, this does not preclude the possibility of ultimate success.

The danger of reinforcing herds from replacements is a matter of grave concern. Many breeders are still of the opinion that a negative test means an animal free from the disease. This, of course, is not always true. All agencies carrying on Bang's disease work should warn breeders to give serious consideration to sources of replacements, for their herds, especially if the additions are to be pregnant heifers. This applies to all replacements whether offspring of their own herds or not. Special attention is directed to the fact that calves under six months of age are not tested in the federal project. Oftentimes these are of sufficient age that they are turned out in a separate pasture, away from the main herd during the summer months. These animals are brought back in the fall of the year and placed with the main herd without ever having been tested. The danger from this group of individuals is important.

Studies of vaccination for the prevention of Bang's disease have been continued. Calfoold vaccination in particular has given encouraging results experimentally and is now being tried under official supervision under field conditions. The results of these trials will supply more definite information as to the practicability of this method of dealing with Bang's disease in which much interest is now being manifested.

DR. FITCH: According to the constitution, we refer this report to the Executive Committee.

PRESIDENT RECORDS: There are several announcements.

. . . Miscellaneous announcements. . .

PRESIDENT RECORDS: If there is no further business, we will stand adjourned until 9 o'clock tomorrow morning.

. . . The meeting adjourned at 4:00 p. m. . .

ADJOURNMENT
THURSDAY MORNING, DECEMBER 5, 1935

The third session convened at 9:30 a. m., President Records presiding.

PRESIDENT RECORDS: The meeting will come to order. The first order of business this morning is a symposium consisting of three papers, and the report of the Committee on Meat and Milk Hygiene.

The first of these papers to be offered is "The Role of the Veterinarian in the Public Health Program," by Dr. Ward Giltner.

... Dr. Giltner read his paper. ... (Applause.)

THE ROLE OF THE VETERINARIAN IN THE PUBLIC HEALTH PROGRAM

By WARD GILTNERT, East Lansing, Michigan
Dean of Veterinary Science, Michigan State College

The subject of this discussion was made the basis for a paper presented at the Ninth Veterinary Conference, College of Veterinary Medicine, Ohio State University, Columbus, March 20-22, 1935.* The paper was presented by invitation upon a subject furnished by the faculty of the University. The author lays no claims to special qualifications in the field covered by the title of his paper. However, he does sense the importance of the subject. Apparently others react similarly since the author has been invited to discuss the subject with both the Michigan and Indiana State Veterinary Medical associations, the American Public Health Association, as well as the U. S. Live Stock Sanitary Association.

Some statistics taken from Public Health Reports were presented to show the place occupied by the veterinarian in relation to the physician, the dentist, the nurse, and the sanitary engineer in public health work. More recent data from the same source indicate no different trends relative to increasing or decreasing importance of the veterinarian in the public health field.

In Public Health Reports, 50, No. 9, March 1, 1935, pp. 296-312, gives the state and insular health authorities for 1934. The degrees possessed by these officers are as follows (column B):

According to the membership list of the American Public Health Association for 1934, the members possessed the following degrees (column C):

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*Veterinary Medicine, xxx (1935), pp. 282-288.
Obviously these figures do not tell us how many veterinarians are engaged in public health work in the United States, nor do they tell the story as far as physicians, nurses, dentists, engineers, or any other group is concerned. Statistics for the number of men in the ranks are not available. The figures presented here may or may not represent the relative importance of the veterinarian in public health work. These data do not shed any light upon the relative importance of the professional groups functioning as semi-public health officers or as private agents in the great and varied attack on the enemies of human health all along the battle line. We are unable statistically to appraise the veterinarian as a factor in promoting human health.

However, in the paper referred to, an attempt was made to answer four questions:

1. What is the responsibility of the veterinarian in rural communities for public health? He should assume certain responsibilities in the way of rendering aid to the lower animals in the field of curative medicine, surgery and preventive medicine; and he must legally assume certain responsibilities for reporting to the public health officials and assisting them in the suppression of dangerous communicable live stock diseases, some of which are communicable to man.

2. Does the training of the veterinarian fit him peculiarly for protecting the health of the public in rural communities? The outstanding public health service the veterinarian can render
his community is the one for which he is primarily trained—the veterinary service.

3. Can the veterinary practitioner afford to function conspicuously in the protection of the health of rural people? The veterinarian can afford to identify himself with community public health activities because they are germane to his essential occupation.

4. In what ways can the veterinarian function to assist in protecting and promoting the health of rural communities? The veterinarian should insist that meat inspection is his peculiar domain, that he is probably better qualified for milk and dairy inspection than is the representative of any other profession, that he is competent as a food inspector, and as a laboratorian, and that he can lay some claim to qualifications as a general sanitarian.

NEW JERSEY POINTS THE WAY

No better recognition of the importance of the veterinarian in the public health program can be cited than is found in New Jersey’s legal requirement. New Jersey requires that one member of the Department of Health shall be a veterinarian, and as far as is known, it is the only state having such a law, although there is a veterinarian on the Washington State Board of Health. The New Jersey law reads as follows:

The Department of Health is hereby established, and the same shall be governed by a board of eleven members, to be known as the Department of Health of the State of New Jersey. Not more than six of the members of the board shall be members of the same political party, and all of said members shall be residents of this State, and two of the members of said board shall be workmen. At least three of the members shall be physicians, at least one a veterinarian, at least one a dentist, and at least two sanitary engineers.

The minimum staff required to operate an efficient county health department in Michigan consists of a health officer, two public health nurses, and a clerk. A dentist and a sanitary inspector are valuable additions. The district health department staff usually is made up of the health officer, a dentist, a sanitary inspector, clerk service, and one public health nurse for each county served. The present Michigan requirements are that the health officer have a medical degree from a class-A school and in addition have either postgraduate training, or adequate experience, in public health work.

Perhaps the minimum requirements may well dispense with the veterinarian; it may not be a serious matter that the health
department staff usually includes no veterinarian; but it may be seriously contended that a complete program is not possible if the veterinarian is excluded.

Most public health work is done by virtue of authority vested constitutionally in the state. This authority resides in and proceeds from the police power, which is a state function. Strangely enough, as far as the official work of the veterinarian is concerned, that done by federal authority is generally and justly commended in this country both quantitatively and qualitatively. That done by the states is not uniformly of such a high character and it impinges upon the public in the various states with exceedingly variable force. It is probably fair to make a similar appraisal of official veterinary health work in the local governmental units. It would be grossly unfair to fail to recognize the high character of this work in isolated instances involving both state and local veterinary personnel.

**Meat Inspection A Good Example**

Let us look for a moment at meat inspection. Federal meat inspection is as good an example as we have of perfect veterinary participation in an enterprise pregnant with public health implications. But there is about 30 per cent of the meat slaughtered annually that is not federally inspected and much of it is not adequately inspected by the states or local governmental units. It has been suggested that, since the present trend in governmental affairs is toward greater federal participation, the federal government subsidize the various states with the view to insuring that all meat, whether it be slaughtered in plants that engage in interstate or intrastate trade, be adequately inspected. Since the meat inspector is a veterinary pathologist, and neither a statesman nor a politician, he can have no worthwhile opinion on this proposal. He can only offer his technical services when the public eventually comes to realize that the reasons for inspecting meat that enters into foreign and interstate trade are equally valid for the inspection of that which figures only in intrastate trade. Assuming that meat inspection has public health value, one, even a veterinarian, might mildly suggest that the jurisdictional disputes of the political scientists and practitioners be settled as soon as possible because the human meat-eater is anatomically and physiologically unable to discriminate between the pathological and toxic effects of meat slaughtered for intrastate consumption and that slaughtered for foreign and interstate trade.
While political science is struggling with its problems—theoretical and practical—what is veterinary science doing to prepare itself for its job? Your attention is directed to an item of interest in this connection. For it is in the local units that the veterinarian has officially functioned least effectively and especially in rural communities.

**The Kellogg Foundation**

In Michigan the W. K. Kellogg Foundation has contributed to the establishment and operation of adequate health departments in seven single counties in the southwestern part of the state: Allegan, Barry, Eaton, Van Buren, Calhoun, Branch and Hillsdale.

In the opinion of the author, one of the most significant steps ever taken to enlist the services of the local veterinary practitioners in a rural public health program was that by the W. K. Kellogg Foundation when a request was made of the Division of Veterinary Science of Michigan State College to conduct a short course for veterinarians in milk and meat inspection. All of the veterinarians of the seven counties benefiting by W. K. Kellogg Foundation aid and veterinarians in adjoining counties who practice in the seven counties were invited to this short course as the guests of the Foundation. The author wishes to testify to the part played by Leonard M. Board, sanitary engineer of Hillsdale County, and his own colleague, Dr. B. J. Killham, Extension Specialist in Animal Pathology. They have cooperated in making the arrangements.

This short course represents the launching of a sincere effort to include the practicing veterinarian in a comprehensive community health project. The veterinarian's place in this participating program is apparent, and it presents a challenging, worthwhile task. The Community Health Projects can be made a better project through the interest, preparation and cooperation of the veterinary practitioner.

Everyone who is interested in a complete program of public health, especially for rural communities, will be interested in the outcome of this undertaking. The author promises to keep the public informed and earnestly invites a public interest in the enterprise. Suffice to say at this time that the attitude of the veterinarians in attendance was cooperatively helpful, the attendance was nearly perfect, interest in the program at times rose to feverish heights. Many testified that it was something for which they had long prayed and there was an expression of
desire that the subject of veterinary participation in public health be considered annually in veterinary conferences, meetings, or short courses. The reaction of the author was that the dull, formal, and conventional wording of the program titles germinated, flourished, and blossomed forth into an inspiring living thing when translated into action. Members of the agricultural and veterinary faculties were ably assisted by representatives of the U. S. Bureau of Animal Industry and U. S. Public Health Service, and the State Departments of Agriculture and Conservation and municipal meat, milk and sanitary inspectors from seven Michigan cities. The sanitary engineers of the seven participating counties served diplomatically and effectively as chairmen of the half-day sessions, stimulating and directing discussions and participating therein. A brief report of the short course, including a photograph of those in attendance, appears in the December, 1935, issue of the JOURNAL of the American Veterinary Medical Association.

Suggested Plan for Veterinary Participation in the Health Department Program

It is the plan to have practicing veterinarians participate in the Health Department's program in the following ways:

1. To make physical examinations of cattle on dairy farms from which milk is sold directly or indirectly to the public within the county.
   A. The first object of such physical examination shall be the detection and elimination of diseased animals from the dairy herd.
   B. The second shall be educational in nature with an effort directed toward informing the dairyman regarding the importance of disease-free animals both from the public health and economic aspect.

2. To make antemortem and postmortem examinations of animals and carcasses, the meat from which is intended for sale for human consumption.

3. To make inspections of slaughtering and retail meat establishments for the purpose of detecting unwholesome meat or meat products, and to inspect the general sanitary conditions of the premises.
   A. The inspection of slaughter-houses and markets is for the purpose of insuring sanitary surroundings where slaughtering is done and meat products processed and sold.

4. To give talks before groups, organizations or clubs, as requested, upon subjects such as health of dairy cattle, milk sanitation, slaughtering inspection and other subjects in line with professional veterinary work which may affect the public health. No charge shall be made for talks of this type.

SUGGESTED POLICY FOR EXECUTION OF THE PROGRAM

1. The first phase of the program to be undertaken shall be the physical examination of dairy herds.

Policy—

A. Those veterinarians who attended the short course held at the Michigan State College shall be eligible to participate in the program.
B. The engineer in each county shall designate, insofar as is practicable, the territory to be covered by each veterinarian, and shall also designate what herds, slaughter-houses and markets the veterinarian is to supervise. (It is believed best to assign each man a territory, so located that a minimum amount of travel time will be expended, irrespective of whether such territory includes certain of his clients, or the clients of another practitioner.) In the case of emergency situations, if the assigned veterinarian is not available the man nearest shall be assigned.

C. Each herd designated as one from which milk is sold for human consumption within the county, directly or indirectly, shall be inspected and examined by the veterinarian twice each year and upon such inspection certain facts shall be recorded on a form suitable for the purpose. One copy shall go to the dairyman, one to the veterinarian, one to the engineer, and one to the Bureau of Dairying, Department of Agriculture.

D. During the first year of the participation program, at least, the engineer shall give veterinarians instructions as to when to visit a herd—within reasonable limits—and if possible the engineer should be present with the veterinarian when the first visit is made at each dairy.

(a) If laboratory results confirm physical findings, or if they confirm suspected disease, re-inspection shall be made by the veterinarian, at which time instructions shall be given to the dairyman. If physical findings are not confirmed by laboratory procedures, no re-inspection need be made, but the dairyman should be notified by the veterinarian of negative results. (Card for reporting such to be drawn up by Health Department for veterinarian’s use.)

(b) With respect to Bang’s disease, it is thought best to approach this from the educational aspect only, and allow the dairyman to handle this problem individually.

E. In order to insure clarity and uniformity, a standard set of instructions shall be drawn up for use by each veterinarian. Such instructions shall include facts about the disease and advice to the farmer as to the most effective procedure for the elimination of diseased animals. On the reverse side of the veterinarian’s examination blank, facts about the disease and the most modern practices to follow shall be printed. Also a space for the veterinarian’s recommendations for a particular situation may be written at the bottom of the examination form (front side).

The drawing up of such a standard set of instructions should be carried out by the veterinary association, with the advice of the engineers, if the veterinarians so request. It is believed very important in this connection to request advice from the Department of Veterinary Science of the Michigan State College in this respect.

F. The engineer shall arrange and schedule a program so that it may be as evenly distributed as possible and so that expenditure will not exceed budgeted allowance. In planning the program it is believed important to leave some allowance for emergency work that may arise.

G. When and if general instructions are given the dairyman with regard to other phases of milk sanitation by the veterinarian, a statement to that effect should be recorded on the inspection report so that the engineer will know what instructions have been given. However,
we believe that definite instructions on milk sanitation, unless specifically requested by the dairyman, should not be given by the veterinarian and he should refer the dairyman to a copy of the milk inspection form which he will have with him, or to a copy of one which the dairyman should have in his possession.

MEAT AND SLAUGHTER INSPECTION

2. The second phase of the program to be undertaken shall be the ante-mortem inspection of animals and the post-mortem inspection of carcasses, the meat from which is intended for human food. Inspections of this type shall be made both at established slaughter-houses and establishments offering meat and meat products to the public.

Policy—

A. It is believed that this work, with the exception of meat market inspections, should not be undertaken until the first phase of the participation program—physical examination of dairy herds—is well under way and giving satisfactory results.

B. With respect to meat inspection at slaughter-house it is believed advisable to begin this part of the program when a suitable co-operative basis of work has been determined upon between the proprietor of such establishment and the Health Department. Further, if such an agreement is reached, the slaughter-house proprietor must agree to destroy carcasses, meat or meat products that are condemned.

C. In the case of meat market inspection, if the proprietor refuses to destroy meat or meat products condemned by the veterinarian, the veterinarian shall call upon the County Health Department to order that the veterinarian's recommendations be carried out.

D. It is recommended that each engineer compile a list of all known slaughtering establishments in his county, the days of the week that slaughter is carried on, the number and kind of animals killed, and whether or not any meat products are manufactured. If the engineer does not have such information available, it is important that it be compiled for future use when this part of the participation program is begun.

E. A similar list of all establishments retailing meat to the public should also be compiled.

F. A meeting of the veterinary association should be called prior to the time that this portion of the program is to be undertaken, so that plans and policies may be fully discussed.

PRESIDENT RECORDS: The next offering in this group is "Parasites of Importance in Meat Inspection in North America," to be given by Dr. T. W. M. Cameron, of MacDonald College, Montreal, Canada.

... Dr. Cameron presented his paper. ... (Applause.)

PARASITES OF IMPORTANCE IN MEAT INSPECTION IN NORTH AMERICA

By THOMAS W. M. CAMERON, MacDonald College, P.Q., Canada

Research Professor of Parasitology, McGill University and Director, Institute of Parasitology

Meat inspection is an old and honored branch of veterinary science and long before the evolution of the highly organized systems which we now have in North America and elsewhere, meat was systematically inspected for various morbid conditions,
and it is of considerable interest to recall that the earliest of these conditions were of a parasitic origin. In the pre-Christian Mediterranean civilization, for example, “measles” in pigs was well known—so well known in fact, that Aristophanes in one of his plays was able to make a slave exclaim:

Let us force a stake into his mouth as do the cooks and then, by pulling out his tongue we will examine, boldly and at our ease, his wide-opened mouth, to see if he is ‘measled’.

It is true, the cyst was regarded as a degenerated product rather than as a parasite and the same view prevailed in the middle ages when the earliest meat inspection regulations were passed in Germany against this same condition.

Even in later years, when the subject was brought more vividly to public attention, parasites were still in the forefront. We can, in fact, date our modern systems here to the discovery that trichinosis in man was almost always contracted by eating infected pork. About the middle of the last century, this disease was exciting much attention in Germany where it was feared almost as much as cholera and the plague; American pork was suspect as a source of infection (almost to the extent of causing international complications) and from this beginning, modern meat inspection developed. Nearly fifty years have elapsed since then, and it seems opportune to review the present relationship between animal parasites and meat.

PARASITES TRANSMITTED TO MAN ONLY THROUGH MEAT

Measles in pork: The parasite causing this condition is still more or less cosmopolitan in its distribution and in certain areas in North America, it is still quite frequently seen (e.g., where minced and peppered raw or semi-raw pork is commonly consumed). As a general rule, infections in pork are more easily detected than in the corresponding condition in beef, because the cysticerci tend to occur in numbers—partly because “joints” of *Taenia solium* are more frequently expelled and partly because of the feeding habits of the pig. Antemortem symptoms of a vague nature are sometimes seen. The host reaction is slight, however, and such disease as exists is due to pressure caused by the growth of the cysts. The cysts at first lie almost free in the muscles and only gradually form a firm capsule (whereas *C. bovis* in the ox has a quite severe reaction and even in the early stages is surrounded by a layer of lymph).

While *T. solium* is much less common in man than is *T. saginata*, multiple infections are more frequently seen. The old belief that *solium* meant solitary was wrong and was due to a
confusion in nomenclature; the \textit{T. solium} of the middle ages was really \textit{T. saginata} which is the true \textit{ver solitaire}.

This worm is much the most dangerous of human cestodes, as it is capable of development in its cystic stage in human beings, often in the central nervous system or the eye, with very serious results.

\textit{Measles in beef}: This condition is much more common than measles in pork and \textit{T. saginata} is very much commoner than \textit{T. solium}. (Its “peak” infection is in Ethiopia where nearly all the inhabitants are infected.) It is less commonly seen, however, because infections are, as a rule, very light. The reaction in the ox is severe and the cyst, if exposed by a cut, is easily detected. The bladders are dry and hard, and not so watery as \textit{C. cellulosae}.

\textit{Measles in sheep}: This condition closely resembles measles in pigs, but the old belief that they were aberrant \textit{C. cellulosae} has now been abandoned and every case examined critically has been found to be \textit{C. ovis}, which develops to adult life only in dogs (or related carnivores).

\textit{Trichinosis}: In spite of elaborate meat inspection regulations and intensive propaganda, both in Europe and North America, trichinosis is still with us. Recent surveys in the northern United States disclose a human infection rate of about 20 per cent, and dogs and cats, at least in some parts, are as heavily infected. It also occurs in bears and wild carnivores. The distribution of this parasite is essentially Temperate and sub-Arctic and it is virtually absent from the tropics. It is common in the southern-most part of South America.

Intradermal and serological tests have recently been elaborated which promise to be of value both in man and pigs, but their value in diagnosing clinical trichinosis in man must be considerably reduced because of the high infection rate. Like most intradermal tests, that for trichinosis persists for years. At the moment, the most useful diagnostic feature of the disease in man is the pronounced eosinophilia, which may be suppressed, however, in the presence of a bacterial infection.

Control is as difficult as it ever was. The elaborate meat inspection systems of Germanic countries are still subject to much internal criticism on the grounds of expense and false security. In North America, there is a quite general popular belief—in spite of education—that pork “federally inspected” is necessarily free from trichina and consequently safe to eat raw and it may be desirable to add to “U. S. Inspected and Passed” some
such phrase as "Not Inspected for Trichina." In any event, there is obviously an urgent need for more effective education.

PARASITES RENDERING MEAT UNFIT FOR HUMAN CONSUMPTION

Liver parasites: Liver flukes are still with us and, in general, are as common as ever. There is little to add to our knowledge of Fasciola hepatica (which may occur in all our food animals), but much new information is now available about Fascioloides magna, which has been shown to have a very wide distribution throughout North America. It has recently been studied very extensively by my colleague, Dr. Swales, and the first part of his work has already appeared in the Canadian Journal of Research. He has shown that while practically every species of ruminant (as well as several laboratory animals) may be infected, the lesions are very different in different hosts.

Although known as the "giant American cattle fluke," it is not a normal parasite of cattle. It lives normally in the liver substance of various members of the deer family, especially in elk or wapiti, coast deer, mule deer and Virginia deer. The lesion in the liver of these animals allows the free exit of ova and thus the life-cycle is completed in the presence of suitable snails (Fossaria parva and Stagnicola palustris nuttalliana have been found to be natural snail hosts in Canada). However, large Bovidae, including cattle, ranging over the same territory as the deer, ingest the infective cysts on grass, etc., and become infested, the liver appearing dark and irregular in outline and individual lesions appearing similar in external appearance to common abscesses. The tissue reaction to the presence of the fluke in these animals results in a high eosinophilia and the formation of a hard fibrous cyst from which all means of exit for the eggs are occluded. Thus the parasite is completely enclosed even before it grows to maturity and its destructive migration and means of reproduction are stopped. Sheep, on the other hand, are unable to resist the migration of the fluke in the liver tissue and the parasite is, therefore, extremely pathogenic in them and, at least in some cases, death appears to precede the maturation of the parasite. Infested sheep livers appear as obviously diseased organs, discoloration, irregularity of outline and fatty infiltration predominating.

The tapeworm, Thysanosoma, is still common in western sheep. Pathologically, it causes lesions analogous to those of liver fluke, but much less serious and more localized to the neighborhood of the bile-ducts.
The most serious of all the liver parasites is the hydatid cyst \((Echinococcus)\) which is still common throughout North America, although not so common as in South America, where a special society for its study has recently been formed. North America is still relatively free from human hydatid and probably not more than 500 cases have been recorded. It seems probable that the most important definitive hosts of the tapeworm are wild carnivores rather than domestic dogs and this may explain the relative human immunity. This would also account for the fact that hydatid is common in pigs and sheep and while it does occur in the liver of the ox, it is more frequently seen in the lungs (being usually sterile, however, in this host). Tanking of all condemned offal should ultimately reduce the incidence of this condition unless the normal hosts are wild animals. The frequency of the fertile cysts in the moose is a most disturbing discovery.

Pig livers often contain the immature adults of the pig kidney worm and not infrequently the livers of cattle as well as the lungs of pigs are erratically infected. The presence of the worm in the liver of the pig is, however, an essential stage in its migration to the kidney region. This parasite is much more serious in the South than in the North.

Many internal parasites must migrate through the body to reach their final habitat and a considerable proportion of these are destroyed in the liver by the host reaction. The commonest parasites in food animals thus captured are ascarids and lungworms, although probably many others are involved. These larvae form the focal points of tubercles which resemble those of bacterial origin except for the accumulation of eosinophiles. These cells are often so common that the small nodule has a greenish tinge to the naked eye. Generally, these lesions become calcified.

**Lung parasites:** Metastrongyles, hydatid cyst and erratic \(Stephanurus\) are the commonest parasitic infections in these organs.

**Kidney parasites:** In the pig, especially of southern origin, the kidney and adjacent tissues may be completely destroyed by \(Stephanurus\), while in localities where \(Ascaris\) is common, a toxic degeneration of this organ may be seen, although the worms themselves are not found in the kidney.

**Alimentary tract:** Of the many parasites found in the alimentary tract, most are of no significance from our immediate
point of view and we may disregard those which do not produce obvious lesions in parts used as edible offal or for sausage casings. Esophagostomes in ruminants and acanthocephalids in pigs are too well known to require special attention, although the value of intestines rejected, because of these parasites, must be enormous.

Recently, amphistome flukes in the rumen have attracted some attention in North America. They cause practically no tissue change in that organ, however, and the rejection of the rumen is due entirely to esthetic considerations. They have been shown to have a life-cycle essentially similar to that of *F. hepatica*.

In the esophagus, we find the burrows of *Gongylonema*, a nematode quite harmless to both man and beast. The hypothesis that it might cause gastric cancer in man has now been completely exploded.

More serious, from the economic point of view, are the young stages of *Hypoderma lineatum*, which, passing part of their life-cycle in the gullet, reduce its commercial value considerably. It is interesting to note that *H. bovis* (the common form in eastern Canada) never is found in this situation.

Both species, of course, still cause enormous damage to hides and, in the aggregate, quite considerable losses in “licked-beef” on the back.

*Muscle parasites*: Sarcocystis is still a common protozoan parasite of food animals, but little can be added to our previous knowledge of it, beyond the fact that it has been suggested that in sheep they are erratic stages of a very common protozoan parasite of the abomasum.

Apart from warbles, which are mentioned above, the only remaining muscle parasite of importance is *Onchocerca*. Some years ago, I described an *Onchocerca* from West African cattle, which formed small nodules in various parts of the body, especially in the intercostal muscles. They had a remarkable macroscopic resemblance to *C. bovis* (until incised). A number of species of *Onchocerca* have recently been found in North American and it would be well that all *C. bovis* nodules be incised before the carcass is condemned. There is no record of this *Onchocerca* here yet, of course, but that does not mean it does not exist. Beyond the fact that *Onchocerca* nodules contain much adventitious fibrous tissue, they are harmless to man in food.
PARASITES OF IMPORTANCE IN DIFFERENTIAL DIAGNOSIS

Quite apart from his main functions in protecting human health and eradicating animal disease, the meat inspector can do much to advance veterinary science. In connection with parasites, he not only is in a most favorable position to report on their incidence, distribution and practical importance but he, better than anyone else, can make those studies on the pathology of parasitic infections which are so essential. Most of the important parasites mentioned are easily diagnosed but a few offer special difficulties. The resemblance of *Onchocerca* nodules to beef measles has already been mentioned. Diagnosis is easy here, provided the nodule is opened with a knife. A parasite very common in North America but of little pathological importance, which often requires a similar technic for diagnosis, is *Setaria* in cattle. This worm often produces peritoneal nodules which, even to the eye of experienced inspectors, are often indistinguishable from those of tuberculosis.

*Fascioloides magna* has already been mentioned. Its pathological picture in bovines is quite unlike that caused by *F. hepatica*. The lesion, to the naked eye, resembles an abscess, and as these are seldom opened on the meat inspection table, the incidence of this fluke in cattle is probably considerably underestimated.

Another parasite worth mentioning in this connection is the larval stage of the "tongue-worm" of dogs, which is quite common in lymph-glands and may require differentiation in its later stages from tuberculosis.

Migrating larvae of the true lungworms reach the lungs, largely *via* the lymph-stream, and if arrested in the lymph-glands, they too may cause some initial confusion.

Dr. A. F. Schalk: I know every man in this room appreciates the excellent paper given by Dr. Cameron. The members of the committee for this section of the program are very glad indeed that they were able to influence Dr. Cameron to leave his work in far-away Canada, to give you the results of his almost world-wide travels and studies. In view of the assistance he has given us, I move that a rising vote of thanks be given Dr. Cameron.

. . . The motion was regularly seconded and carried. . . .

. . . The members rose and applauded. . . .

President Records: The next presentation in this group will be a discussion of "Bovine Mastitis," by Dr. D. H. Udall, of Cornell University.

. . . Dr. Udall presented his paper. . . . (Applause.)
BOVINE MASTITIS

By D. H. UDALL, Ithaca, N. Y.

New York State Veterinary College, Cornell University

INTRODUCTION

In presenting this subject an attempt will be made to give a survey of what is known about mastitis, what has been accomplished in its control, and what may be anticipated from an effort to maintain herds reasonably free from the disease.

While mastitis presents both public health and economic aspects, the requirements of each group are identical. When a case is so advanced that the milk is undesirable for the fluid milk market, the cow is usually unprofitable as a producer, and she is always an active spreader of infection; this cow stands first among the causes of the disease.

Necessity has forced an increasing interest in mastitis. Either losses have led to financial ruin, or demand for quality in milk has forced the advanced case from the stable. There is also the influence of successful attacks on other diseases. Now that farmers have learned that disease is controllable, there is increasing interest in how to prevent this one. Interest is comparatively slight, however, except from necessity, and the malady is increasing in intensive dairy districts where preventive measures are not in operation. Most diseases increase in frequency when left to themselves. Accurate statistical records of its prevalence are wanting and they would be difficult to obtain. More eloquent than statistical reports, however, are the facts that in dairy states most cows offered for sale by cattle-dealers are affected; that the purchase of sound cows for additions to herds can be safely accomplished only by a veterinarian trained in udder examinations; that few sales managers will permit examinations of cows' udders for a certificate of soundness; that where such certificates are issued the certified cow brings from $40 to $60 more than the uncertified; and that annual physical examinations of cows in the New York City milk-shed result in condemnation, chiefly because of mastitis, of about 5 per cent of all cows examined. In our demonstration herds it has not been unusual to find as high as 30 to 40 per cent of chronic mastitis in an advanced form. In the New York State Dairy Herd Improvement Association for July, 1934, 317 cows were discarded, of which 16.7 per cent were dropped because of mastitis, and no other single disease approached these figures.
WHAT IS MASTITIS?

Perhaps no other disease of domestic animals touches the interests of so many different people, and consequently there are several views concerning its nature. To the owner, mastitis presents the case of a cow that gives gargety milk, or the one that has lost one or two teats and is finally sold to the dealer because of ruined production. To the milk-dealer, mastitis causes high bacteria counts, leaves stringy material on the strainer, and shortens the keeping qualities of milk. To the public health officer it is one of the causes of milk-borne disease which renders pasteurization necessary in order to make milk safe for human consumption. To the dealer, mastitis affords an opportunity to buy cows cheap and sell them high, as springers. In addition to the various people affected by mastitis there is also the case of the chronic, subclinical, occult, or latent mastitis. To quote from a leading authority:

It is widely recognized that in many cases of streptococcus mastitis the disease remains latent or occult for long periods, and for this reason a diagnosis on purely clinical grounds is often difficult or impossible and can be arrived at only by an examination of the milk.

These viewpoints have at least one thing in common, in that they deal chiefly with the milk.

To define any disease one needs to consider the seat and nature of the tissue changes, the symptoms and the cause. In mastitis the changes in the udder are chiefly a fibrosis in which glandular tissue is lost and in which a variety of other changes may occur. Clinically it is characterized by asymmetry of the quarters with respect to size, weight and consistency, changes in the milk, a slow onset, and a chronic progressive course through successive lactations. The bacterial cause is found chiefly in *Streptococcus agalactiae*, according to nearly all investigators. But the dominant cause may be found in a poorly constructed stall, or in improper care of the udder. While mastitis is contagious, it is also a wound-infection disease, and introduction by means of teat injuries may lead to subsequent transmission either through direct or indirect contact. Unlike tuberculosis and Bang's disease, no permanent barrier has been erected between the cow and the invading microorganisms. One can only reduce exposure and combat invasion.

In table I, I have placed a record of observations, covering a period of five years, of a cow that entered production with a normal udder at two years of age and gradually developed into
an advanced case of chronic mastitis at about eight years of age. Her record is characteristic of the disease and is a partial answer to the question: What is mastitis?

This Jersey was born in March, 1928, and entered the stable as a first-calf heifer in September, 1930. In the table are recorded observations which may be termed clinical, since they may be made on the premises. In the first lactation, nothing abnormal was noted. On the blood-agar plates a few unidentified bacteria were found in the right hind and right front quarters, marked "bb."

In the second lactation, there appeared bromthymol blue and chlorine reactions, fibrosis, and many staphylococci, but no streptococci. Twenty-five examinations of milk at the Geneva Experiment Station for streptococci and leukocytes gave negative results.

In the third lactation, bromthymol blue and chlorine reactions had apparently receded somewhat, fibrosis had advanced, staphylococci were unchanged, and leukocytes had appeared in excessive numbers. No Geneva report.

In the fourth lactation, all previously observed changes had progressed. Monthly examinations at the Geneva Experiment Station revealed streptococci in the seventh month of lactation.

In the fifth lactation, all previously observed changes had progressed and many streptococci appeared on blood-agar plates made in our laboratory. No Geneva report.

This case illustrates certain fundamental characteristics:

1. The onset is slow and the course is progressive through successive lactations without acute activity.

2. Chronic mastitis (so-called occult, subclinical, or latent) is distinctly clinical except to the casual or inexperienced observer, and many farmers become fairly proficient in its detection. These symptoms constitute the characteristic syndrome of the disease.

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**KEY TO TABLE I**

| Column 1 | Calving dates. |
| Column 2 | Dates of observation. |
| Column 3 | Strip-cup examination and appearance of milk in test-tubes: w, watery; b, bloody; +, clots observed by milker; † bloody. |
| Column 4 | Bromthymol-blue test: —, negative; g, light green; G, green. |
| Column 5 | Chlorine test. |
| Column 6 | Gross appearance of milk incubated 24 hours at 37° C. |
| Column 7 | Results of physical examination of udder: S, slight fibrosis; D, distinct fibrosis; Da, distinct fibrosis with atrophy. |
| Column 8 | Blood-agar plates: b, few bacteria, unidentified; s, few staphylococci; S, many staphylococci; S*, many streptococci; s*, few streptococci. |
| Column 9 | Presence (+) or absence (—) of streptococci in milk samples examined at the Geneva Experiment Station. |
| Column 10 | Leukocytes: less than a million (—); one million or more (+). |
| Column 11 | Classification of the cow (2, 3, 3+). |
### Table I—Record of Jersey cow, born March, 1928, and received as first-calf heifer, September, 1930.

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Table I—Record of Jersey cow, born March, 1928, and received as first-calf heifer, September, 1930—continued.
Actively acute symptoms may never occur; they are always transient, and they are not characteristic. Acute activity is of chief occurrence in herds where the percentage of chronic mastitis is high. To refer to mastitis as clinical only when acute symptoms appear is a gross error.

3. Few diseases invite so wide a variety of diagnostic methods, both clinical and laboratory. This is explained partly by the position of the organ in relation to observation and palpation, and partly by the constant supply of secretion in the form of milk.

4. In general there is uniformity of agreement between the clinical and laboratory observations. But since the laboratory examinations are limited to the milk, individual observations may fail to reveal the true condition of the udder. Laboratory findings, therefore, should be correlated with clinical observations. As they are in other affections. Many cases observed in the same manner have given similar results with the appearance of the various groups of symptoms in about the same order. Possibly the relation between clinical symptoms and the shedding of streptococci may be similar to that of tuberculosis, of which it is written that “while tubercle bacilli may be present in the sputum when there is no other evidence of tuberculosis, it is more common for them to be absent for several months after the onset of the disease.” Instead of streptococci appearing before clinical symptoms, the reverse seems to be true, though it is probable that exceptions exist.

5. Changes in the milk are variable, but when fibrosis or atrophy appear these changes remain and they tend to progress. Any examination of the milk should be compared with the last calving date.

6. The bromthymol-blue and chlorine reactions appear early, vary somewhat in degree according to the breed, and should usually be interpreted as a signal rather than a verdict. Preference is given to solutions. The presence of reactions within one to two days after calving is of value in detecting cows that may prove by other methods to be distinctly affected.

7. The gross appearance of milk after an incubation of 24 to 36 hours at about 100° F. is a valuable diagnostic method. It is probably the safest and most practical milk test to recommend for the use of the farmer, since there are few false reactions, and it costs nothing.
8. Fibrosis is an early and distinctive symptom, and its extent is the chief guide to the degree of mastitis, of which four groups may be identified, namely, 1, 2, 3 and 4. Considerable practice is required if one is to become skilled in the detection of fibrosis. Even when advanced, it may not be recognized by the milker.

9. Blood-agar plates reveal unidentified bacteria and staphylococci for some time before streptococci appear. Streptococci may appear in the milk during one lactation and be absent from that of the next; the appearance may be irregular during any current lactation.

10. An increase in the leukocytes to a million or more usually precedes the presence of streptococci in the milk.

11. Infection is being disseminated from about 50 per cent of No. 3 udders and from 100 per cent of No. 4 udders. For this reason, segregation should include both groups where control is in operation. When streptococci are being shed freely and regularly, the clinical signs are easily recognized. Cows with No. 2 udders rarely shed streptococci in the milk.

WHAT HAS BEEN ACCOMPLISHED IN THE CONTROL OF MASTITIS?

I assume that sanitary officials are more interested in what may be accomplished than in the details of the operation.

In mastitis control the disease sets two chief requirements; first, detection and segregation of the active spreader of infection, the advanced case, and second, practice of stable and milking hygiene for the protection of normal udders.

As shown in table I, detection of the active spreader presents little difficulty to either a trained clinician or bacteriologist; and this includes the cow that may be an intermittent spreader. Since one must anticipate a certain amount of contact, it is not assumed that complete absence of exposure can be accomplished.

My discussion of what may be accomplished concerns itself solely with the area with which I am familiar, namely, the New York City milkshed. It is probable that similar results are being obtained elsewhere.

At the present time, there are three main groups engaged in control efforts; the individual owner, who may have suffered severe loss in production; boards of health and milk-dealers, who desire quality in milk; and the federal government as a part of their disease-elimination or cattle-reduction plan.
Among individual herd-owners demonstration herds have been established, chiefly under the auspices of the Extension Department of the College of Agriculture. The local veterinarian and the county agent select a suitable herd, to which farmers and veterinarians are invited for the survey and presentation of the plan to be followed. In some instances veterinarians have recognized the opportunities of this service in their practice, and have arranged for a mastitis demonstration in the herd of an influential client. Owners of valuable herds are gradually adopting a mastitis control plan under the supervision of their veterinarian. There is unanimous opinion that this method has great educational value and that the program should be extended. One reads with satisfaction that a badly infected herd has reached a leading position in the herd improvement association within one or two years after the adoption of the plan.

Physical examinations of cows under Board of Health Regulations of New York City, other large cities in the East, and various milk companies have led to the exclusion of many advanced cases from producing herds. Under the regulations it is the duty of the veterinarian to instruct the owner in methods of disease prevention with special emphasis upon mastitis. Within the past five years, and since the adoption of a method of classification of udders, skill in the detection of chronic mastitis has advanced rapidly. Rejections under annual examinations have risen from 1 per cent to 5 per cent. In a group of 1,000 cows examined twice yearly in our ambulatory clinic, condemnations are 3 per cent at each examination.

Dr. F. D. Holford, Chief of the Veterinary Department of the Borden Farm Products Company, has kindly given me the results of the first year of quarterly examinations of approximately 41,000 cows. In the first three quarters, rejections and segregations were about 3 per cent at each examination; in the fourth quarter, these dropped to 1.5 per cent, and in the fifth quarter, the percentage is still on the decline. While these rejections may indicate a heavy loss, one needs to consider that loss in production has already taken place and that rejection has removed only a boarder cow. Progressive farmers are friendly to the service and appreciative of suggestions for control. Indifferent dairymen and dealers furnish a rejection rate far above the average. In many herds, indeed, there are no rejections. In our own group, for example, in the last examination made there were no rejections in 60 per cent of the herds. On two large farms that
have been badly infected in the past not a single rejection was found.

From the beginning of these inspections, about 25 years ago, when the veterinarian did little more than write a certificate for a nominal fee, the service has acquired effective regulations, and supervision of inspectors. The veterinarians operate under a Manual of Instructions, many demonstrations for those engaged in the work have been held, and many veterinarians have spent several days each at the college in order to meet the increasing demands of the service. Regulations without adequate instruction and supervision of inspectors are apt to be ineffective; as a rule they are unfair to the producer, and they tend to discredit the veterinarian.

Since the beginning of the federal program under the provisions of the Jones-Connally bill, over 5,500 cows have been rejected under this plan in New York State because of advanced chronic mastitis. The benefits of this program are several:

1. Federal activity has convinced many owners that there is a practical method of control.

2. It has introduced the practice of branding animals rejected because of mastitis. For some time it has been recognized that branding of rejects is desirable as a means of preventing traffic in condemned cows. Such traffic has cost farmers thousands of dollars and been a frequent cause of financial ruin. Now that the brand has been introduced, it is reasonable to predict that in time all rejected cows will carry a permanent mark of identification. Dealers as well as farmers believe in it.

3. It has encouraged the practice of sound replacements and provided the owner with financial support in their purchase. From the standpoint of disease control, it may well prove to be one of the most useful by-products of the depression.

Perhaps the most substantial contribution of these various efforts has been recognition by leading dairymen that mastitis may be controlled; that the method is practical and effective; and that it brings immediate economic improvement. The most important feature of all, however, is not the number of cows that have been rejected, or the methods of diagnosis, but the success that has attended the program.

**President Records:** If there is no discussion, we will proceed with the next item, which is the report of the Committee on Meat and Milk Hygiene to be made by Dr. A. F. Schalk, Chairman.

... Dr. Schalk read the report. ... (Applause.)
REPORT OF COMMITTEE ON MEAT AND MILK HYGIENE

DR. A. F. SCHALK, Chairman, Columbus, Ohio

Dr. M. F. Barnes, Harrisburg, Pa. Dr. J. S. Koen, Chicago, Ill.
Dr. J. G. Hardenbergh, Plainsboro, Dr. D. H. Udall, Ithaca, N. Y.
N. J.

Your Committee on Meat and Milk Hygiene is grateful that it was possible to obtain the able speakers to present at this meeting the excellent program which you have just heard on subjects having a close relationship to human foods, and, consequently, to human health.

Foods of animal origin constitute a major portion of the elements essential to human existence. Man's welfare is dependent upon the wholesomeness of these food products which, unquestionably, are best when produced by healthy animals.

Your Committee is cognizant of the existing relationship of many diseases of animals to human health, although the significance of all diseases has not been determined.

We believe the time is at hand when we should outline and approve definite principles for adequate control over food products of animal origin.

MEAT

The meat hygiene service as performed by the U. S. Bureau of Animal Industry is unexcelled and should constitute the standard for all such services. It has supervision over approximately 60 per cent of the meat supply of the nation.

There are a few counties and many cities that conduct local meat inspection under varying degrees of efficiency. There is still a comparatively high percentage of meats prepared and sold without official supervision. For a detailed report on meat inspection we refer you to the report of the Special Committee on Meat Hygiene of the American Veterinary Medical Association, as published in the October, 1935, issue of the JOURNAL of the A. V. M. A.

We earnestly urge this Association to lend its support to every worthy effort to secure the preparation of all meats and meat food products under supervision comparable to that of the U. S. Bureau of Animal Industry.

MILK

When not adulterated and when free from disease-producing germs, milk is the most wholesome food for mankind. It constitutes a large proportion of the diet of infants, invalids and convalescents and is indispensable for growing children.

Many cases are on record of undulant fever in humans from contact with animals infected with organisms of the Brucella group and from the consumption of milk from animals so infected. It is also known that a high percentage of these animals eliminate the Brucella organisms in the milk. Thus, raw milk from such infected animals should be considered unsafe for human consumption.

For dairy inspection service your Committee submits the following recommendations:

(a) In the production of fluid milk for human consumption, regulations should provide for the proper physical examinations of cows producing such milk.

(b) Veterinarians engaged in this work should be provided with suitable instructions and authorization to order removed from the herd cows found to be unfit for milk production.
(c) In order to secure uniform and effective results, veterinarians conducting the inspection service should be properly supervised.

The Committee recognizes that food inspection is primarily a public health function. We believe that supervision of inspection of foods of animal origin constitutes a distinct division in public health service.

The facts which have been established should indicate that veterinarians, who are familiar with the diseases of animals communicable to humans and the diseases intercommunicable between animals and humana, should occupy important administrative positions on national, state, county and municipal health boards or administrations whose duties are to execute and regulate the control of foods of animal origin.

Your Committee further recommends:

1. That properly qualified veterinarians administer the specific branch of work having to do with diseases of animals communicable to humans, and that they be represented on all public health boards and all other boards, commissions and departments whose duties require the handling of human foods of animal origin.

2. That all meat and meat food products for human use receive adequate inspection comparable to federal meat inspection.

3. That this report be used by this Association as a basis of procedure for the future policy in this connection.

4. That a Committee on Meat and Milk Hygiene be continued by this Association.

DR. SCHALK: Mr. Chairman, the members of your Committee have entered into this work with considerable enthusiasm, and I want to take this opportunity to thank them for the assistance they have given.

PRESIDENT RECORDS: I have been instructed by the Executive Committee to name a nominating committee. I will appoint on that committee Dr. E. A. Crossman, of Massachusetts; Dr. C. P. Fitch, of Minnesota, and Dr. H. D. Port, of Wyoming.

Owing to the prospects of congestion, and for certain reasons involving some of the membership, I have been requested to introduce Dr. R. M. Hofferd at this time, for the first paper in the Transmissible Diseases of Swine Symposium, "Swine Dysentery in Iowa from a Field Standpoint."

. . . Dr. Hofferd read his paper. . . . (Applause.)

SWINE DYSENTERY IN IOWA FROM A FIELD STANDPOINT

By R. M. HOFFERD, Cedar Rapids, Iowa
United States Bureau of Animal Industry

Swine dysentery is an acute infectious disease of swine, characterized by bloody diarrhea which contains gross red blood, mucus, and sometimes particles of croupous exudate. At times, quantities of practically free blood are passed.

Synonyms: Hemorrhagic enteritis, acute infectious enteritis, swine typhus, bloody diarrhea, bloody dysentery, bloody flux, colitis, Dakota disease, bloody scour, and black scour are other terms used for the disease in the field. The name "black scour" was introduced by the laity as the fecal discharge at the onset of the disease is frequently dark in color.
EXTENT

Dr. G. A. Kay, United States Inspector-in-Charge, Meat Inspection Division, Cedar Rapids, Iowa, informed me that he encountered the disease in western Iowa, in 1918, while in hog-cholera-control work for the Bureau. Doctor Kay stated that the disease was very extensive at that time in feeding hogs that were shipped into Iowa from public yards. Other than this, he was unable to recall the origin of the disease. The disease was very acute and losses were extensive. Most of these were recently vaccinated hogs. This report is the earliest available concerning the occurrence of this disease in Iowa. Since that time, swine dysentery has been spread far and wide to all corners of the state by the movement of livestock for feeding and breeding purposes. In our state, the community sales have been a major factor in the dissemination of the disease. This occurred despite every effort by our state regulatory officials to formulate and enforce regulations to prevent the spread of the disease by such means.

To my knowledge, swine dysentery has been encountered in eastern Iowa for ten years. There were only a few cases at first, but year by year, it has increased so greatly in prevalence that there now is scarcely a veterinary practitioner in the entire state who has not encountered the disease.

No statistics are available concerning the economic loss in dollars and cents but reliable veterinarians estimated death losses up to 1,500 head in their respective practice areas in a single year. Veterinary practitioners have held special meetings in various sections of the state for the sole purpose of discussing this new disease and the problems of control. Swine dysentery had become so prevalent, menacing, destructive, and difficult to control that it had caused alarm among the livestock raisers and veterinarians all over the state.

The disease is believed to be less prevalent during the hot summer months but does occur during the entire year.

MORTALITY

The mortality varies greatly, depending upon the virulence of the disease, the weather, and other conditions under which the drove is maintained. If weather conditions are such that it is impossible to control the intake of the infection by sanitation, or if no efforts are made to follow the recommendations as to sanitation and diet, death losses have been noted that ran as high as 90 per cent. Many droves were observed in which death losses were 50 per cent, even though every effort was made to stop the losses.
A case is recalled in Johnson County where a veterinarian was called to see a drove of 100 shoats averaging 125 pounds. These shoats had been cholera-immunized two months previously and were following steers on full feed. The day before our arrival, some of these shoats were sick, off feed, and scouring profusely. On the day of our visit, the owner found seven dead and a number passing blood. We advised removal of the well shoats from behind the steers to clean ground and no further access to the old yards and buildings. Proper diet was also advised. The veterinarian administered enteritis bacterins and prescribed medication. The sick shoats were segregated. About 25 per cent of the drove had died by the time death losses ceased. Two weeks more elapsed and everything seemed fine when the veterinarian met the owner on the street. The owner said he did not think there was much to the idea of the shoats getting sick in that lot with the steers, because they got some boards off the fence and got in with the steers again. This happened a week ago, he said, and the shoats were still doing nicely. The next day the veterinarian received a call to come right out to the farm. The hogs were sick again. The same procedure was followed as before and another 25 head died, making a 50 per cent death loss in all. There is no question in my mind but that this man would have lost almost every shoat in his drove had he permitted them to remain in the infected feed-lot.

In many droves that are not moved, pulmonary complications result. It is my belief that these complications arise from inhalation of dust that has become infected from the fecal discharges. When this occurs, fatalities result and, as a rule, not many survive an attack of this kind. It is my observation that the average mortality in droves where efforts are made to follow recommendations will run 30 per cent. In exceptional cases, the disease terminates with a relatively small death loss. Spontaneous recovery with no treatment or sanitary measures is occasionally reported.

Susceptibility

Field observations show that swine of all ages, cholera-immunized or cholera-susceptible, are susceptible to swine dysentery. It would seem that very young pigs have less resistance to the disease than older swine; also, that recently vaccinated swine are more susceptible, due, no doubt, to the leukopenia that follows the serum-virus treatment, demonstrated by Dr. C. N. McBryde. In fact, it is the opinion of some veterinarians that
the serum-virus treatment has been the spark that set off this alarming disease, especially in incidents of insufficient serum dosage and otherwise incompetent administration. In short, any conditions that lower the resistance of the animal naturally render it more susceptible to the disease.

It is also the observation of veterinary practitioners in Iowa that one attack of this disease does not render swine non-susceptible to subsequent attacks. Farmers on numerous occasions, have pointed out animals to me identified by markings which have gone through more than one attack. Either this is the case or such animals did not completely recover.

A veterinarian in Buchanan County had a case in his practice that might be of interest in this connection:

This drove received medicinal and biological treatment. Also changes were made in diet and strict sanitation was established. Fatalities ceased after a 10 per cent death loss, but the disease started up again whenever corn was added to the diet. The owner finally had to give up trying to feed corn to the remainder of the drove and marketed them before they were really finished. It is the opinion of many veterinarians that irreparable damage is done the intestinal tract in many animals which go through swine dysentery or they continue to harbor the infection after they have apparently recovered and have done well for a period of time. Other veterinarians hold the opinion that biological agents cannot produce an artificial immunity when no natural immunity follows recovery from an attack of the disease.

TRANSMISSIBILITY

Swine dysentery is most likely transmitted by the ingestion of infective material. Pulmonary complications probably result from inhalation of infective dust.

The disease may be transmitted experimentally by feeding intestinal tissue from affected pigs to normal pigs, according to Biester, Schwarte and McNutt. These investigators further state:

The experimental cases were confined to several pens in a barn. In this same barn, but in other pens, some non-infected pigs were kept for as long as five weeks but the infection never escaped from the infected pens. In some instances the same attendant, cleaning his rubber gloves and boots with antiseptics, cared for both groups. Previous observation showed that pen exposure without feeding intestinal tissue resulted in infection. We have often observed that this hemorrhagic enteritis occurs when hogs are following cattle. This probably is only a coincidence. A calf was drenched with material from affected swine but it failed to show any response.
This quotation brings up some points that should be emphasized:

That the disease may be transmitted by feeding affected material.

That it may be transmitted by exposure in infected pens. This is evidenced by infection being so frequently contracted by hogs passing through public sales.

That premises may remain infected for a variable length of time, probably from three months to three years, according to personal observations.

That new additions of swine to a drove are a means of transmission.

That cases have been noted in which new importations of cattle appear to have been responsible for the disease in a drove of swine previously healthy. Even though the disease is not transmissible to cattle, experimentally or otherwise, we in the field can not understand why cattle cannot be carriers.

**PERIOD OF INCUBATION**

To quote further from Biester, Schwarte and McNutt:

The cases produced experimentally, by feeding intestinal tissue and contents, showed an elevation of temperature beginning from the fourth to the sixth day and in one instance not till the seventh day. One pig did not show a rise in temperature. Diarrhea appeared about the sixth day. Usually, the elimination of blood began one or two days later.

In the field, it is more difficult to determine the period of incubation but it is believed to be usually about seven days but may be longer or shorter. It is the opinion of a number of practitioners that the period of incubation may be as short as two days.

A case is recalled of a drove that was purchased at a community sale and immediately trucked home. These cholera-immune shoats were brought from the farm to the sale on the same day they were sold. They sickened two days after their arrival at their new home. The farm where the shipment originated was visited, as it was believed that surely the shoats came from a sick drove. Such was apparently not the case, for the remaining shoats on the farm were doing fine. The farmer claimed he sold these shoats due to shortage of feed. The local veterinarian verified this fact and further stated there had never been any yard diseases on this particular farm to his knowledge. From our observation, it appeared that this shipment was exposed while passing through the community sale and that the period of incubation was two days.
ETIOLOGY

From a field standpoint, not much can be said concerning the etiology. A variety of microorganisms, both bacterial and protozoan, are named as causative factors by laboratory men. They receive numerous specimens submitted by veterinary practitioners for laboratory examination from a great many infected droves. Many investigators concur. Others claim that these organisms should be considered as merely associated with the disease and that the etiology should be considered as unknown until definite evidence has been presented and examined. The question arises as to whether there is a specific causative factor and whether the organisms mentioned are merely secondary invaders which aid the primary factor in its destructive work. Evidently the bacteriological picture changes as the disease progresses in a drove.

CLINICAL SYMPTOMS

When we first see these cases in the field, the symptoms are pretty well established in some of the pigs and other pigs of the drove are manifesting the first symptoms. Usually, a few pigs show evidences of the disease at the onset and each ensuing day more animals show symptoms. The rate at which they become sick depends upon the virulence of the infection, no doubt, for in some droves the disease develops very rapidly. In some affected individuals there may be complete loss of appetite, diminished appetite, or no impairment of appetite whatsoever. Diarrhea is an early symptom, which at first is often dark colored, later becoming bloody, with mucus and sometimes croupous exudate. Sometimes animals are noted that move about freely and actively and exude quantities of apparently free blood.

Some animals show weakness and great loss of body weight, while in others these symptoms are less evident at the beginning of the attack. Temperatures have been noted to vary considerably from as low as 100.8 to 105 and sometimes up to 106° F. Usually, the temperature runs about 104.5. During the latter stages, there is great prostration. As the disease progresses in a drove, it appears to become somewhat less acute. Some animals die suddenly or after two or three days of illness and others are sick from four to seven days before they succumb. In some droves, pulmonary symptoms develop as a complication, evidenced by labored breathing but at times there is only a slight coughing. Animals so affected frequently die very suddenly.
POSTMORTEM FINDINGS

According to Biester, Schwarte and McNutt:

The experiment animals, when killed in the early stages of the disease, showed a hemorrhagic enteritis, a bleeding mucosa, and gross free blood in the cecum and large intestine. As the disease progressed, this acute hemorrhagic picture disappeared and, if the animal lived four or five days after the blood disappeared from the feces, the lesions assumed a different picture. The formation of a diphtheric membrane occurred. During the acute stage, there was often a pronounced subserosal edema.

Findings in field cases are much the same. Besides the inflammation and bleeding of the mucosa of the cecum and large intestine, we frequently encounter a severe gastritis and hyperemic lymph-glands of the mesentery. There may be pronounced nephritis and cystitis. Frequently enlargement and inflammation of the spleen are encountered. At times a slight petechiation of the kidneys and bladder is noted. In the acute stages, the contents of the cecum and large intestine are usually very liquid, bloody in places, and dark or chocolate-colored and very fetid in other sections. The mucosa is intensely reddened and often sloughing in patches. There is frequently an edematous thickening of the bowel wall. In the later stages, there is usually considerable diphtheric membrane formation.

In the pulmonary complicated cases, we find bilateral pneumonia varying from slight to extensive with consolidated areas in the lungs usually gray and containing fluid, mucus, and sometimes pus. Also there is observed considerable fluid in the pleural cavity and pericardial sac. The bronchial lymph-glands are frequently enlarged and somewhat hyperemic.

DIFFERENTIAL DIAGNOSIS

At the very onset of the disease, swine dysentery is difficult to detect but after blood appears in the feces, it is easily recognized from clinical observation. However, the disease usually develops very rapidly and blood appears in the feces within two days after becoming sick so that some animals are invariably passing blood when the veterinarian is called. In the later stages, when the disease becomes somewhat less acute, and blood is no longer perceptible in the feces, swine dysentery is differentiated with difficulty in the field from other less acute forms of enteritis. This is not so important, as the same control measures apply.

Generally speaking, the clinical observation, supported by postmortem findings and the history of the drove and the premises,
makes the diagnosis of swine dysentery a relatively definite matter. This information is necessary in the diagnosis of all swine diseases. The chief difficulty in the diagnosis of swine dysentery, in my opinion, is encountered in complicated cases, especially in our inability to eliminate hog cholera in cholera-susceptible droves. The possibility that hog cholera might make its appearance in any cholera-susceptible drove should never be overlooked.

CONTROL

The chief measure effective in controlling this disease has been sanitation, and details of sanitary measures vary according to conditions on different farms.

Prevention is more effective than cure and, in this regard, the details of the McLean County system of swine sanitation should be strictly applied. We should bear in mind the possibility of mature hogs being carriers and the possibility of drainage carrying the infection to the new ground. Also, the spreading of manure from old yards and buildings to the new ground should be avoided.

The treatment of droves affected with this disease offers a very grave problem. There are times when the disease terminates after small losses, but usually, if strict sanitation is not applied, losses may be very extensive. Biological and medicinal treatments have their merits but it is unfair to expect much benefit from them without the support of sanitation and diet. The intake of infection should be controlled. If the hogs are following cattle, they should be removed. Also, all corn should be removed from the diet. Soaked oats and buttermilk, or sour milk, is the diet usually recommended in our state. During the drouth of 1934, this problem was very much increased because oats were very scarce. The water supply should not be overlooked, as it may be a source of re-infection. The visibly sick animals should be segregated and, if possible, the apparently well animals removed from the old yards and buildings to clean ground. Sometimes hogs can be confined to a concrete floor and, if this floor is kept scrupulously clean, the intake of the infection may be controlled to the extent that good results may follow treatment. The best method, however, is to remove operations to clean ground for a time and thoroughly clean and disinfect the old premises allowing them to remain idle for a season at least and preferably longer. Following this, the premises may be tested with a few head of hogs to determine whether or not the infection has been exterminated.
New shipments of hogs or cattle should be quarantined for a reasonable time before being added to a healthy drove of swine. A few hogs may be turned in with the new shipment of cattle thus isolated to determine whether they are carriers of the disease.

Cases have been noted in which biological treatment appeared to work like a charm but the variance of the organisms which are found associated with this disease would lead one to believe that good results should not be anticipated from its use in all cases. Likewise, the protection is believed to be of short duration and, if animals become re-infected, they may again develop the disease. Sanitation, therefore, seems to be an imperative measure if enduring results are to be anticipated.

A very few veterinarians have reported good results from the use of anti-hog cholera serum but these reports remain unverified. We do feel that the application of the serum-virus treatment to droves affected with swine dysentery is contra-indicated.

The greatest problems in connection with the control of swine dysentery are encountered during cold weather, when sanitation is difficult to establish and it is not possible to move the animals from the infected premises, likewise, in instances where cattle feeding is done on a large scale and the feeding yards become infected. On these latter farms, there is always a great investment in permanent equipment that cannot be moved. The owner does not consider cattle feeding profitable without having hogs to consume the waste feed. Fifty per cent death loss is likewise unprofitable. The veterinarian is handicapped because, under these conditions, the intake of the infection cannot be controlled nor the diet regulated and all treatments are ineffective. So the feeder sustains extensive death losses in each shipment of feeder hogs. On some farms, this goes on year after year and on a few farms, the disease seems to run out after two or three years of death losses. On one farm in Grundy County, the farmer sold off all his hogs and three months later purchased another shipment and did not have any further trouble. Another farmer in the same community had a costly death loss last year and had no loss in another shipment, this year. These are considered exceptional cases, however.

A prominent cattle-feeder in Dubuque County experienced this disease in his hogs following the cattle five years ago. For three years, 50 per cent of all his hogs placed in feed-yards died after recurrent attacks of the disease. One shipment of 100 head was split up into two lots. One lot was placed in the feed-yards with
the cattle and the other lot was kept away from the yards and buildings. Fifty per cent of the hogs in the feed-yards died and in the other lot of 50 head not a single hog died or developed the disease.

This indicated that the feed-yards were infected. Losses continued for three years. Then he marketed all his feeding cattle and hogs, gave the yards and buildings a thorough cleaning and disinfecting and for the past two years has had no trouble from the disease. Losses from swine dysentery on this farm alone aggregated about 300 head.

Numerous cases of this kind could be cited, perhaps on a smaller scale, but illustrating the futility of attempting to control the disease without the application of sanitary measures and proper diet.

DISCUSSION

For the sake of discussion, the history of swine dysentery on two farms might well be recited:

Seven years ago, Mr. H. bought 50 head of shoats from his brother who lived nine miles distant. His brother had never immunized against hog cholera and luckily had never had any swine troubles. These 50 head and 50 head of home-raised shoats were immunized with anti-hog cholera serum and virus the day Mr. H. brought home the purchased shoats. Twelve days after this, he castrated the boars that he had purchased. Four days later, six of these castrated shoats had bloody diarrhea and three died. The next year, Mr. H. raised 100 head and had them immunized against cholera at weaning time. He had no trouble until late that fall. All that winter, about 20 head at a time contracted the swine flu at intervals and each time about half of those that sickened with the flu developed a bloody diarrhea and died. He lost 75 head that winter. He was advised concerning the change of quarters but he did not make such changes. Every known treatment was tried, including dietary, medicinal and biological treatment, without apparent benefit. The following spring, he had 140 pigs. When six weeks old, these pigs developed a bloody diarrhea and 120 head died. Mr. H. immediately rebred the sows and had them farrow in late summer, on clean ground, in movable hog houses. The yards and buildings were thoroughly cleaned and disinfected and left idle until late in the winter when the shoats were brought up to the yards and fed out. Mr. H. continued this procedure and to date has had no further trouble.
A creek runs down from the farm of Mr. H. through the farm of Mr. S. In fact, their farm pastures are adjacent. The year after Mr. H. lost the 120 head, swine dysentery started on the farm of Mr. S. He had 65 head of bred sows. These sows would farrow and in two or three days develop a bloody diarrhea. The sows and litters thus affected all died. The only sows that survived were those that were not pregnant. Mr. P. purchased this farm two years ago. He did not have any trouble last year, but he did not immunize against hog cholera. This year, Mr. P. vaccinated 113 head. Six days after vaccination, 50 head sickened, apparently with the same infection. The last report was that 25 head died.

The history of swine dysentery on these farms illustrates some of the important features that should be emphasized in this summary:

- That the disease may be harbored on premises from year to year.
- That swine of any age may be affected.
- That lowered resistance, whether due to castration, farrowing, vaccination, or other factors, may render animals more susceptible.
- That the infection may be carried by drainage.
- That the disease may be recurrent in a drove.
- That sanitation was a measure that terminated the disease.

The procedure that Mr. H. followed, contrary to advice, was to retain the same sows but luckily he escaped ill results. In many such instances, sows apparently were carriers and started the disease in the newly-farrowed pigs.

We should here again stress the necessity for supporting the treatment with proper diet, sanitation, and pure water supply in treating affected droves.

Lastly, it would be well to emphasize the advisability and good economy of holding under voluntary quarantine on farms newly purchased animals for a reasonable time before allowing them to mingle with healthy animals on the farm.

Members of this Association have ever exercised great influence in urging such important precautionary measures. Our continued efforts for the education of livestock owners along these lines can result in further immeasurable savings in dollars and cents in preventing the dissemination of not only swine dysentery but other costly infectious diseases of livestock so transmitted.
CONCLUSION

In conclusion, let it be said that the foregoing methods afford the best means of control in the light of our present knowledge of the disease. In the field, we continue to hope that the etiology will soon be cleared up in order that more specific control measures may be established to obliterate this increasing menace to the swine-raising and cattle-feeding industries. Not only is the economic loss from swine dysentery of grave importance but it interferes greatly with the successful immunization against the most devastating disease of swine—hog cholera.

PRESIDENT RECORDS: If there is no discussion, and there are no objections, we will recess until 1:30 p.m.

... The meeting recessed at 12:20 p.m. ... Recess

THURSDAY AFTERNOON, DECEMBER 5, 1935

The fourth session convened at 1:45 p.m., President Records presiding.

PRESIDENT RECORDS: The first speaker this afternoon is Dr. H. W. Schoening, who will present a paper by himself and Dr. G. T. Creech, of the Pathological Division, U. S. Bureau of Animal Industry, on "Swine Erysipelas—with Particular Reference to Serological Diagnosis."

... Dr. Schoening presented the paper. ... (Applause.)

SWINE ERYSIPELAS—WITH PARTICULAR REFERENCE TO SEROLOGICAL DIAGNOSIS

By H. W. SCHOENING and G. T. CREECH
Pathological Division, Bureau of Animal Industry
Washington, D. C.

Since the recognition of swine erysipelas as an acute herd infection of swine is comparatively recent in this country, the diagnosis of the disease has presented many difficulties. In those areas where the disease first has appeared in a number of herds, many veterinarians, through their clinical observations, supported by laboratory examinations, have become fairly able, after considerable experience with the disease, to recognize it in most cases. However, like other diseases, swine erysipelas may at times be difficult of clinical diagnosis even by one familiar with the disease, particularly in its early stages when it first appears in a herd. Postmortem examinations in many cases are of only limited help in diagnosis.

It is not the intention here to go into a detailed description of the disease and its differential diagnosis, since this has already
been done in a thorough manner by Fosterman,1 Breed,2 Munce,3 Hays,4 Harrington,5 Stiles and Davis,6 and others, but rather to devote our time to a discussion of the application of the agglutination test in the diagnosis of the disease.

Recognizing the difficulties of diagnosis of the disease and the need for a specific diagnostic agent, we have been engaged in a study of an agglutination technic that could be applied practically to the diagnosis of swine erysipelas. In 1932, we reported the development of a whole-blood agglutination test and a laboratory tube test as applied to the diagnosis of the disease. In this report, quite encouraging results were obtained with the tests in limited trials, both in the field and in the laboratory.

We have continued our investigations since that time and now desire to report the results of our studies and the present status of the agglutination test in the diagnosis of swine erysipelas.

We have given attention to both the whole-blood plate test and tube test. The technic of the former consists in mixing a loopful of the whole blood to be tested with the antigen on a glass plate and reading the reaction within a two-minute period. This is the field test. The laboratory tube test is performed by placing various dilutions of serum in a series of tubes, adding the required antigen, incubating for 30 minutes at 37° C. and then centrifuging the tubes for four minutes at 1,800 revolutions per minute and reading. The technic is, in short, that described in our first paper.7

Early in our work we encountered difficulties in the preparation of uniformly satisfactory lots of antigen. Some lots of antigen were quite satisfactory at the time of preparation and remained so for a period of two to four weeks, when they either became too sensitive or developed a tendency to more or less spontaneous clumping. Other lots of antigen were satisfactory for a longer period of time. During the past year, particular attention has been given to a study of the various factors that might be considered to be responsible for the instability of certain antigens. After studying a number of these factors without success, attention was given to a study of the colony development of E. rhusiopathiae, the causative agent of swine erysipelas. Two types of colonies could be demonstrated, a rough and a smooth. Cultures made from these two types of colonies have maintained, after more than 200 transfers over a period of eight months, their rough and smooth characteristics on plating. Antigens were made from both types of colonies according to the standard method as previously described. Those made from the smooth type (S) were invariably more satisfactory than those prepared
from the rough type (R). In the S-type antigens, the organisms were in a fine uniform suspension, which showed little or no clumping on standing; showed a uniform suspension on shaking by hand; and had a satisfactory degree of specificity, characteristics which have been maintained for a period of months. On the other hand, antigens prepared from the R type had a tendency to clump after standing, to be more sensitive and to have inferior keeping qualities.

The antigens prepared from the S-type colonies appear to be sufficiently stable and specific now to permit of their application with the plate test in the field in order to determine their effectiveness as an aid in the diagnosis of swine erysipelas.

THE PRACTICAL APPLICATION OF THE AGGLUTINATION TEST IN THE DIAGNOSIS OF SWINE ERYSIPELAS

The successful use of any diagnostic test depends not only on the specificity of the test materials but also on a recognition of the limitations of the test itself and on a proper interpretation of the results obtained from the use of the test.

We do not have a biological test that is 100 per cent effective. The agglutination test for swine erysipelas is by no means an exception to this.

Specific agglutination of bacteria by the serum of an animal is an indication that the animal has been exposed to microorganisms similar to those in the agglutinating fluid and that they have gained entrance into the animals with one of the following results: (1) That the animal is actually infected with the disease produced by these organisms, (2) that the animal has been infected with the disease, or (3) that the organisms have resided temporarily or are still present in the animal without producing any visible symptoms of disease. Much information on these points is obtained in the tube test by the dilution of the serum causing positive reactions and subsequent testing.

Reactions in low dilutions (1:25) may mean that infection has been recent, or that antibodies are in the formative stage. Tests of the serum taken at a later date in such cases will usually show a reaction in higher dilutions. On the other hand, later tests may give no change in the readings. Reactions are still in the same low dilution. This would most probably indicate that the animal either had contact with the organism or was harboring it, possibly without actual infection.

These brief examples are mentioned as a forerunner to a specific discussion of the limitations of the agglutination test for swine erysipelas and interpretations of the reactions.
The agglutination test for swine erysipelas has the same limitations as other serological tests and needs proper interpretation of its results. We believe that the test is best suited for determining the presence of the disease in a herd rather than for picking out individual diseased animals.

Comparative tests made with serum by the plate test and the tube test indicate a fairly close agreement in results in general. However, in certain serums some differences have been noted. With the plate test (two drops of antigen and one of serum or whole blood) the final reading is made within a two-minute period, the time factor being used for the information furnished by reactions in various dilutions of serum in the tube test.

Comparative tests with the whole blood and serum by the plate method are in general agreement. However, the presence of corpuscles in the blood has a tendency to mask somewhat the clumping of the bacteria in the presence of positive serum, so that the whole-blood test is somewhat less sensitive than the serum test.

The whole-blood, rapid plate test is made by placing two drops of antigen upon a glass plate and adding to it a standard loopful of blood, mixing by stirring with the loop and then gently rotating the plate. The reading is made within a two-minute period. Only when definite clumping occurs within this period is the reaction considered positive.

While the two-minute period has been suggested as the time limit for reactions in positive cases, it has been our observations that in known positive cases rapid and definite clumping is seen within one minute and in many instances has been noted in less than one-half minute.

Where swine erysipelas is suspected in a herd, particular attention should be paid to the history, with reference to the presence or absence of the disease in the general territory; to whether the animals have been immunized against hog cholera; and to the history of swine troubles on the farm in previous years and the results. Hog cholera should always be kept in mind as a possible cause of the trouble, as this disease is still the most important single swine disease, which, it should be remembered, may at times be of an atypical nature. In any question of doubt, specific treatment for hog cholera should always be recommended.

With the history in mind, as well as the clinical features of the various hog diseases, the whole-blood, plate agglutination test should be applied to a number of animals in the herd. Animals that are obviously sick should be selected. If any animals show evidence of soreness in the joints, these should be
among the first animals tested. If a strong positive reaction is obtained within a two-minute period, it is an indication that the animal is or has been infected with the swine erysipelas organism. Where animals have visibly enlarged joints due to erysipelas infection, a strong positive reaction is usually obtained. It should be kept in mind, however, that such animals have been infected sometime and are now in the chronic stage of that disease, but they may, however, have contracted hog cholera or some other disease. It has been shown that hog cholera and swine erysipelas may exist in the same animal at the same time, so that a positive reaction to the agglutination test for swine erysipelas does not necessarily mean that some other infection may not also be present.

It has been shown that agglutinins in swine erysipelas appear in the blood-stream rather early in the disease, from two to five days after the animals show visible evidence of illness. This, however, may be variable and a number of animals in the herd should be tested if negative reactions are obtained.

The test has given best results in animals that show evidence of joint involvement. In animals showing involvement of the skin, we have failed, in the cases that have come to our attention, to obtain a positive reaction with their serum even though in one case the specific organism was isolated from a typical skin lesion. We have as yet no explanation to offer for this.

Animals that may have passed through a mild attack of the disease at some previous time and made a complete recovery may still have sufficient antibodies in their blood to give some evidence of agglutination on the test. Likewise, animals that may have been exposed to the organism or animals that may be harboring the organism in their bodies without infection may also contain in their blood limited numbers of antibodies.

Tests using the serum alone are more sensitive or delicate than those where the whole blood is used, since the corpuscles have a tendency to mask slight agglutination. However, a reaction to the whole-blood test should not be considered positive unless there is definite clumping within a two-minute period. Settling of dust on the test plate should be avoided and the drying action of the wind and sun should also be guarded against. The temperature of the plate and test materials is also a factor to be considered. Tests made at laboratory room temperature and at the temperature in the field in the summer and fall have been read satisfactorily within a two-minute period. However, in cold weather, a longer time should be allowed for reading or arrange-
ments made to use a warmed plate for the test. Slight reactions may indicate that the animal has had exposure at some time to the specific organism with or without infection. When slight reactions are obtained and the clinical evidence points to erysipelas rather than some other infection, tests of the herd should be made a few days later for more definite information, since antibodies may be in the formative stage. A subsequent test of these animals should, if they are actively infected, result in a strongly positive reaction. If the reactions to the test are of the same type as the first (slight), it would probably indicate that the reaction is not of a specific nature from a diagnostic standpoint. It should be remembered that a number of animals in the herd should be tested if necessary.

It has been found that animals injected with anti-swine erysipelas serum may give a positive reaction to the agglutination test as early as 24 hours after the injection and that the reaction may persist for some weeks. Agglutination tests should be applied only to animals that have not received specific serum.

Due precautions should be taken to prevent the transfer of infection from a sick to a healthy animal by instruments or hands contaminated with blood. Since humans are susceptible to infection with E. rhusiopathiae, due care should be exercised in handling blood or other tissues from sick animals. That human infections frequently occur is quite apparent from the literature. Munce reports infections in twelve veterinarians. In 1933, there were 170 cases of human infection with swine erysipelas reported in Prussia. Most cases occurred in butchers and farm helpers, although several veterinarians also were reported infected, one having had two infections in one year. In a limited trial, the agglutination test in our hands has been of value in the diagnosis of the disease in man.

The test is only an aid in the diagnosis of the disease and in our hands has been of considerable value in establishing the presence or absence of the infection in herds. It has been used to a considerable extent by several veterinarians in districts where swine erysipelas exists and they have reported favorably on its use. It is now proposed to extend the use of the test to a limited number of veterinarians in various sections where the disease now exists in order to obtain further information on its practical value.

Tissue specimens, blood, kidney, spleen, and affected joints of animals coming to postmortem should be forwarded to the laboratory for confirmation of diagnoses. This should be done
whenever possible, particularly in areas where swine erysipelas has not been previously definitely diagnosed or when practitioners have had little or no experience with the disease.

REFERENCES


PRESIDENT RECORDS: The next paper in this group is "Vesicular Exanthema of Swine," by Dr. J. Traum, of the University of California. In the absence of Dr. Traum, Dr. L. M. Hurt will read this paper and discuss the disease as observed in Los Angeles County.

. . . Dr. Hurt read Dr. Traum's paper. . . . (Applause.)

VESICULAR EXANTHEMA OF SWINE

By J. TRAUM, Berkeley, California

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In a paper on methods of handling foot-and-mouth disease in the United States, presented at the 12th International Veterinary Congress, in August, 1934,1 a considerable portion was devoted to the diagnosis of the disease, and particularly to its differentiation from other similar diseases. At that time attention was called to a disease in garbage-fed swine, which appeared in the southern portion of California in 1933, and probably in 1932 also, which was clinically indistinguishable from natural and experimental foot-and-mouth disease, and from experimental vesicular stomatitis of swine. In its behavior in test animals, however, this disease differed sufficiently from both vesicular stomatitis and foot-and-mouth disease to warrant the use of a new term to identify it. The name "vesicular exanthema of swine" was proposed. This disease was called to your attention in 1934 by your Committee on Miscellaneous Transmissible Diseases."
In June of 1934, this disease again appeared in garbage-fed swine in California, this time in the central part of the state, and later in that year in three garbage-feeding ranches in southern California. No cases have been found in the state since May, 1935.

In the United States, where expensive and radical methods are used in eradicating foot-and-mouth disease when it makes its appearance, and where it is economically so important both from the effects of the disease and also from the effects of local, inter-county, interstate, and foreign quarantine, great caution should be exercised in establishing a definite diagnosis. It is perhaps on this account that Mohler, in 1918, first called attention to vesicular stomatitis as a new entity in cattle diseases. He also reported its experimental transmission to swine.

Vesicular exanthema of swine has thus far not been reported outside of California, and it probably has not occurred in other states. It undoubtedly would have been suspected of being foot-and-mouth disease, and in all cases of foot-and-mouth-like diseases among hogs in this country, other than those reported in this discussion, cattle also were infected, and the disease definitely proven to be foot-and-mouth disease. In countries where foot-and-mouth disease is enzootic, however, there is more of a possibility of vesicular exanthema being overlooked by calling it foot-and-mouth disease.

We will devote most of our discussion to the problem of diagnosis, and also, to some extent, discuss methods of handling this disease.

**DIAGNOSIS**

Since the presence of vesicle formation, or the evidence of its previous existence, is one of the most essential characteristics of foot-and-mouth disease, the experienced observer, excepting in cases of vesicular stomatitis, had no serious difficulty in establishing a diagnosis until the advent of vesicular exanthema of swine in California. Thus far no records of natural outbreaks of vesicular stomatitis in swine have been reported, but there may, however, be a first time. Field conditions which approximate experimental inoculations have been encountered. Such are present in garbage-feeding ranches, where, mixed with the food, may be found broken glass, crockery, tin cans, needles, knives, and other sharp objects which may cause a break in the skin of the mouth, snout, or digits, and allow the virus to be readily introduced.
In vesicular exanthema of swine, as in foot-and-mouth disease or in experimental vesicular stomatitis, vesicles of varying size may appear on the snout, nose, lips, gums, or tongue, or on the feet between the digits, around the coronary band, on the ball of the foot, or on the dew-claws. Udder and especially teat lesions have been observed in a large proportion of nursing sows. These eruptions are usually preceded and accompanied by a rise in temperature, and then rupture and heal clinically the same as they do in foot-and-mouth disease and in vesicular stomatitis. In some outbreaks there may be a predominance of snout lesions, while in others foot lesions will be numerous. In some pens the vesicles will mostly be found back of the rim of the snout, but occasionally nearly all of the hogs in other pens on the same ranch will show the infection on the front portion of the snout. Often an animal will show lesions on more than one site.

As a rule there is no general systemic disturbance such as is present in cases of foot-and-mouth disease. At feeding times, it is found that most of the affected hogs will come up to the feeding platform and eat their food. This, however, is not always the case, and since there are probably also mild cases of foot-and-mouth disease in which swine will feed more or less regularly, this factor cannot be used safely to differentiate between the two diseases. Various degrees of lameness result from the foot lesions.

Vesicular exanthema of swine usually does not spread extensively, and may affect only a small number of hogs in a pen, although we have observed certain pens with practically every hog showing lesions.

In view of findings such as outlined above, we should suspect the presence of foot-and-mouth disease, and resort to inoculation of test animals as we do in all suspected cases of foot-and-mouth disease. For test purposes, cattle, swine, guinea pigs and horses are used.

ANIMAL TESTS

The causative agent of vesicular exanthema of swine has been proven, at Washington and in California, to be a filter-passing virus, and is contained in the coverings and lymph of the vesicles. The coverings and lymph of unruptured or recently ruptured vesicles should therefore be used for inoculation, and should always be as fresh as possible. This is essential, for until further work is done with this virus, we must assume that its resistance is like that of foot-and-mouth disease. This latter virus has been proven by practically all investigators to lose its virulence rather
rapidly in the infected animal, although it may remain viable
and capable of producing lesions for some time under certain
conditions outside the animal body. When practical, the sus-
ppected inoculum, suspended in buffered solution, should be filtered.
This, however, can seldom be done, as proper facilities for doing
so are not, as a rule, to be had without causing a great delay
and without danger of spreading the virus.

Cattle: At least two cattle are exposed to the virus. The first
animal is injected, by means of an intradermal syringe, in any of
the mucous membranes of its mouth, or exposed by applying the
virus to a scarified area on the dorsal surface of the tongue and
the mucous membrane of the gum, lips or dental pad. The other
bovine is injected intravenously or intramuscularly. These two
methods of exposure are used because it has been found that local
inoculation of cattle with vesicular stomatitis virus induces
lesions which, although milder, are indistinguishable from foot-
and-mouth disease lesions, while the intramuscular or intra-
venous inoculation of this same virus is not apt to produce lesions,
and in our experience so far has failed to do so. If the suspected
inoculum contained foot-and-mouth disease virus, lesions would
be produced in the bovine by the intramuscular, intravenous, or
local inoculations. If negative results are obtained in both
animals, especially at the beginning of an outbreak, more cattle
should be subjected to the test.

It has been the experience of the investigators in California,
at Washington, and in Germany,4 that cattle of various ages have
thus far proven resistant to the virus of vesicular exanthema of
swine. In the aggregate, 75 to 100 or perhaps more cattle have
been inoculated with the virus from several outbreaks of this
swine disease, and the virus has also been tested on cattle after
its passage through the horse. On several ranches attendants
cared for both infected swine and exposed cattle, without the
latter contracting the disease.

Thus we found that the virus of vesicular exanthema of swine
yielded a negative result in cattle, while the viruses of foot-and-
mouth disease and vesicular stomatitis produced positive results.
However, consideration must be made for adaptation of foot-
and-mouth disease and perhaps other vesicle-forming viruses,
and this will be referred to later in the discussion.

Swine: Foot-and-mouth disease, vesicular stomatitis, or ves-
icular exanthema of swine, can be readily induced in swine by
intravenous or intramuscular injection, or by intradermal injec-
tion or application of the virus to a scarified surface of the snout,
mouth, or feet. The diseases thus produced in swine are, however, indistinguishable from each other. In this connection it might be noted that on one ranch the application of the virus locally, intravenously or intraumuscularly resulted in transmitting the infection to less than 50 per cent of the test swine, while on all other ranches practically 100 per cent of the tests on swine were positive.

Guinea pigs: The guinea pigs are inoculated intradermically on the soles of the hind feet, either by scarifying and applying the virus, or by tunneling the skin with a fine hypodermic needle and injecting the virus, or by both methods. In guinea pigs, the experimentally-induced foot-and-mouth disease, and vesicular stomatitis can not be differentiated from each other, although the foot-and-mouth virus causes lesions which are more severe, and produces secondary lesions oftener, than does the virus of vesicular stomatitis, but these are only differences of degree. Several batches of the virus of vesicular exanthema of swine, from different outbreaks, have thus far failed, however, to induce the disease in several hundred guinea pigs used in tests in California, at Washington, and in Europe.

Thus we find that guinea pigs give negative results with the virus of vesicular exanthema of swine but yield positive results with the viruses of foot-and-mouth disease and vesicular stomatitis. Here also the question of adaptation of virus should be considered.

Horses: The horse is exposed by direct injection of the virus into the mucous membrane, or by applying the suspected virus to a scarified area on the dorsal surface of the tongue. This is the most suitable point of inoculation of the vesicular stomatitis virus for this animal. The horse has been depended upon to differentiate foot-and-mouth disease from vesicular stomatitis, and this animal also plays an important, though sometimes confusing, part in the diagnosis of vesicular exanthema of swine. Spontaneous cases of foot-and-mouth disease in horses exposed to infected cattle have been reported, but never definitely proven to be foot-and-mouth disease. These observations are overshadowed by the failure of German, French, and American workers to transfer foot-and-mouth disease experimentally to the horse.

In the California outbreaks of vesicular exanthema of swine, in 1933 and 1934, we have been able to induce a mild lesion in 16 out of 28 horses used. The lesion was always mild, sometimes so mild that it was difficult to determine whether or not to con-
sider the test positive or negative. The lesion may be accom-
panied by a slight rise in temperature (101 to 103.4° F.). In
most cases even this slight rise is absent. The positive results
consist, for the most part, of the blanching and lifting of the
epithelium for about 2 to 5 mm along the lines of injection or
scarification, or around the puncture wound. The intradermic
inoculation yielded most of the positive results, although our
first positive “takes” were seen when virus was applied to the
scarified areas on the tongue. The area in the epithelial layers
of the tongue covered by the intradermically injected materials
will show a similar blanched, lifted epithelium, and when detached
leaves an erosion. There may be a slight extension of the in-
volved area. No appreciable fluid, or only a small amount, has
been observed under the lifted epithelium.

This picture differs considerably in severity from experimental
vesicular stomatitis in the horse, where, in general, we would
find the following: From 36 to 72 hours after injection with
vesicular stomatitis virus, the tongue shows areas of blanched,
easily detachable epithelium at the site of inoculation, which soon
fills with clear, straw-colored fluid. These areas coalesce, form-
ing a large vesicle containing from 5 to 10 cc of fluid. In the
next 24 hours, the vesicle ruptures, leaving a deep, red, raw
erosion, which heals very slowly.

No natural cases of vesicular exanthema of swine have been
observed in the horse, although we suspect that such cases may
have occurred, and perhaps would explain some of our failures
to transfer the disease experimentally from swine to horses. This
also indicates that it is very desirable to obtain horses for the
tests from other ranches or localities.

Positive results in the horse point to a malady other than foot-
and-mouth disease, and place it closer to vesicular stomatitis, for
the virus of vesicular exanthema of swine, as noted above, pro-
duces comparatively very mild lesions in the horse.

Summary of animal tests: In differentiating between these
similar diseases by means of the test animals discussed above,
we conclude that a diagnosis of foot-and-mouth disease is justi-
fied when typical vesicles, preceded by a rise in temperature, de-
velop in swine, cattle and guinea pigs, but not in the horse; that
when all of these four species develop vesicular lesions, the dis-
ease should be considered vesicular stomatitis; but when lesions
are produced in swine, less frequently and to a milder degree
in horses and not at all in cattle or guinea pigs, we have a con-
dition which is typical of vesicular exanthema of swine.
Theoretically, a definite and most accurate diagnosis should be possible by the use of one or more of the immunity tests which have been developed for foot-and-mouth disease and for vesicular stomatitis, and which have been used at Washington and in Germany, and perhaps also in England, for vesicular exanthema of swine.

Details of procedure and setups for such tests will not be discussed at this time, excepting to call attention to the fact that while in foot-and-mouth disease, and in vesicular stomatitis, guinea pigs have been used principally for these immunity tests, the horse, or preferably swine, must be resorted to in the case of vesicular exanthema of swine.

The cross-immunity tests thus far reported by Reppin and Pyl, of the Riems Institute, show that the virus of vesicular exanthema of swine distinctly differs immunologically from the three standard types of foot-and-mouth disease virus. In similar tests with the virus of vesicular stomatitis, three of seven recovered cases of vesicular exanthema of swine developed local lesions when injected with vesicular stomatitis virus. Therefore, the authors concluded that there is an immunological relationship between the viruses of vesicular stomatitis and vesicular exanthema of swine. At Washington, cross-immunity tests on horses failed to show this relationship.

Unreported work in the Bureau of Animal Industry at Washington suggests that there may be different types of the vesicular exanthema virus. The recognition of different types of virus in foot-and-mouth disease, and in conditions resembling foot-and-mouth disease, complicate the interpretation of these cross-immunity tests.

Size of virus: A great deal of work has been done, and various technics have been developed for measuring filtrable viruses. Gallaway and Elford have found vesicular stomatitis virus to be approximately ten times the size of the foot-and-mouth disease virus, the former being 80 to 100 m\(\mu\), while foot-and-mouth disease virus is 8 to 12 m\(\mu\). The virus of vesicular exanthema of swine has been sent from the United States to these investigators, but the results, if reported, have not as yet come to my attention.

Realkalinization test: The realkalinization method of Reppin and Pyl fails to destroy the virus of vesicular exanthema of swine. In this respect it behaves like the virus of vesicular
stomatitis, but not like the foot-and-mouth disease virus, which is destroyed by the Reppin and Pyl realkalinization technic.

Test on European hedgehog: British workers\(^{10}\) have found the hedgehog highly susceptible to foot-and-mouth disease virus. Mohler\(^{11}\) failed to infect a European hedgehog with the virus of vesicular exanthema of swine.

Adaptation of virus for certain species: The possibility of the loss of infectiveness of the foot-and-mouth disease viruses, and perhaps those of other vesicular diseases, for species commonly susceptible to the virus, must be taken into account when depending upon test inoculation of animals in making a diagnosis. References in the literature on adaptation of the foot-and-mouth disease virus for certain species of animals are not rare. In 1927 and 1928, in Germany,\(^{7,12}\) a foot-and-mouth disease virus from swine was encountered which readily produced the disease in swine, but which could not be transferred to cattle except in rare instances and with great difficulty. In Germany also, the virus causing foot-and-mouth disease in sheep and goats, in 1919 and 1920, was found to be only slightly infective for cattle and swine. The usual finding is that cattle and swine are more susceptible than goats or sheep.

The British research committee\(^{10}\) on foot-and-mouth disease reported several instances where proved South American foot-and-mouth disease virus from cattle would not induce lesions in guinea pigs even after many trials, but would, at the same time, readily infect cattle with the typical disease. However, a personal communication indicates that they have finally succeeded in transmitting the disease to guinea pigs.

At the Riems Research Institute\(^{12}\) the results with Argentine virus were the same as those reported by the British investigators. Perhaps both groups were working with virus from the same outbreak. The work at Riems showed also that the virus induced the disease in swine, and that only after many passages through cattle and swine, during the course of a half-year, were they finally able to produce the disease in guinea pigs.

Many of us since the universal confirmation of Waldman and Pape's\(^{13}\) repeated transference of foot-and-mouth disease to guinea pigs, have been laboring under the wrong impression that all foot-and-mouth disease viruses produce lesions in guinea pigs, and the failures which most of us have at times encountered have frequently been considered as an indication that the virus had perished. Some of such failures to transmit foot-and-mouth dis-
ease virus no doubt were due to a strong adaptation for the species from which it was originally secured, and to the loss of infectivity for the guinea pig. The importance of giving consideration to the possibility of predilection or adaptation of viruses for certain species in making a diagnosis is evident.

METHODS OF CONTROL

In California, in 1932, the virus readily infected swine, but failed to produce lesions in any of the other test animals used, namely, two horses, 24 guinea pigs, two calves, two heifers and one cow.

In the 1933 outbreak of this disease in San Diego County, California, we were fortunate that one of the first two horses exposed to the virus developed a mild lesion with a slight rise in temperature (101°). Swine were readily infected, but the guinea pigs and cattle did not develop lesions. Before the results of further animal tests with virus from other swine and from the mild “take” in the horse were available, we asked and obtained permission from Washington to proceed with the slaughter of the hogs on the premises and with the cleaning and disinfection of the premises as practiced in foot-and-mouth disease outbreaks, and to await pronouncement of definite diagnosis until further work had been done. We also obtained permission from the state and federal agencies to continue and extend the animal tests on a portion of the infected ranch until the cleaning and disinfection neared completion.

In the meantime, systematic inspections of hog and cattle ranches were being carried out, as is done in foot-and-mouth disease outbreaks. Hogs on two nearby ranches were found to be infected. Agreeing with the animal tests in California, those tests made with virus sent to Washington by air mail resulted in infecting swine and horses, but not cattle or guinea pigs.

At the United States Bureau of Animal Industry Experiment Station, investigations with this virus were continued. Virus from this outbreak had also been sent by Dr. Mohler to the Riems Institute for further study, and especially for cross-immunity tests with foot-and-mouth disease immunes and viruses. Further work at the Bureau Experiment Station confirmed their early findings and those obtained by us in the field. The results of the German studies, reported to Dr. Mohler, demonstrated that the virus of vesicular exanthema of swine was distinctly different immunologically from foot-and-mouth disease viruses.
The German workers were also able to induce lesions in horses and swine, but not in guinea pigs or cattle.*

When the disease was encountered in central California, in June, 1934, animal tests in the field and at the Bureau Experiment Station, with virus from several ranches, indicated that we were dealing with a disease caused by a virus similar to that found in 1933. There were available for guidance the results of our studies, and also those made by the Bureau and the Riems Institute on the 1933 virus. Strong efforts were made in 1934, by various influential persons and organizations, to have the authorities order the slaughter and burial of animals on infected ranches as was done in 1933.

The authorities at Washington stated that the methods of control used in vesicular stomatitis of cattle and horses were to be the basis for the handling of this disease. Briefly, these consisted in the quarantine of animals, and prohibiting their movement from the infected premises for a period of 30 days. This was modified to some extent to fit the practices on the garbage-feeding ranches.

After the disease subsided on a ranch, hogs were permitted to be sent for slaughter after an inspection on the premises within 48 hours before slaughter, and preferably within 24 hours. In such cases the hogs were trucked or shipped directly to the slaughtering pens. Unnecessary transfer or detainment in yards was avoided.

With this method of handling the disease decided upon, some of us thought it desirable, for obvious reasons, to infect artificially all apparently noninfected animals, and also perhaps, for a short period, all additions to the ranch. The intramuscular injection of a small dose of virus was considered the simplest and most rapid method. Unfortunately, in one such trial with field virus on 100 uninfected and presumably unexposed hogs brought to the infected ranch, there resulted a heavy morbidity and some mortality from intercurrent infection. The advisability and practicability of such procedures is therefore not yet determined, and more experimental work is necessary before trying any immunity methods in the field.

**DISCUSSION AND SUMMARY**

From the above presentation it is evident that we are dealing with a disease in swine which, from lesions and symptoms, and

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*Excerpt from communication, Prof. Dr. Waldmann to Dr. J. R. Mohler: "The picture of such a generalized hog disease, after infection with the virus in question, corresponded fully to that in hoof-and-mouth disease, so that even we, who work daily with hoof-and-mouth disease, could not distinguish between the two."
even from its course, can not safely be differentiated from footand-mouth disease without the aid of animal tests. Although differences have been pointed out, we must consider that the viruses of foot-and-mouth disease, vesicular stomatitis and vesicular exanthema of swine are closely related. In fact, the first two have been demonstrated by various tests to be so much alike that, aside from their immunological differences, only the constant pathogenicity of the vesicular stomatitis virus for the horse, and its lower degree of pathogenicity for cattle and guinea pigs, differentiates it from foot-and-mouth disease virus.

The vesicular exanthema virus has not as yet received so much study as either foot-and-mouth disease or vesicular stomatitis viruses. Thus far it has been found to differ immunologically from foot-and-mouth disease, and to be not altogether in accord immunologically with the vesicular stomatitis virus. It also differs from both by its failure to induce lesions in guinea pigs and in cattle, and it further differs from foot-and-mouth disease virus by its infectivity for the horse. All three viruses seem experimentally to be equally pathogenic to swine.

For a period of almost 20 years, we have been differentiating foot-and-mouth disease from vesicular stomatitis, and in the case of the latter we have not invoked a drastic slaughter method or severe quarantines, but have simply prevented movement of infected live stock from the individual premises for a period of approximately 30 days. We have had no serious spread of this malady. We have no reason to change our methods of control of vesicular stomatitis.

We have thus far found greater differences between vesicular exanthema of swine and foot-and-mouth disease than we do between vesicular stomatitis and foot-and-mouth disease. In 1932, we were probably dealing with vesicular exanthema of swine, but it was not at the time permissible to carry the tests to the desired point, and although a diagnosis of foot-and-mouth disease was made, and the eradication proceeded with accordingly, the virus causing the outbreak in 1932 will have to be recorded as not having been definitely identified.

In the 1933 outbreak, while awaiting a diagnosis, we proceeded to slaughter the swine on the infected premises, and to clean and disinfect without establishing any drastic quarantines. Since then, the viruses of the 1933 and 1934 outbreaks have been studied not only in the field but also in Washington and at the Riems Institute, and the results of the three investigating groups were the same, namely, there was transmission of the disease
to swine and horses, but not to guinea pigs or cattle. When the disease broke out in 1934, and the field results indicated that we were dealing with the same virus which caused the disease in 1933, i.e., a virus which has been proved to be different than foot-and-mouth disease, we applied methods of control based on those used in vesicular stomatitis.

If what has been done in California in 1933 and 1934 can be considered as a precedent for future guidance, we could take a middle course when we encounter a disease which markedly simulates foot-and-mouth disease but which can not definitely be proved one way or the other without great delay. This course would consist of slaughter methods without severe quarantine.

REFERENCES

11Mohler, J. R.: Personal communication.

DISCUSSION

Dr. L. M. Hurt: Attention is occasionally drawn to new diseases or to old ones which appear in new phases or places and therefore amount to the same thing as far as our current knowledge of enzootics and epizootics to which animals are susceptible is concerned. The unexpected appearance in a single herd or several herds of a hitherto undescribed set of symptoms and a series of changes constituting a hitherto unchartered course of disease developments, especially if a serious mortality rate is reached, will cause much agitation in the minds of practitioners, experimentalists and research men. When the new or hitherto undescribed symptom complex approaches very closely the recognized course of development of a well known and highly destructive disease of animals in foreign countries, the effect is much the same. Errors in diagnosis are likely to be made until properly qualified investigators are enabled to enter the field and establish carefully planned experiments, cultural, bacteriological, serological and microscopical tests.

The results of their work are viewed from the point of vantage gained by experience. If the disease is one that has gained access to our shores from a foreign land, the proper methods are outlined for its
control and eradication. If, on the other hand, the investigations lead to the diagnosis of a disease which has not been encountered in the experience of trained observers and described in our records or the literature of our profession, then an interesting study is afforded to all having contact with the disease.

Such a case recently occurred in California and the new disease has been named vesicular exanthema of swine. It is highly contagious to swine, the infective agent being a virus capable of producing symptoms and lesions very similar to those observed in swine affected with foot-and-mouth disease. The similarity in new outbreaks is too striking to give any comfort to either the owners, veterinarians, or live stock sanitary officials in the area in which it appears.

This was probably its third appearance in California. Of the previous outbreaks, one occurred in Orange County, in 1932, and was carried over the line into Los Angeles County; the other in San Diego County, in 1933. Experimental work in the first instance was not allowed to proceed to any definite conclusion. The infected and exposed hogs were disposed of by federal and state governments as if the case were foot-and-mouth disease; also the second, without a diagnosis. However, during this second outbreak, which occurred in San Diego County, research work was carried to a point indicating a strong probability that a new disease was affecting our hogs. Samples of virus from lesions of sick hogs were forwarded to the Chief of the Bureau of Animal Industry at Washington, D. C., and by him to laboratories in Germany, in which experimental work upon foot-and-mouth disease, vesicular stomatitis and other diseases similar in appearance are being studied. As a result of exhaustive tests run in both countries, it was announced, late in 1933, that the disease was not true foot-and-mouth disease, although similar in many respects, and figuratively, at least, "betwixt and between" foot-and-mouth disease and vesicular stomatitis.

During 1934, another outbreak was detected. It broke out in the San Francisco Bay district and spread rapidly to 15 premises in the counties surrounding the Bay. The history in each instance was very similar. Its appearance was marked by sudden onset, rapid spread for several days, with increase in intensity of symptoms and extent of lesions; followed by a definite down curve in infectivity and severity, and finally by apparently dying out altogether. However, it smoldered in a mild form, largely confined to the brooder pens, and was capable of "flaring up" again among newly purchased feeder stock when they were brought into the infected premises.

On account of the similarity in symptoms and lesions of the infected swine with those noted in the San Diego outbreak, the federal and state veterinarians conducted exhaustive tests. The presence of the disease within the state was immediately brought to the attention of the field veterinarians in charge of hog ranches in our county. Special vigilance was observed in making inspections which were conducted at more frequent intervals, so that if by any chance it should be carried from the Bay counties to this area its presence might be detected as early as possible. No evidence was noted of its appearance in the county until October, by which time we were commencing to feel fairly secure from exposure by reason of the distance separating us from the Bay section.

On October 10, sick hogs were observed on the ranch wherein we had our last experience with true foot-and-mouth disease, which, of course, added a chill to the telephone report of the field veterinarian making the discovery. The ranch containing 3,500 hogs was immediately quarantined and placed under guard. State and federal authorities were notified and tests started upon experiment animals, includ-
VESICULAR EXANTHHEMA OF SWINE

ing horses, cattle, calves, grain-fed pigs and guinea pigs. Upon ar-
rival of Doctor Traum, representing the Bureau, and Doctors Duck-

worth and Stuart, State Department representatives, more experiment

animals were secured and diagnostic tests begun.

The quarantine regulations enforced were exactly the same as those

observed in an outbreak of foot-and-mouth disease. This is one of

the serious aspects of these outbreaks. Live stock sanitary officials

cannot guess at the nature of this disease, nor can they afford to take

any chance regarding the outcome of its spread until fully informed

of its nature. As a result, it is necessary to conduct the usual foot-

and-mouth tests on experiment animals. In its initial stages it will

baffle the most experienced among the old foot-and-mouth disease fight-
ers. If a typical case were placed on a table before a group of exam-

iners, it would puzzle any of them to say that it was or was not the

real thing, from a clinical examination alone.

The progress of this disease after its appearance upon a premise,

however, is reassuring. During the first few days its virulence seems

to be increasing. Rapid spreading, with the customary "jumping" of

virus from pen to pen, and the rapid development of symptoms so

characteristic of foot-and-mouth disease are apparent. By the end

of the first week, the virus seems to have lost interest in the job.

In searching for fresh virus after the first week, we were surprised at

the abatement in symptoms and scarcity of good vesicles, compared

to the first few days. Breaking of lesions on nose, tongue and feet

was attended by an immediate drop in temperature, followed by rapid

gain in appetite and early return to normal condition.

Little lameness was noted after a few days except in heavy sows,

and shoats which had suffered lesions in three or four feet. In the

first pens affected practically all the pigs reacted. Those pens affected

a few days later did not show reaction in over one-half of the pigs.

After ten days, we were surprised to find only five or ten per cent of

a lot developing symptoms and lesions after definite exposure through

feed or actual contact.

In our experimental work we had no difficulty in transmitting the

disease to "country" pigs, that is, those brought in from grain-feeding

plants for experimental purposes, although in a later break Doctor

Traum found a type of virus that was undependable to the extent that

it would "take" on only about one-half of the experimentally exposed

grain-fed swine.

About the time we were letting down from high tension with the

negative results of our tests for foot-and-mouth disease, an outbreak

was reported in a neighboring county, involving a ranch upon which

50,000 head are maintained. The federal and state government repre-

sentatives immediately started another series of tests upon the newly

infected premise and conducted experimental work as long as it seemed

necessary. Representatives of our Department were detailed to assist

in this important work in every way possible. The test in both in-

stances proved negative for foot-and-mouth disease and vesicular stom-

atitis, and positive for vesicular exanthema, a name which had been

coined to designate the disease during the San Francisco outbreak,

since it so aptly describes the lesions in two words.

From the nature and source of the food in these two outbreaks, the

virus was believed to have originated in the Bay area. The northern

outbreak had necessitated holding several thousand hogs in quaran-
tine for several weeks after they were ready for market, thus produc-
ing more "heavies" than that market could absorb. Naturally a part

of these heavy carcasses were disposed of to the best advantage after

the quarantine was lifted. The infection, therefore, probably gained
entrance to these ranches in Los Angeles and San Bernardino counties in meat trimmings from heavy carcasses received from packing-houses in the San Francisco Bay region. Possibly some heavy hogs were trucked south for slaughter.

On November 20 and December 5, the third and fourth outbreaks occurred upon smaller ranches in Los Angeles County. These were placed under strict quarantine until a full set of tests to exclude foot-and-mouth disease could be conducted upon each premise. Since the experimental staff of the federal and state departments were very busy upon the first two premises mentioned, these later tests were conducted by members of the Live Stock Department. The virus in both latter cases proved to be of low virulence and did not affect over one-half of the hogs in either place.

An interesting peculiarity was noted in the November 20 break. Vesicles appeared only upon white hogs during the first three weeks, after which lesions were found upon the black and red hogs. Temperature studies were disappointing on both of these premises. After tests were completed, quarantine restrictions were modified. For 60 days after the last case was observed on a premise, no hogs were allowed to be moved except for immediate slaughter. Feed-wagons and other equipment were not permitted to move to other hog ranches without proper cleaning and disinfection. We were unable to establish any connection between any two of these outbreaks. The probability of the virus coming from a common source was rather generally accepted, that is, in meat trimmings from pork prepared while hogs were carrying high temperatures and active lesions of the disease.

Extreme caution was observed by representatives of the State Department and our office in not allowing the removal of any hogs from the infected premises unless and until they had been carefully inspected for the presence of lesions, and then only for immediate slaughter. A written release was prepared covering each shipment for the information of the veterinarian in charge of the packing-house making the purchase. This inspector, in turn, was required to make a careful count of the number received and report same to the State Department. It was further required that any hogs released for slaughter should not be unloaded in any public or private pens or yards but must be delivered to the killing-floor or into the chutes leading thereto. After each delivery the trucks were carefully cleaned and disinfected under official supervision.

All slaughtering in our area is conducted under federal and State Department of Agriculture meat inspection system, which gave additional protection against the release of any pork from carcasses showing lesions and which might carry infection through meat scraps to other ranches. Apparently this was the "cause and effect" explanation, since no spread occurred directly from the ranches mentioned nor did any new breaks occur as the result of distribution of meats prepared from hogs released from these infected premises.

Temperatures ranged from 3.8 to 6.8, averaging above 4.5. Test swine ran temperatures in 24 to 36 hours after inoculation, practically the same as noted in natural infections. Vesicles developed sometimes in 30 hours and ordinarily inside of 48 hours after inoculation, slightly more quickly following the snout-and-lip scarification method than the intramuscular or intravenous injections. Secondary vesicles sometimes occur on feet, snout, lips or tongue in five to seven days after inoculation. Lesions are almost entirely subepidermal and possibly the walls were slightly thinner than those noted in cases of foot-and-mouth disease. The borders of the vesicles are usually regular, that is, the lesions are circular, ovoid, or elliptical. When they are multiple and become confluent the broken lesions may present a very uneven or ragged appearance.
Fresh lesions suggest light burns in that they appear lighter in color than the surrounding healthy tissues and are filled with straw-colored lymph or serum, which may be slightly darker or even carry a reddish tinge in some specimens. These latter cases probably result from bruising. Lesions vary considerably in size from that of a lentil to large vesicles measuring 20x40 mm on the snout, 10x15 mm on lips and 5x10 mm on the tongue. Those appearing on the feet in this outbreak were usually not very large, varying from 2x3 mm up to 3x10 mm. However, they may be numerous and become confluent so that they surround the hoofs completely. They were usually confined to the coronary bands and only occasionally observed between the digits. In foot-and-mouth disease the tissue reaction in the feet is apparently more severe, extends more deeply and causes considerably more lameness, although the appearance of the fresh lesions is very similar in appearance to those produced by this virus.

In this outbreak a surprisingly large number of hogs showed tongue and lip lesions. We were lead to make this discovery after failing to find satisfactory snout and foot lesions for fresh virus supplies in lots of hogs which should have shown large numbers of cases. Finally, a few were caught that seemed to be rather "dumpy." Some of these showed two to four degrees rise in temperature, and were carefully examined for beginning lesions, including tongue and lips, by use of the speculum. We were surprised to find several swine showing lesions in these organs which showed no other lesions and practically no indications of disease. After this experience we made it a point to "mouth" all hogs more carefully.

In our experimental inoculation of bovines we included two cows and two calves. Intramuscular and intravenous injections were used, also scarification of tongue and dental pads. All methods of inoculation gave negative results and temperatures remained unaffected.

Seven horses were used in this test, the tongue in three being scarified and punctured and the others treated by tunnelling and puncturing. Of these, our horse 2 developed superficial lesions, paralleling the lines approximately 4x3, 3x2, and 5x4 mm respectively, 24 hours after injection. One day later, the borders had extended about 1 mm at each point, suggesting a fringed epithelium. On the third day, coverings having broken on the second day, the erosions were somewhat larger, the middle and outer borders meeting. No temperature reaction developed.

Our horse 3, likewise exposed by the tunnelling method of injection, showed in 24 hours blanching and lifting of epithelium the length of the tunnels, that is, approximately ¾-inch, or the length of the needle used. On the second day, the two outer tunneled areas showed a 4-mm lifting and the inner one 3 mm, extending the full length of the tunnel. The lymph in these swellings was collected and saved for test purposes. On the third day, tunneled areas showed a 4-mm lifting and the inner one 3 mm, extending the full length of the tunnel. The lymph in these swellings was collected and saved for test purposes. On the third day, tunneled areas were still larger. Definite healing began with the fifth day. Our mare 5 developed very good vesicles up to the second day, 7x4 mm, 5x4 mm and 3x2 mm in extent each over tunneled site. This lymph was also saved for experimental work. On the third day, another small vesicle was observed over a puncture.

In our horse 6, treated by scarification and puncture, rise of temperature was noted beginning at 99° on the second day, 99.6° on the third, 102.8° on the fourth, and 104.4° on the fifth day. It then fell to 101.2° on the sixth day and was 99° again at the end of the week and remained normal. One point of scarification in this animal
developed a 1-mm lifting on the second day, which remained about the same in size and appearance until the fourth day, after which it healed quickly. Of these horses, six were brought in for experimental purposes. One was owned and kept on the ranch. No reaction in temperature or at points of inoculation was noted in this last-mentioned animal, nor in horses 1 and 4, all of which were treated by the puncture and scarification method.

Six guinea pigs were inoculated with virus taken from different hogs upon the premise. Injections were made by the tunnelling method on the right hind foot, and scarifying or puncturing the left. Inspections, continued for ten days, failed to reveal any reactions from these inoculations.

In the present state of our knowledge the results of these tests as noted are considered sufficient proof that the infection was not foot-and-mouth disease, and that its natural infectivity is confined to hogs alone. Hence, the new name was required for its designation.

We planned to run cross-immunity tests, using virus from these three ranches, but since the rainy season came upon us early and facilities for experimentation were inadequate to warrant taking any risks, this procedure was considered inadvisable. Samples of the several strains of virus and supplies of serum from recovered hogs were preserved and forwarded to Doctor Traum.

Advice from the Bay region during the winter months brought the information that nearly all their infected ranches showed some active cases. We were agreeably surprised, therefore, when all three of our outbreaks seemed to clean up; even the brooder pens apparently did not harbor the infection.

The disease seemed to have disappeared entirely by the middle of February. No active cases were observed upon any of the quarantined premises between February and April and our quarantine restrictions were practically removed. Light feeder pigs were allowed to be brought in at intervals and as a test were thoroughly mixed with the hogs that had been through the outbreak. Over 200 were thus added during the month of March, and two more shipments of 100 each in April.

On May 13, however, in our regular inspection of the No. 1 ranch, vesicles were found upon three pigs of the last lot which had been brought in.

Quarantine was again established and all necessary horse, cattle and guinea pig tests were made using this new virus. These tests proved the disease to be vesicular exanthema again. Thus the outbreak was termed a "rebreak." It was of short duration and very mild in its effects upon the hogs. Seldom could we find over seven or eight visibly sick. Probably not over 20 per cent of the newly introduced feeders developed the disease, and these entirely among the last two shipments of feeders.

Fourteen pigs raised upon a distant ranch, one grain-fed pig, one calf, four guinea pigs, two horses and two steers (by contact exposure only) were used in our tests and the diagnosis of vesicular exanthema was reached once more. During this test some interesting findings were made. Six of the test hogs used during October were still on the place and to check their immunity we injected them with virus obtained from these new lesions.

No data of this kind had been reported by experimenters and this break offered us an opportunity to learn something about the duration of immunity to this disease. These six hogs were classed as "test-test" swine during this experiment. Two of them were inoculated by the
snout scarification method and both developed excellent reactions, in fact, rather severe ones for this disease. Contrary to findings noted in connection with the original break, they continued to show temperatures between 104 and 106° for several days after the primary vesicles had broken. Each developed good secondary vesicles upon the snouts and lips. One was hyperimmunized by using mixed field and test virus and a supply of serum was collected for further experimental purposes.

Two more of these test-test hogs were given intravenous injection using virus taken from test pigs. The remaining two head were subjected to contact exposure among hogs showing reactions to natural exposure and to cases induced by artificial inoculation. None of the four head developed temperatures or lesions. As soon as it was definitely determined that the virus was that of vesicular exanthema, it was classed as a "rebreak." While we termed this a "rebreak," it is equally possible that this infection resulted from another exposure to meat trimmings from the original source, that is, from carcasses released from cold storage this late date.

The disease proved to be mild in type compared with its first appearance upon this premise. The spread of the disease was very slow and symptoms were slight. At no time were there more than seven or eight visibly infected pigs in either of the two lots of hogs recently received on the premise. Although 100 per cent of "takes" was secured in our pigs inoculated experimentally less than 20 per cent of the shipped-in feeders developed the disease naturally when brought in from uninfected plants and mixed with these cases. No cases developed upon contact exposure among pigs raised upon the ranch, although inoculations gave positive results in practically all cases. Very little loss of condition was noted in those developing symptoms upon exposure. The disease again disappeared entirely by the end of June, and although 450 head more feeders have been added to the ranch and well mixed with those which have had the disease—or had ample opportunity through exposure—we have seen no signs of further rebreaks.

Its effect upon the herd as a whole is not serious, possibly no more than from the occasional upset from colds or indigestion which sometimes affects a herd. Furthermore, there are no serious after-effects such as the loss of hoofs. The appetite is seldom affected for over two days, in fact, after the first few pens have gone through the outbreak, it is rather out of the ordinary to have any pigs off feed at all. They continue to eat in spite of the vesicles on the snout and in the mouth. Secondary infection around the hoofs in a small percentage of cases leaves animals lame for some time.

This picture is vastly different from that presented by true foot-and-mouth disease, in which we have individuals shrinking in flesh almost visibly and flock loss of condition more apparent from day to day. In that disease, hogs lose appetite very quickly after exposure and remain off feed for several days. They move with difficulty from apparent lameness in the feet and tenderness of the articulations. A peculiar "stilt" gait is noted in which the pigs tend to pull the feet together as closely as possible when standing or walking. Moreover, the whole herd is affected. Few, if any, make any attempt to go to the feed-floor or even to leave their bedding until forced to do so. Such movements are usually attended by a lot of squealing from the pain in their swollen feet. There is no diminution in the severity of the symptoms as the disease progresses from pen to pen.

During the first few days of an outbreak of vesicular exanthema, this description holds good for the first individuals and pens affected.
As stated, however, the symptoms abate rapidly after the first few days. Whether this is a result of a lowering of virulence remains to be learned. Possibly all pigs are not equally susceptible to natural exposure and our field cases appear only among those most susceptible. This may also be learned from further study.

Speaking for the members of the Live Stock Department, it is sincerely hoped that this will be our last experience with vesicular exanthema, and that the whole group of virus diseases to which it belongs will appear only in history form in our vicinity.

President Records: The next paper in this series is "Community Sales, a Factor in the Spread of Swine Diseases," by Dr. H. E. Curry, State Veterinarian of Missouri.

. . . Dr. Curry read his paper. . . . (Applause.)

COMMUNITY SALES, A FACTOR IN THE SPREAD OF SWINE DISEASES

By H. E. Curry, Jefferson City, Mo.

State Veterinarian

In a general way, we are all familiar with existing conditions and practices that are carried on at most of the community or auction sales and transit feed yards. Therefore, I shall not take up your time by going into a detailed description of these sales. I find that various terms are used in different localities, when referring to these public sales. In order that you may understand the types of sales referred to in this report, I shall define "auction sale," "community sale," and "transit yards," as discussed here.

The auction sale is generally a weekly or monthly sale, preceded by broadcast advertising, and the animals offered for sale usually are shipped from outside points.

The community sale is more of a local affair, where people gather on certain days during the week to sell, trade, or exchange live stock and poultry of all kinds and description, including second-hand or discarded articles from the home or farm. In most cases, these sales were primarily started by commercial or civic clubs, with the intention of helping the farmers; and, as long as the trading was confined locally, little harm was done. But, like many other good plans designed to help the farmer, when tested by time and experience, these sales have proved in the final analysis to be a liability, instead of an asset.

The transit yards were originally founded for use as places where live stock in transit could be unloaded for feed, rest and water, before going on to the markets; but, today, we find many
of these yards operated by traders and dealers. Sales at some of these yards approach a million dollars annually.

The auction and community sales and transit yards are all factors in the spread of live stock diseases. We probably hear more about the spread of swine diseases from such points, for the reason that swine represent the largest number of animals that pass through such places, and perhaps they are more subject to diseases usually encountered where proper sanitary conditions are not maintained.

It is not deemed necessary or advisable to enumerate the various diseases of swine found in animals that pass through these sales. It will suffice to say that they range from hog cholera to rabies.

The control of these sales is primarily a state problem. However, it is not exclusively confined to the states, because we have sales where a large percentage of the live stock offered is shipped in from other states, or out, as the case may be, thus involving an interstate as well as an intrastate regulation.

It is well known to all live stock sanitary officials that the movement of live stock by truck has multiplied the problems of disease control. The truck is the greatest contributing factor in the establishing and maintaining of these public live stock sales here discussed, and will probably prove the most difficult to solve.

Some of you are fortunate enough to have laws or legal rules and regulations, with appropriations to provide competent veterinary inspection and supervision over such operations, but most of us are not in that enviable position; hence, we hope that this body will take favorable action on the resolutions that I understand may be presented for your consideration.

The late Dr. U. G. Houck, in his report, "The Feeder Pig Problem," presented to you in 1932,* said:

"The most dangerous practice that has developed largely from motor transportation, and which is increasing in extent and importance, is the marketing of feeder pigs in increasing numbers through auction sales. The assembly pens at the point of origin usually are infected, the motor trucks may be infected, verbal assurance or even certification as to immunization is not always reliable, and the auction yards and the pigs offered for sale frequently are infected. Whatever the contributing conditions may be, it is common knowledge that cholera appears in a large proportion of the pigs sold at public auction, that they may spread infection while in transit, and that frequently they do carry the disease to the home herds of the purchaser."

It has been advocated in the proceedings of this Association and on the floor that a system of strict licensing and supervision of auction sales, including immunization of the stock against hog cholera when considered advisable, be inaugurated by the states to improve present conditions and reduce preventable losses. Some states have taken steps along this line, but they seem to be "stepping lightly," due to the lack of funds to carry out any effectual general plan. There is no question in regard to authority of the states to control auction sales and assembly stations; also to supervise the intrastate movement of shipper pigs and to impose quarantines.

In the report of the Committee on Transmissible Diseases of Swine, the same year,* we find:

The increasing number of assembling and sales yards, other than public stock yards which are operated under federal inspection, for traffic in feeder pigs, multiples the opportunities for spreading diseases of swine. In some states these yards have been shown to be the source of serious outbreaks of cholera. The increased volume of business done by them has been accompanied by correspondingly increased and heavy losses.

More rigid state control of import shipments and auction sales, including permits for auction sales and veterinary supervision and inspection of animals offered for sale, is recommended. The rules and regulations prescribed by the U. S. Bureau of Animal Industry governing the movement of swine from public stockyards where federal inspection is maintained are recommended as fundamental in all details to such control supervision and inspection.

On November 18, 1935, live stock sanitary officials of nine states met at Oklahoma City and drafted model regulations, applicable to states where the live stock sanitary officials have constitutional authority to meet the problems by regulation.

In many states, a new statute must be enacted. A few states have passed such laws. From the foregoing, it would seem that the time is opportune for the Committee on Unification of Laws and Regulations to prepare and submit a model state law for the licensing, bonding and inspection of auction, community or public sales of live stock, including operations at transit yards not under federal supervision, and I respectfully submit the problem for your consideration.

**President Records:** The three papers presented in this group are open for discussion or questions, if there are any. If not, we will proceed to the report of the Committee on Transmissible Swine Diseases, which will be presented by the Chairman, Dr. A. T. Kinsley.

**Dr. Kinsley:** First, as chairman of the Committee, I want to thank the members of that Committee for their splendid coöperation, and second, on behalf of the Committee, I wish to thank Drs. Hofferd, Schoenberg, Traum, Hurt and Curry for the splendid papers they have given you.

. . . Dr. Kinsley read the report. . . . (Applause.)

*Jour. A. V. M. A., Ixxxii (1933), n. s. 35 (3), pp. 515-516.*
REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

Dr. A. T. KINSEY, Chairman, Kansas City, Mo.

Dr. F. A. Imler, Kansas City, Kan. Dr. Chas. Murray, Ames, Iowa
Dr. C. N. McBryde, Ames, Iowa Dr. H. J. Shore, Fort Dodge, Iowa

Your Committee deemed it advisable to devote the major portion of the time allotted to the swine section to papers and discussions by others than those on the Committee, on specific swine diseases and control problems. The Committee report will, therefore, be brief and confined to a consideration of two diseases—hog cholera and swine erysipelas.

HOG CHOLERA

Hog cholera, in the opinion of this Committee, continues to be the most important transmissible disease of swine. Owing to the shortage of feed and reduced prices, both of which operated to reduce the number of hogs on farms during the spring and early summer, the disease was less prevalent than usual during those seasons. However, with increased prices and prospects for an abundance of feed, both of which operated to increase the traffic in feeder pigs, there was an appreciable increase in the prevalence and distribution of the disease during the later summer and fall months. Reports from some sections indicated that post-vaccination losses were uncommonly heavy during the fall months. These reports also indicated that failure to determine the condition of the pigs before vaccination and insufficient doses of serum, and not impotency of the product, were responsible for most of these losses. Your Committee, therefore, desires to repeat with emphasis the recommendations often made by former committees, that greater care should be taken to determine the absence of disease and other devitalizing conditions, before administering the serum-simultaneous treatment to hogs and that more liberal doses of anti-hog cholera serum should be used at all times in field practice.

SWINE ERYSPIELAS

The increase in the prevalence and distribution of swine erysipelas has caused your Committee to regard this transmissible disease of swine as rapidly approaching hog cholera in importance in this country. The complexities that may attend a differential diagnosis, particularly between swine erysipelas and hog cholera, add to the difficulties encountered in the effective control of both diseases. The early recognition of the disease, therefore, is of first importance. To this end, your Committee recommends the more frequent use of the tests which have been developed as an aid in diagnosing the disease. After a positive diagnosis of swine erysipelas has been made, the use of anti-swine erysipelas serum, together with the adoption of sanitary measures and isolation of the affected animals, will produce satisfactory results. Owing to the increased prevalence and distribution of swine erysipelas, your Committee recommends that steps be taken to make it a reportable disease in the several states.

We recommend that this report be received and referred to the Executive Committee for its consideration.

DR. KINSEY: This report is signed by the entire committee, and has been approved by the Executive Committee. Therefore, Mr. President, I move you it be received.

PRESIDENT RECORDS: You have heard this report with Dr. Kinsley's recommendation. What is your pleasure?
Dr. J. L. Axby: I second the motion that it be received.

The question was put to a vote and carried.

President Records: The next order of business is the Symposium of Tuberculosis, to be opened by Dr. Walter Wisnicky, of Wisconsin, with a paper on "The Necessity for Continuing Tuberculosis Control and Eradication Activities in Modified Accredited Areas."

... Dr. Wisnicky presented his paper. ... (Applause.)

THE NECESSITY FOR CONTINUING TUBERCULOSIS CONTROL AND ERADICATION ACTIVITIES IN MODIFIED ACCREDITED AREAS

By Walter Wisnicky, Madison, Wis.

Director, Division of Live Stock Sanitation
Wisconsin Department of Agriculture

Placing additional states and areas, with rapid succession, into the column of modified accredited areas has had its effect on the public viewpoint in respect to the necessity for the continuance of the activities under the bovine tuberculosis control and eradication program. There appears to be a tendency toward the creation of a public impression, in the areas that have been modified accredited, that the job of controlling and eradicating bovine tuberculosis has neared its completion. It is necessary that such an impression be corrected, because the disease has not yet been eradicated in a high majority of the modified accredited areas. It merely has been brought under control by reducing the incidence of infection to such a low minimum, that the disease has practically ceased to be an economic hazard. In reality, it will require many years of sustained effort to reduce further or perhaps eradicate this disease entirely from modified accredited areas. Foci of infection still exist in individual herds or groups of herds in the accredited areas, which serve as smoldering embers awaiting an opportunity to set up a disease conflagration at the first relinquishment of control efforts.

The public viewpoint regarding matters of disease control and eradication or other activities has an important bearing on legislative results, and since it is necessary to secure public appropriations for the continuance of the work, it is obvious that citizens in all walks of life should have a correct understanding, not only of the actual status of the program, but also realize the necessity for the continuance of the program to maintain the advantages gained and to reduce the incidence of the disease to a still lower level.

Permit me to refer to a problem in modified accredited areas which concerns herd-owners. They raise the question regarding
the necessity for making special tests in addition to the tests made by official agencies at public expense, in order to qualify their cattle and dairy products for special markets. In reply it is necessary to point out to them the distinction between tests made by federal and state agencies for the purpose of controlling and eradicating the disease, and special tests required by states, cities, or villages, for the purpose of qualifying the animals or dairy products for entry in compliance with existing laws and regulations.

It is commonly reasoned, that if the work in connection with tuberculosis eradication conducted by the state and federal agencies is being performed for the purpose of controlling and eradicating the disease in the area, the status of the cattle and their products in such area should qualify them on the various markets, from the standpoint of safety in regard to animal and human health.

The tuberculosis control and eradication program, itself, and the classifying of townships, counties and states into the accredited column have been so rapid, that it perhaps would be too much to expect the various units of government to adjust bovine tuberculosis requirements from time to time to conform with their actual necessity, as they apply to the different states and areas. Legislative bodies move rather slowly. There are many factors other than animal disease control and human health which create a bearing on law and regulation amendments. It appears, therefore, that we may have to continue for a time to contend with the dual situation of conducting a planned program at public expense to continue to reduce tuberculosis infection in the accredited areas, along with the necessity of making special tests at herd-owners' expense, merely for the purpose of complying with market requirements, whether such tests are necessary or not for animal disease control and for the protection of human health.

It does seem unjust for the herd-owner to be penalized by causing him to make unnecessary expenditures for tests not needed. Every effort should be put forth to work speedily in the direction of adjusting the market requirements to the actual needs from a health standpoint.

The problem of retest and maintenance of accredited areas has changed considerably. In 1923, there were only 17 counties accredited in the United States. Now approximately 88 per cent of the counties in this country are modified accredited. When the accredited areas were few, there was a great hazard occa-
sioned by the infiltration of tuberculosis infection from adjacent non-tested or non-accredited areas. This hazard existed in spite of the quarantine provisions surrounding the accredited areas or areas in the process of being tested. Today, the hazard of reinfection of cattle in accredited areas has been very greatly reduced on account of cleaning up vast contiguous areas. Nevertheless, hazards which must be recognized still exist. There exists the problem of truck transportation which has grown contemporaneously with the tuberculosis program, and which has not been brought under proper control and supervision. Cattle, from areas where cattle have not been tested or which have not qualified as accredited, may be trucked, without regard for state and federal laws and regulations governing the movement of cattle, from non-tested to clean areas. This jeopardizes the status of the modified accredited counties and areas.

Just to point out how serious this hazard may be, I wish to relate an incident which occurred in our state which came to our attention about two years ago. A male animal was brought into our state without complying with test requirements and without a health certificate. It later developed that this animal was transported by truck from a non-accredited area into our state. This animal was placed in a herd some months after the completion of an area test in the county. On the subsequent area retest, we encountered a great deal of tuberculosis infection concentrated in one portion of a township. In the study of the case, it was revealed that the herd into which the bull was introduced became very heavily infected with tuberculosis. Milk was sold from this farm to a cheese factory and the whey, without proper pasteurization, was taken back by the patrons to their farms. After another area test was completed, it was disclosed that a very high percentage of the patrons of this cheese factory had introduced tuberculosis onto their premises through the whey which they took back to their farms. Postmortem records and all other information pointed clearly to the fact, that the infection was introduced into the herd with the male animal, which was brought into the state by truck in contravention of the state and federal laws and regulations.

The illegal transportation by truck is not the only evil existing. Some of the people engaged in the buying, selling, and transportation of cattle from certain parts of the country to others are disregardful, not only of the existing laws and regulations, but also of the welfare of the cattle industry of the country. The only object of this element is to secure such profits as
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*Incomplete. Postmortem reports in some counties not available.
†Complete.
‡Incomplete. Area retests not yet made in all counties.
are to be derived from their various transactions. We must face facts as they are and actually recognize that some of those who are engaged in the buying, selling and transportation of cattle will resort to every conceivable means to avoid the necessary existing laws and regulations. These people will go to any length to avoid laws and regulations, if they can profit financially by their methods. The records of every state would reveal that bovine tuberculosis and other diseases have been spread in the past into clean herds and into clean areas by the unscrupulous element that is engaged in the cattle business. It appears that stringent licensing provisions, that apply both to agencies transporting cattle by trucks and to cattle-dealers, are needed to prevent further unnecessary spread of tuberculosis and other diseases of cattle.

Those associated with tuberculosis control work are frequently confronted with questions such as these: "How long will this tuberculin-testing work have to be continued?" "What are the factors that stand in the way of complete eradication of the disease?" It is difficult, if not impossible, at this time to answer the first question. The most plausible reply is that we will have to continue to carry out periodical retests on all cattle in the accredited areas, or on a fraction of the cattle in such areas, to maintain all advantages gained, and to continue to reduce the infection to a lower level, with the hope that eventually it may be entirely eradicated.

Table I shows that the percentage of infection has been markedly reduced. It also indicates that there was a very marked reduction in infection between the initial and the first area retests. On subsequent retests, there is a further reduction, but the rate of decrease is becoming gradually less. The graph in figure 1 shows this reduction of tuberculosis infection very strikingly.

If the program is continued, as it has been conducted in the past, and successive retests continue to show a decline in infection, it would be only reasonable to assume that the downward curve, in time, would reach the zero mark. How long this will take, it is difficult to foretell, because of the various new problems which arise as the work progresses.

On casual survey, it may appear, on the basis of progress made, that the different problems in respect to tuberculosis control have been solved. This, however, is not true, as those of you who are closely associated with the work realize. We still have a tuberculin problem, a skin and no-lesion problem, and the problem
of tuberculosis in other species of animals and human beings, affecting the progress of the bovine tuberculosis program. These factors and others stand in the way of complete eradication of the disease.

It is safer now than it was some years ago for us to discuss our difficulties in respect to tuberculin-testing of cattle without being conscious of the hazard that someone may wrongly use some of the statements made for the purpose of obstructing the program. Progress has been made to a point where agitators and opponents to the program find it almost impossible to secure attentive ears to their views.

The success of the tuberculosis program as shown by table I and figure 1, bespeaks the effectiveness of tuberculin which has been used as the diagnostic agent. Nevertheless, some of those of us who have watched this work closely, and who have studied results in detail, realize some of the still existing limitations of tuberculin. Perhaps the most obvious condition which

![Graph showing percentage of tuberculosis infection in Wisconsin on the initial area test and the general area retests.](image-url)
exists in respect to tuberculin is the fact that we have no generally accepted method of checking the properties of tuberculin in respect to its diagnostic effectiveness prior to using it in the field. The criterion as to whether a particular lot of tuberculin does its work effectively, if the test is properly applied and interpreted, is by the evaluation of field results on cattle tested and retested over a series of months and years. Although tuberculin is prepared according to precise and accepted methods, it appears that variations in some lots of tuberculin still do occur. In the review of postmortem results one may be led to suspect that the diagnostic properties in different lots of tuberculin may vary in both directions, namely, that one lot may have a tendency to produce deviations at the point of injection in healthy cattle which may be construed as reactions, and another lot may in some degree lack the properties which are responsible for the production of the characteristic reactions in infected animals.

Mention of this tuberculin problem is being made only for the purpose of bringing out the point, that as the infection in accredited areas becomes less and less, it becomes necessary to utilize still more precise methods and means in order to increase the possibilities of transcending from the control of this disease to the goal of eradication.

The skin and the no-lesion problems are still with us. Their significance from the viewpoint of the herd-owner has been somewhat modified. It appears that the herd-owner does not regard the elimination of animals that do not show glandular lesions on postmortem examination so seriously as they did in the early years of the tuberculosis program. However, instances do still occur where the spotlight of attention is focused on a situation where an individual or a group of animals react to the test and where on postmortem examination no glandular lesions can be disclosed.

In observing the figures in table II, it will be noted that the actual number of no-lesion cases (this does not include skin-

<table>
<thead>
<tr>
<th>TEST OR RETEST</th>
<th>NO-LESION CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial test</td>
<td>3,921</td>
</tr>
<tr>
<td>First general retest</td>
<td>581</td>
</tr>
<tr>
<td>Second general retest</td>
<td>810</td>
</tr>
<tr>
<td>Third general retest</td>
<td>867</td>
</tr>
</tbody>
</table>
lesion cases) was reduced markedly between the initial area and the first area retest. Subsequent area retests show a gradual rise. This table is a compilation made possible by the existence of records on a limited number of counties which have received the initial and several area retests, and on which postmortem records are available. The data in this table are, perhaps, representative of the condition existing in our state as a whole. The question raises itself, as to whether the decrease in no-lesion cases between the initial area test and the first area retest truly represent the actual situation, or whether the men engaged in testing have learned by experience to interpret the deviations from normal more competently.

We have found that regularly employed veterinarians, when moved from one area in our state into another area, adjust their standard of interpretation on the basis of past experience, in order to avoid the condemnation of large numbers of animals which would not show lesions on postmortem examination. It so happened that in some instances, inspectors who were not experienced in the change in conditions in the different areas would soon find themselves in the position where they had condemned a considerable number of animals which would not show lesions on postmortem examination. There are a number of counties in our state in which it is believed some causes other than bovine tuberculosis organisms exist which cause cattle to be sensitized to tuberculin. These causes appear to be noticeably less prominent in other parts of our state. The problem seems to be peculiar to an area wherein a number of counties are located.

This brings up the point of sensitization by organisms other than the bovine tuberculosis bacillus. In looking about for probable causes for this sensitization, we cannot overlook the part that may be played by acid-fast soil organisms, the bacillus of avian tuberculosis, the organism causing Johne's disease, and the organism causing pulmonary human tuberculosis. Although the no-lesion cases are not so great in number, it will be noticed that the percentage of no-lesion cases based on the number of reactors disclosed is gradually increasing. (In the way of explanation, I want to point out, that in table I, the fourth general area retest which is not complete does not represent the true picture in regard to no-lesion cases, because practically all of the counties in the areas where the no-lesion problem is mostly encountered have not as yet received their fourth retest.) In a general way, I may indicate that, at present, the percentage of
both skin and no-lesion cases is between 40 and 50. From the percentage basis the problem seems to make itself more prominent as we approach a lower level of infection.

Mention has already been made of the possible complications of the tuberculin test on cattle as a result of the existence of tuberculosis in other animals and in human beings. In looking about for a possible explanation of some field cases that occur, it would seem that the different kinds of tuberculosis organisms cannot be definitely classified into four definite types. Each type may include strains which vary considerably. Some of the strains of one kind may approach the properties of extreme strains of another type. If such is true, then we have to abandon our viewpoint of regarding bovine tuberculosis as an entity in itself, and assume the broader viewpoint that a comprehensive tuberculosis control and eradication program will include the control of tuberculosis in all classes of farm animals and also of the human family. I have the feeling that tuberculosis, in other than bovine animals and in human beings, is already tugging at the coat-tail of the bovine tuberculosis program to diminish the large lead which this program has taken.

Although there are a number of counties in this country which have had no cattle react on one or more complete area retests, and although the situation looks very encouraging when viewed from the standpoint of decrease in infection as indicated in table I, I am somewhat reticent to believe that we can completely eradicate bovine tuberculosis in most of our areas, unless we correlate this effort with definite attention which may be given to tuberculosis in other species of farm animals and in human beings.

The present activities in carrying out the periodic retest schedule must be continued for the purpose of protecting the large investment already made in this work. Our hope for complete eradication of this disease is met with the challenge that we give earnest study to the problems confronting us, with the thought of improving and making more precise the methods which we now employ, and modifying our approach to the bovine tuberculosis problems by giving cognizance to all other types of tuberculosis.

**President Records:** Next on our program is the annual report on “The Progress and Status of Tuberculosis-Eradication Work,” by Dr. A. E. Wight.

... Dr. Wight presented his paper. ... (Applause.)
THE PROGRESS AND STATUS OF COOPERATIVE TUBERCULOSIS-ERADICATION WORK

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

Chief, Tuberculosis Eradication Division
Bureau of Animal Industry, U. S. Department of Agriculture

During the past year, much greater progress was made in the tuberculin-testing of cattle in the United States than in any other similar period. It was possible to conduct a much greater amount of work because of additional federal funds made available through the LaFollette amendment to the Jones-Connally Cattle Act. These emergency funds were used both for operating and indemnity purposes, and the project was administered by the Bureau of Animal Industry, working in cooperation with the various state livestock sanitary officials.

During the fiscal year ended June 30, 1935, more than 25,000,000 tuberculin tests were applied to cattle, and of this number 376,623 reacted to the test. The largest number of cattle ever tuberculin-tested in any one month was during May of this year, when tuberculin tests were applied to approximately 3,100,000 cattle, located in about 300,000 herds.

Tuberculosis eradication work was carried on in many different sections of the country. In some localities tuberculosis in cattle was very prevalent, while in others the disease existed to but a very slight extent. This great volume of work has produced results that could not possibly have been obtained for several years without the additional federal funds, which made it possible to employ a large force of additional veterinarians and other personnel. The additional federal funds for indemnity also contributed very much to the accomplishment of such a large volume of work.

STATE AND FEDERAL FUNDS

The regular federal appropriation and many state appropriations have been somewhat reduced, but the total state appropriation for both operating and indemnity in tuberculosis eradication work is now about $7,500,000 annually. The regular federal appropriation for this work during the fiscal year ending June 30, 1936, is $2,631,616.

AREA WORK

Practically all the tuberculin-testing was conducted under the area plan, although, in a few states, a considerable number of cattle were tested under the accredited-herd plan. During the
year from November 1, 1934, to November 1, 1935, 817 counties were added to the list of those in the modified accredited area, indicating that the degree of infection of bovine tuberculosis exists to less than 0.5 per cent. In addition to these counties, 46 towns in the state of Vermont also were placed in that classification. During the twelve months ended November 1, 1935, the required number of cattle located in 565 counties and 36 towns, which were due for remodification, also were tuberculin-tested, and it is very gratifying to be able to report that as a result of these retests the infection in each county and town was found sufficiently low to continue them as modified accredited areas. On November 1, 1934, the states of Oregon and Virginia were added to the modified accredited area, and since that time Minnesota, Kansas, Florida, Missouri, Arkansas, New Mexico, Colorado, Wyoming, Tennessee, South Carolina, Massachusetts, Louisiana, Georgia and Alabama have also been added, making an increase of 16 states in one year. On December 1 of this year, the states of Iowa and Montana were declared modified accredited areas, making a total of 33 states in that classification.

It is, of course, of much importance to mention this accomplishment in Iowa, where the cattle population is so large, and where tuberculosis existed to a considerable extent in several counties. All of us acquainted with the work in that state appreciate the splendid work that has been accomplished by the state, county and Bureau officials in spite of some very vigorous and well-organized opposition in certain localities.

**APPRAISAL, SALVAGE AND INDEMNITY**

The amount of salvage received by the owners of cattle marketed because of reacting to the tuberculin test was larger than during the previous year, due to the increased prices for all classes of cattle. During the month of October, 1935, the average salvage received for reacting cattle was $24.13, the average appraisal $76.82, and the average federal payment $20.95. On June 10, 1935, the maximum federal payment for grade cattle was increased from $20 to $25. No change was made in the maximum payment for registered purebred cattle, which remains at $50.

**CATTLE TUBERCULIN-TESTED FOR INTERSTATE SHIPMENT**

Most of the tuberculin-testing of dairy and breeding cattle for interstate shipment is performed by approved practicing veterinarians who, during the fiscal year ended June 30, 1935, applied such tests to approximately 370,000 cattle. During this period
75,000 similar tests were applied by Bureau veterinarians, which, due to the movement of large numbers of cattle from drought-stricken areas, is larger than during the previous year.

**ORDINANCES REQUIRING TUBERCULIN TESTS**

A large number of cities and towns continue to enforce ordinances requiring the tuberculin-testing of all herds of cattle used in supplying milk to their municipalities. Several cities now also require that butter and other dairy products be obtained from herds negative to the tuberculin test or located in modified accredited areas. This action has been taken by the City of Chicago, and has resulted in stimulating the tuberculin-testing program in several localities where butter is produced for sale in that city.

**AVIAN TUBERCULOSIS**

Some work was conducted in connection with the control and eradication of avian tuberculosis in poultry and swine during the past year, and within the last six months the number of Bureau veterinarians assigned to this project has been slightly increased. A special conference on this feature of the work was held in this city last Monday for the purpose of discussing future plans for this project.

**TUBERCULOSIS IN CATTLE AND SWINE DECREASING**

A compilation of reports received from the Meat Inspection Division of the Bureau of Animal Industry indicates that there is a gradual reduction in the amount of tuberculosis found among hogs and cattle given postmortem examination in connection with meat inspection. During the fiscal year ended June 30, 1935, approximately 12,500,000 cattle, exclusive of known reactors to the tuberculin test, were slaughtered at establishments operating under federal supervision. Of this large number of cattle, only 30,567, or about 0.2 per cent, showed any evidence of tuberculosis upon autopsy. Out of the total number showing any infection, 7,299 were condemned as unfit for food.

There has also been a slight reduction in the percentage of hogs showing evidence of tuberculosis, but the percentage found throughout the entire country last year was slightly more than 10. It is found that hogs from sections where there is a large amount of avian tuberculosis often show slight lesions of tuberculosis on autopsy. The tracing of the origin of hogs and cattle that show tuberculosis on autopsy continues to be one of the features of the tuberculosis eradication campaign, and has proved
to be of considerable value in locating infections in modified accredited areas.

RESULTS OF BIENNIAL SURVEY

The eighth survey to determine the approximate extent of bovine tuberculosis in the various counties in the United States was completed on May 1, 1935. It indicated that the approximate degree of infection of tuberculosis among cattle had been reduced to 0.6 per cent, and this has now been reduced to 0.5 per cent. The first survey, made in 1922, indicated that about 4 per cent of all the cattle in the country were affected with tuberculosis, and in some of the states the extent of the infection was very much higher. In the most recent survey it was found that in only nine counties in two states was the degree of infection more than 7 per cent, and in only four counties in two states was the infection more than 15 per cent.

JOHNE'S DISEASE (PARATUBERCULOSIS)

During the fiscal year ended June 30, 1935, Johne's disease was reported from 13 states, in which 154 animals were condemned on account of infection. This is approximately 5.4 per cent of the total number tested. This disease will be discussed on this program today by Dr. A. J. DeFosset.

PRODUCTION OF TUBERCULIN

The vast amount of work carried on in connection with the tuberculin-testing of cattle in official work required a very large amount of tuberculin. The Bureau of Animal Industry, fortunately, has been able to produce a sufficient quantity, which has been exclusively of the type known as Special F. We are very much indebted to the late Dr. Marion Dorset, and his associates, for the development of this product, which he so well described at this meeting two years ago.* The scientific work of Dr. Dorset in connection with the eradication of tuberculosis in live stock has been one of the most valuable contributions to our campaign in ridding our live stock of this plague.

PERSONNEL

The federal force of veterinarians was used to a considerable extent in supervising field work performed by a large number of junior veterinarians employed for a temporary period with federal emergency funds. The work was conducted from 44 different field stations. During the fiscal year ended June 30, 1935, the states employed an average of approximately 275 veterin-
narians for the entire year, in addition to 210 veterinarians on full time in the employ of the various counties. An average of 756 temporary junior veterinarians were employed by the Bureau of Animal Industry during the year. They were assisted by approximately 500 laymen employed locally from government funds. During the last six months of the past fiscal year, the average number of temporary junior veterinarians employed by the Bureau was 1,000, who were assisted by 733 laymen. In order to obtain proper supervision of this large volume of work, considerable effort was required on the part of the regular officials in charge of this project, and they deserve much credit for carrying the extra load, not only in tuberculosis eradication, but in the Bang's disease project, which has become one of great magnitude.

PUBLICITY

A considerable amount of favorable publicity has been given this project during the past year, especially in connection with the great progress that is being made in the placing of counties and states in the modified accredited area. Several exhibits of the work have been held at various places, and one is being shown this year in connection with the International Live Stock Exposition in this city. There has been quite a demand for the series of 55 pictures and film strips mentioned last year, due to their convenience and ability to be carried in the vest pocket. They may be obtained through the Extension Service of the Department at a cost of 45 cents.

CONCLUSION

Within the next six months, it is believed that the remaining counties in several additional states will be placed in the modified accredited area, as the work in those localities is now well advanced and progressing in a favorable manner. Nearly all the initial testing in the eastern states not in the modified accredited area has been completed, and good progress is being made in the retesting work in those localities. In the three southern states not, as yet, in the modified accredited area, the infection is slight, and the tuberculin-testing is progressing very rapidly. In South Dakota and Nebraska, a large force of veterinarians is now engaged in applying the required amount of testing to cattle and, barring interruption, this work should be completed within the next six months. In Arizona, nearly all the required amount of testing has been completed, and within a short time it is expected that the remaining herds will be tested and the entire state placed in the modified accredited area.
In California, where tuberculosis in cattle was found to exist to a considerable extent in several counties, the work is progressing, but some opposition is being encountered in the dairy sections, where the owners feel they are not receiving a sufficient amount as indemnity. Except in a portion of the work, the state has not provided funds for a state payment, in which instance the owner receives only the salvage and the federal payment, which can not exceed $25 for a grade animal or $50 for a registered purebred animal. Within the next six months, however, it is believed it will be possible to make considerable headway in the tuberculin-testing work in that state.

In November, 1934, arrangements were made to inaugurate tuberculosis eradication work among cattle in Puerto Rico, and since that time it has been possible to conduct a considerable amount of testing there. The degree of infection has been a little less than 2 per cent, but in certain localities some herds were found to be quite heavily infected with the disease. Cooperation on the part of the herd-owners has been very satisfactory.

A limited amount of tuberculin-testing of cattle was conducted in Hawaii, where only a slight infection of tuberculosis was found.

The usual report, containing various tables and other information in connection with tuberculosis eradication work, is available at this meeting. Additional copies, if desired, may be obtained by writing the Bureau of Animal Industry at Washington, D. C. This report contains some reference to the results of the testing of cattle for Bang's disease.

It has afforded me great pleasure to be with you again this year, and I wish to thank you for your most kind and appreciative attention.

PRESIDENT RECORDS: The next paper in this series is "Johne's Disease, a Menace to the Cattle Industry," by Dr. A. J. DeFosset, B. A. I. Inspector-in-Charge in Ohio.

Dr. DeFosset read his address... (Applause.)

JOHNE'S DISEASE, A MENACE TO THE CATTLE INDUSTRY

By A. J. DeFosset, Columbus, Ohio

U. S. Bureau of Animal Industry

Live stock production is unprofitable and can not long continue on a farm where contagious or infectious disease has established itself. What is true in this respect to successful husbandry on a farm is equally true, as the subject relates itself to the industry
as a whole and to infectious maladies spread over wide areas. Of this, our successful breeders and foremost sanitary workers long have been convinced, and it has been an impelling force in this country in devising ways and means for effective control and extermination measures. Upon this fact rests the foundation of the structure we call the United States Live Stock Sanitary Association.

The achievements in disease control and eradication during the last half-century in this country were not possible without vision and leadership, and with these rich elements in human endeavor, the live stock industry and the veterinary profession were amply endowed.

These two organizations, when we think of contagious disease control, in principle and effort are almost synonymous. Their common task as they labor together through the years becomes less irksome as the breeders' conception of disease expands and their knowledge on sanitation becomes applicable and they sense more clearly the value of science and its attainment in the field of regulatory work. This is further augmented on the part of the sanitarian as he learns with a keener sense of appreciation the value of sympathetic and harmonious relationships.

With these factors at work to fortify us in our cooperative endeavor, we need no longer be hesitant or fearful of the future when confronted by emergencies.

The restoration of the cattle industry to a sound economic basis in so far as it relates to such formidable foes as contagious pleuro-pneumonia, foot-and-mouth disease, southern tick fever, and tuberculosis, is almost an accomplished fact, and we envisage this progress with a degree of pride. This is all very well if adopted to serve as a stimulus to fortify us in making attacks on still other vexatious problems that are confronting us; and this brings me to the subject of Johne's disease that I am to discuss.

It is not my purpose to dwell on the history or the cause of this disease. As sanitary officials, I feel we are all more or less familiar with this, because we are not dealing with a disease entirely new to us. Much has been written by investigators abroad, where Johne's disease in some sections is quite prevalent, and valuable material is available, also, from the pens of our American investigators.

When this disease first made its appearance in this country is not definitely known, probably more than 25 years ago. Its presence in many of our states, and in an ever-increasing number of herds, has not in the past been looked upon with alarm. However,
as the infection continues in its spread from herd to herd, and considering the insidious nature of the malady, it is high time that all sanitary officials, if they have looked upon Johne's disease with indifference, and as of little importance from a sanitary or an economic aspect, change their view, and take prompt steps to the end that this disease be given early recognition and dealt with most drastically.

It is quite apparent that Johne's disease oftentimes has escaped recognition by the practitioner, as well as the owner of affected cattle, until after it had become implanted so firmly in the herd that control measures were almost beyond hope. This is due in large part because of the insidiousness of this malady. Investigators have proven that the infection, after having been taken into the body of an animal, may remain latent for a long period of time, and no clinical manifestations may be observed sometimes for several years. The organisms, even when given to young animals by inoculation, frequently propagate very slowly. Symptoms sometimes fail to appear until months or several years afterwards. Eventually, as the infection advances, the animal gradually loses flesh and this is associated with a more or less intermittent watery diarrhea that will not respond readily to medicinal treatment.

With the appetite unimpaired, especially in the early stages, and a conspicuous absence of fever, a veterinarian may not be called by the owner and later, due to general unthriftiness, this disease carrier, as is too often the case, finds its way to the auction sales to become a dangerous disseminator of infection.

If this disease were more spectacular in its onslaught and destroyed its victims within a few days after attack, it would be less baneful. Not unlike a malignant growth fastened upon its prey, death, although slow, is inevitable. The gravity of this condition is not to be measured in the morbid loss of the individual itself, but in the possible damage to the entire herd through dangerous exposure.

Treatment, in so far as is known, is of no avail. Rigid sanitary control measures as a means of prevention offer the only hope.

The disease is spread most readily from herd to herd through the direct transfer of the affected animal, and it is important that we consider at this time the location of the predominant lesions found on autopsy of diseased cattle. As in avian tuberculosis, these are found in the alimentary tract. As a potent factor in the transmissibility of disease organisms, could one conceive of a more favorable location for these lesions? It is needless to say that the excreta of affected animals, even long
before there are any clinical manifestations, are capable of conveying the infective organisms to other animals in the herd and dangerously exposing them before the presence of the disease in the herd is known. There is no question but that many of our large herds that harbor this infection were polluted in this manner.

The dangerous aspect of this mode of transmission should not be taken lightly. To comprehend the full significance of this mode of transmission, we need only to point to avian tuberculosis and note the alarming rapidity with which this disease spread throughout the Corn Belt states. It is true, of course, that the habits of feeding in the fowl are quite different. However, the offending organisms confine their activity somewhat similarly to the intestinal tract, are eliminated from the disease carrier through the excreta in a similar manner and remain viable on the soil for a considerable period of time.

With regard to the behavior of the organism after its entrance into the host, we have this striking difference. The avian tubercle bacillus, when taken into its natural host, as a general rule makes its presence known in a flock relatively early, whereas in Johne's disease we note a marked variation in time after the paratuberculosis bacillus is taken into the body. As previously stated, the incubation period in cattle is variable. Sometimes we may find young calves less than six months of age affected and showing clinical evidence, and at other times the incubation period may be drawn out over a period of years.

Considering now our more modern means of transportation and the readily accessible marketing points for our live stock, more or less unrestricted in its movement, is our industry not facing a great peril unless more active measures are taken for the control and extermination of Johne's disease?

In 1932, before this body we had the pleasure of hearing a paper read by Dr. W. A. Hagan,* of the New York State Veterinary College, entitled, "Studies on the Control of Johne's Disease." He pointed out, in that splendid treatise, that the necessity of controlling this disease is of greater importance than many realize, because of the inroads it had already made; also, he covered quite fully the use of the allergic tests for diagnostic purposes and the results with the various tests used by him and his coworkers.

Since then several years have passed by, and this country has witnessed the expenditure of huge sums of money for the elimination of disease in cattle. But what about Johne's disease?

Has any appreciable progress been made in checking its spread? With this thought in mind, the speaker, with the aid of the sanitary officials in the various states, made a recent survey. Time did not permit of an exhaustive study of the subject, but some facts are brought out from which we might be able to draw some conclusions.

It is of particular interest to learn from this survey that Johne's disease has been diagnosed during the past three years in 151 herds in 33 states, including all the principal dairy states. Numerically, this may not impress some of us as of serious import. It is a matter of grave concern, however, when one considers this from the standpoint of number of centers of infection from which this disease may spread, and the wide area involved, together with the nature of this malady, and its stubborn resistance to our present methods of control. Then again we must take into account that these figures unquestionably are representative of only a part of the herds that actually are involved. This may be expressed more clearly in the following quotation from a sanitary official in a questionnaire that had been sent him:

If more cattle were tested, the disease might be found more prevalent in this state, because the average cattlemen and dairymen usually destroy these animals, thinking that the trouble was some digestive trouble, and are not profitable to feed, hence are eliminated from the herd.

From an official of another important dairy state I quote as follows:

It is believed that more infection exists than we know of. More cases are coming to our attention yearly.

In the state just referred to were tested, during the past three years, 21 herds with 906 cattle for Johne's disease and 13.5 percent of the animals reacted.

**Summary of Survey Through Questionnaire**

States replying to questionnaire.......................... 41
States reporting existence of Johne's Disease................ 33
States reporting no existence of Johne's Disease............. 8

**Diagnostic agent used**

<table>
<thead>
<tr>
<th>Diagnostic agent used</th>
<th>States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avian tuberculin and johnin subcutaneous</td>
<td>1</td>
</tr>
<tr>
<td>Johnin intradermally</td>
<td>13</td>
</tr>
<tr>
<td>Johnin subcutaneously</td>
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</tr>
<tr>
<td>Johnin and avian tuberculin, intradermal and intravenous</td>
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</tr>
<tr>
<td>Hagan's avian tuberculin</td>
<td>2</td>
</tr>
<tr>
<td>Johnin and avian tuberculin, intravenously</td>
<td>2</td>
</tr>
<tr>
<td>Microscopic examination of scrapings</td>
<td>1</td>
</tr>
<tr>
<td>Clinical and postmortem examination</td>
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</tr>
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<td>States having a program for testing for Johne's disease</td>
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</tr>
<tr>
<td>States not having a program for testing for Johne's disease</td>
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### Disposition of reactors

<table>
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<tr>
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</tr>
<tr>
<td>Reactors not slaughtered but quarantined</td>
<td>8</td>
</tr>
<tr>
<td>Reactors not slaughtered or quarantined</td>
<td>8</td>
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</table>

**Is infection increasing?**

<table>
<thead>
<tr>
<th>Reporting</th>
<th>States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>4</td>
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<tr>
<td>No</td>
<td>31</td>
</tr>
<tr>
<td>Uncertain</td>
<td>1</td>
</tr>
</tbody>
</table>

It will be noted from this summary that there is considerable variation in the method of test; also, in the biologic used. If the results following the test for Johne's disease or paratuberculosis are not uniform, it is due, no doubt, to a lack of uniformity in the methods employed. It is of interest, also, to note that in all states, with the exception of two, either avian tuberculin or johnin was used for determining the presence of the disease.

A factor of much concern in connection with the control and extermination of the disease is the application or use of the various biologic tests. Apparently, in but few cases have these tests proven successful in freeing herds that were extensively infected. This is a matter of great importance and it appears that research along this line should be continued.

Personally, it is my opinion that the johnin test will function in locating infected animals after the disease has progressed to a certain stage. We are dealing here, however, with a disease, the incubation period of which is variable and it may range over a long period of time. It is probable that the gauge or measure used so successfully as a diagnostic agent in other maladies is not applicable here, at any rate, not with the same degree of success.

If it has been determined after repeated efforts with the use of the approved or recognized biologics that an extensively infected herd cannot be rid of the infection, would it not be advisable and good policy, after securing the consent of the owner, to slaughter the entire herd? Indeed, this is a policy that has forced itself upon us in some herds and it is quite likely that it may need to be extended, if the disease ultimately is to be exterminated on some farms.

Commenting further on this survey, we find in states where this disease has not succeeded as yet in establishing itself in some of the large or more prominent herds, little concern is felt in its presence there. On the other hand, in several of our states where the larger and more conspicuous herds, because of breed value,
have fallen prey to its ravages, there is more serious concern, especially after several years of unsuccessful effort in combating this malady.

In Ohio, where we are plagued with this disease in more than 35 herds, we are fully aware of its serious aspects, particularly for the reason that we are making no appreciable progress in curbing its spread to new centers. Neither are we certain that we have been able, after repeated tests, to exterminate it from the heavily infected herds by the use of the usual biologics. There have been too many instances where animals in infected herds have shown clinical evidence of the disease several months after the herd had succeeded in passing a negative test. This is very discouraging, not alone to the officials having the herd under test, but to the owner as well, who after several years of unsuccessful effort is ready for a dispersal sale; and herein lies the real menace of this disease to the industry. In states where considerable infection has been reported during the last 15 years, the officials are cognizant of the fact that they are dealing with a most serious and perplexing problem.

There have been occasions in the past, when destructive animal plagues had invaded our country, when the industry faced a real crisis. We were fortunate on those occasions in having had the counsel and leadership of men gifted by years of experience. Such men we have with us today, and because of them we have hope.

Now, before bringing my discussion to a close, I wish to quote in part from a communication that was received a few days ago from our good friend and coworker, Dr. C. E. Cotton, of Minnesota. His observation, as well as his experience in coping with Johne's disease, is so similar to that reported from several other important dairy states, where a considerable number of herds are affected, that it may well serve as a criterion and should be of value. Dr. Cotton has the confidence and respect of every member of this body and it is a pleasure to quote from his letter:

* * * Prior to January, 1933, Johne's disease existed in 18 herds in our State. * * * The owners of five of the herds eliminated the infection by slaughtering all of their cattle; thus leaving 13 herds in the state in January, 1933, known to be harboring the disease. Since that time the disease has been disclosed in eleven additional herds.

With reference to question 8 (percentage of infection), 9.9 per cent represents the percentage disclosed on our first test of the herds in this state since January, 1933. Our experience with the test and its results have not been satisfactory. In studying the individual herds in which our laboratory has verified the existence of the disease after a histopathological and also a bacteriological examination, and the results of the semi-annual tests, it is disclosed
that frequently within six weeks to two months after all reactors have been removed from a herd, another animal will be reported as showing clinical symptoms of the disease. In all such instances we immediately appraise the animal and have it shipped for slaughter. The next semi-annual test of the herd may reveal from one to four animals again reacting to the test, and the following semi-annual test may not disclose any reactors. In some of the herds the second semi-annual test will fail to disclose reactors, and on the following semi-annual test there will be a few more reactors disclosed. After the first test of a herd is made, we find that reactors disclosed in successive tests are, in practically all instances, three- and four-year-old animals.

Dr. Hagan informs me that in his investigations and studies of this disease in his experimental herd, he has disclosed the period of incubation in some instances is longer than three years. This fact and the results of our experience with the present methods of diagnosis in this state, to my mind, are conclusive that the one practical method to control and eliminate this infection when it is definitely established in a herd is to arrange, if possible, with the owner to slaughter the complete herd. The stables should then be thoroughly cleaned and disinfected and the pastures plowed; further, not to permit the re-establishment of a new herd on such pastures for a period of two or three seasons.

Gentlemen, Dr. Cotton speaks from experience and with authority and I feel certain that no one having had so intimate contact with this disease will disagree with him and others whose sentiments he expresses on this subject. Now, should not the seriousness of this malady impress itself upon us with sufficient force as to prompt a more concerted action in preventing its further spread?

Congress has recognized the seriousness of this disease and authorized the Department of Agriculture, in the appropriation bill for the fiscal year 1928, to cooperate with stock-owners, under a plan somewhat similar to that followed in tuberculosis eradication. A number of states have availed themselves of this assistance and have made possible the payment of indemnity to owners of diseased animals through enabling legislation. It is our understanding that each year since then the indemnity appropriations have been continued for animals slaughtered as a result of Johne's disease or paratuberculosis and there should be no good reasons for longer delay in attacking this problem in earnest.

CONCLUSIONS

1. Research work should be continued to the end that we have more satisfactory results from biologic tests.

2. Every effort should be made to locate the infected herd and prevent the removal of diseased animals from the herd for purposes other than slaughter.

3. In extensively infected herds, an effort should be made to get the owners' consent, if possible, to slaughter the exposed, as
well as the infected animals, and to provide means, if necessary, for compensating the owners. It is believed that this procedure would prove of great economic value to the industry.

PRESIDENT RECORDS: The next item on the regular program is the report of the Committee on Tuberculosis, Dr. J. L. Axby, Chairman. This report has already been approved by the Executive Committee.

Dr. Axby: I want first to thank the gentlemen who participated on this program. I do that representing the Committee. As a foreword, I want to say that I met with a surprise as Chairman of this Committee. In my life up to this time, I have had the buck passed many, many times, but my pleasant surprise on this occasion was to write to these men, stating to them what I had in mind, and I received a letter from them agreeing, without any equivocation or argument whatsoever, and consenting to go on the program, and you have heard the results this afternoon. To me that indicates taking seriously the job of being a member of the United States Live Stock Sanitary Association that augurs well.

I also want to extend my thanks to the members of the Committee on Tuberculosis with whom I have worked. You gave me ready response, and your entire coöperation. This, Mr. President, is an account of their stewardship, and leaving the personal element out of it, I want to say to you that in the selection of the personnel of that committee, other than myself, you exercised good judgment, and they functioned properly and well.

... Dr. Axby then read the report of the Committee on Tuberculosis. ... (Applause.)

REPORT OF COMMITTEE ON TUBERCULOSIS

Dr. J. L. Axby, Chairman, Indianapolis, Ind.

Dr. C. U. Duckworth, Sacramento, Dr. C. C. Hisel, Oklahoma City, Calif.
Dr. E. T. Faulder, Albany, N. Y. Dr. H. D. Port, Cheyenne, Wyo.
Dr. George Hilton, Ottawa, Canada. Dr. A. E. Wight, Washington, D. C.

We recommend that the Bureau of Animal Industry Regulations be modified to permit feeder or grazing cattle of recognized beef breeds to move interstate from modified accredited areas without ear-tagging, when accompanied by official health certificates, issued by a state, a federal or an accredited veterinarian, setting forth the number, origin, destination, breed and class of cattle.

We further recommend uniform state regulations be made, modified or changed to conform to the federal recommendations herein made.

Dr. Axby: Mr. President, as this has been approved by the Executive Committee, I move its acceptance.

... The motion was regularly seconded and carried. ...

PRESIDENT RECORDS: The papers presented in this symposium are now open for discussion. Since no one will take the initiative, it has been suggested that Dr. Hagan be asked to discuss Dr. DeFosset’s paper.

Dr. W. A. HAGAN: Mr. President, I am very glad to say a few words about this paper, because, as most of you know, I have been interested in the subject for some years.

I will say, in the first place, that Dr. DeFosset has made a very fair statement of the situation that exists. Some years ago, I made a
survey, and I believe I found at that time that infection existed in one or more herds in at least 37 states. That was at least five years ago.

The disease probably is not wide-spread in dairy cattle in any of the states. It is unquestionably spreading, however, because of the lack of recognition and because of the reasons given. The disease is not at all spectacular. It is frequently not recognized by veterinarians.

Another difficulty, of course, with Johne's disease, is that the lesions are not at all conspicuous. They can be overlooked easily unless a careful postmortem is made, and even then, I have arrived at the conclusion that only occasionally can you be sure that Johne's disease exists. In other words, I do not believe I can tell the disease when I see it, unless it is an advanced case.

We do have instances where the examination suggests Johne's disease, and it has been pointed out that when the intestines are taken from the warm animal and dropped on the cold floor, the muscles will contract, and that will produce an apparent thickening that may easily be taken for Johne's disease. A large majority of these cases come back marked positive, and we fail to confirm them in the laboratory. That is simply a case of physiological folding of the bowel.

I am glad Dr. DeFosset mentioned the possibilities of the infection existing on the premises for a considerable length of time. I have been interested in that. We are still working on it, and I hope some day to have some information about it. It is difficult, because you understand there is no easy way of detecting this organism in soil. It does not infect ordinary laboratory animals, therefore, we have to use cattle. We do not know how big a dose is needed to infect cattle. I know you can feed calves a fairly large amount of infectious material over a period of time and a certain number will apparently escape infection entirely.

We had that experience in a group of calves we killed recently. Out of 20 animals, five animals, although they had been fed four different times with infectious material mixed with their feed, failed to show infection when they were killed. There is a possibility that those animals contracted the infection and recovered from it. I am not sure there is not such a thing as recovery from Johne's disease. When cases become so advanced as to show marked symptoms, we have an advanced form of disease, and those animals probably do not recover.

The experience that we had with one animal seemed to indicate that recovery occurs under those circumstances. After going through two clinical stages of the disease, this cow lived on until we finally got tired of keeping her. She was nine years old when we slaughtered her, and we had to look a long time before we found the infection. She was still infected, but I doubt if that cow would have shown much evidence of Johne's disease. She lived five years after the last attack, and was a fine, sleek animal. She was hopelessly sterile, and we could not breed her. That shows that an animal may recover after an acute attack of the disease. We fed small doses. I do not know and no one else knows how often there is a minor infection from which the animal recovers.

In the diagnostic work, I think Dr. DeFosset made a fair statement of the situation. We have a number of products we have been using for diagnosis. The intradermal test we have used for seven or eight years, and in our hands it has not been at all satisfactory. Perhaps with some others, it has been satisfactory. We have a complete history on the cattle that we have infected ourselves, and we know what we have done. We have found on those animals that the intradermal test is only occasionally positive, whereas our intravenous test on such animals is quite uniform in its behavior.
When we apply the test in the field, as we have done in Minnesota, with the cooperation of Dr. Cotton, the results do not seem to work out so well as they do in our experiment herd. I haven't the precise figures, but there are several of the herds in Minnesota that at one time had numerous reactors, that I now believe show no reactors and have not shown any for the past few years, and there are a number of others in which we have had reactors, but in the laboratory we have been unable to prove the existence of the infection.

There is another point. How are we going to tell whether the animal has Johne's disease or not? When these animals react and we find no lesions, we may be missing them, or it may be that the test is taking more animals than it should. This thing is significant. On the original test we usually get the very bad cases. In only one or two instances were extensive lesions found at the semiannual retest. In most of the animals reacting on retest the lesions are very mild and it is necessary to look for the bacilli to confirm the diagnosis.

It is true there have been several animals, I think perhaps four or five, that have broken down within two or three months of these semiannual tests, and in at least one animal, we had an extensive case of Johne's disease. Some of them were marked clinical cases and actually didn't have Johne's disease, as far as we could determine. I do not know what those animals had.

In 1931, before I knew about some work that had been done in France, we started out with 20 calves. We vaccinated half of them, and the other half we kept as controls. Those 20 animals were kept in the same lot, and we purposely put in, from time to time, infected animals, to mingle with them. Four different times, in order to be sure they got it, I introduced infectious material in their feed. At the end of the third year, we had to terminate the experiment. At that time, in the unvaccinated group, we lost four from Johne's disease. Of the six remaining, two were clinical cases, and the others seemed to be normal. In the vaccinated group, we had no losses. When we slaughtered them, we found that there were five out of the 20 in which we could not find infection; three in the vaccinated group, and two in the unvaccinated group. The vaccination certainly did not prevent infection, but the infection was very mild, and whether the animals would have gone to clinical cases eventually, I do not know.

It seems to me there may be some possibility under restricted conditions of applying a vaccination program. However, that isn't so much in our general scheme. If we had a diagnostic procedure for the work, I am sure we would rather use that method. (Applause.)

President Records: Is there any further discussion?

Dr. E. A. Watson: I should just like to add a word to what Dr. Hagan has said in relation to the diagnostic test. I think in studying disease experimentally lies the solution to controlling it. The fact that avian tuberculin appears to give comparative results, I would not say whether good or bad, in Johne's disease, is indicative that we haven't an agent of sufficient specificity to give us the diagnostic reactions we hope to get. I personally had hopes that with the improved methods of producing johnin—and I might say we are now producing it in a similar way to Dr. DeFosset—that we would have a more specific agent, but so far, our hopes in that respect have not been fulfilled.

Possibly it is that it requires a strain of particular virulence or particular properties to produce the johnin necessary, but that is our great difficulty at present.

I think it is agreed by the previous speakers that the diagnostic test is very unsatisfactory; I am inclined to believe not so much as to the mode of application, whether it is introduced intradermally, subcutaneously or intravenously, as something lacking in the product itself. We have tried all methods and we have met with failures in
each method in the experiment herd that we maintain and in the field. Animals that we know are infected do not react.

In regard to intravenous inoculation, unfortunately, with the concentrated johnin, normal calves and cattle sometimes give a reaction to intravenous inoculation which is very confusing. It can be a positive reaction when we know they are not infected; whereas, sometimes the diseased animal does not react. We are still hoping we may be able to isolate the substance of johnin and study it with the hope that a more specific diagnostic may be evolved through the present work in which we are engaged. What we must look for is a more specific method of diagnosis. (Applause.)

PRESIDENT RECORDS: Is there further discussion? If not, we will move on to the section under the heading of "Miscellaneous Transmissible Diseases." The first paper is under the title, "The Present Status of Infectious Equine Encephalomyelitis in the United States," by Drs. L. T. Giltner and M. S. Shahan, of the U. S. Bureau of Animal Industry.

. . . Dr. Giltner presented the paper. . . . (Applause.)

THE PRESENT STATUS OF INFECTIOUS EQUINE ENCEPHALOMYELITIS IN THE UNITED STATES

By L. T. GILTNER and M. S. SHAHAN
Pathological Division, Bureau of Animal Industry
Washington, D. C.

During the past season, appreciable changes in the epizootiology of encephalomyelitis have taken place. Several states or portions of states which suffered severe outbreaks during the years 1930-1934 experienced little or no infection this year. Others which previously had been free or relatively lightly affected sustained considerable and in some instances extensive losses.

Although there is reason to believe that the disease has existed for decades in this country, the discovery of the causative virus by Meyer and his associates in California, in 1930-31, provided an impulse for close study of the widespread wave of this disease which has swept the United States during the past few years. Professional and lay interest has been great and we feel that the progress made in researches of the disease is considerable.

The great confusion as to the etiology and nature of this and clinically allied diseases has led to diligent search by interested agencies for the specific virus in order to establish with certainty, primarily, the existence of the disease. As a result, virus has been recovered from cases in 16 states. First, of course, in California, then in quick succession in Nevada, South Dakota and Utah.

In 1933, an exceptionally severe form of the disease prevailed in the coastal and tidewater areas of Maryland, Virginia, New
Jersey and Delaware. The several strains of virus recovered in these states have been found to cause a clinically identical, though more acute and otherwise more severe, disease than that which had previously been found in cases encountered in the west. It was soon found that the two strains were serologically and immunologically distinct and as far as we are aware, at this time, this so-called per-virulent virus has thus far remained confined, in general, to the original region where it was first found. Simultaneously, several western states were suffering considerable loss.

The recurrence of the disease in the Atlantic Coast states, in 1934, permitted the further observation that, as far as reported, the same virulent type of virus was still active, but without marked spread to new areas. The western-type virus, however, had spread generally eastward and it was demonstrated in Minnesota and again in South Dakota and Utah. Several other states in the Great Plains and Rocky Mountain sections were invaded to a serious degree by a disease which was diagnosed clinically as infectious encephalomyelitis. In the winter of 1934-35, a severe epizootic of encephalitis, due apparently to another as yet undetermined cause, occurred in several central states, Illinois being particularly afflicted.

By 1935, further advances had been made by the disease in previously involved western states and other scarcely affected states. Virus was recovered in Texas, Colorado, Idaho, North Dakota, Iowa and Wisconsin in the western areas, and in North Carolina on the east coast. Several other states, previously infected, were again found to have cases of the virus disease.

Thus to date, there are at least 16 states in which the specific nature of the clinical disease has been established. Aside from these, clinical reports strongly indicate the existence of the malady in at least 15 other states. The remaining twelve states in New England and the South chiefly give no indication in their reports that the disease exists within their boundaries.

For the purpose of securing these and other pertinent data, questionnaires were sent out to the various state authorities and Bureau representatives. Questions leading to the determination of the extent and duration, lethality, and recurrence of the disease from 1930 to 1935 were included. Additional information was sought as to environmental conditions influencing insect life, and the use of tissue vaccines.

All but three of the states which answered this inquiry reported the absence of this disease in the cold months. In the East, the first cases have usually been observed about the middle
of July, the peak of the infection occurring about one month to six weeks later, with a termination of the outbreak shortly following the appearance of killing frosts. With the three exceptions mentioned above, the disease was reported no earlier than June and disappeared not later than late November. In several sections of the United States, outbreaks of encephalitis occur which are very similar clinically to the virus disease, as for example, the outbreak of cornstalk disease last winter, but as far as we are aware, no one has been able to demonstrate virus in these cases.

Twenty-three states reported conditions favorable for insect life; only one reporting in the negative and here it is definitely known that virus has not been recovered. In the East the areas of infection are confined largely to the coastal and tidewater sections, where the land is low and interspersed by tidewater inlets. In the other sections of the country the disease occurs principally where the land is poorly drained or there are lakes, sluggish streams, bodies of stagnant water or irrigated areas.

Thus it is seen that there is a direct coincidence of seasonal occurrence and favorable environment for insect life and, in fact, reports indicate actual abundance of both mosquitoes and biting flies in the infected districts. Experimental evidence thus far obtained likewise points to mosquitoes as potential vectors of the disease. Kelser's work has been amply verified by the Rockefeller Institute, the Utah Experiment Station, and the Bureau. In addition, Merrill, Lacaillade and Ten Broeck have reported transmission of the infection by at least two species of mosquitoes (Aedes sollicitans and Aedes cantator) which are prevalent in the New Jersey area. Madsen and Knowlton found Aedes nigromaculis and Aedes dorsalis, both native to Utah, capable of transmitting the disease.

That mosquitoes may transmit the disease can no longer be questioned. Still it remains to be proved that natural transmission is accomplished by these agents alone. The Bureau, in cooperation with the Bureau of Entomology and Plant Quarantine of the Department, attempted to demonstrate virus in field-collected mosquitoes during the 1933 eastern outbreak in Maryland but with negative results. It is believed that virus must be demonstrated in nature in the mosquito before it may be safely concluded that these insects do act as vectors.

At this time we should like briefly to mention certain experimental studies which were conducted with Aedes aegypti in cooperation with Dr. Fred Bishop and Mr. Carrol Smith, of the U. S. Bureau of Entomology and Plant Quarantine. With the
view of determining a practical means of testing mosquitoes or other insects collected in the field for the presence of virus, trials of intradermic injections of infected *A. aegypti* mosquitoes into the abdominal skin and into the plantar pads of guinea pigs have been made. Apparently neither method will cause typical, easily recognizable disease in all inoculated guinea pigs but either or both means might be applicable under conditions where the intracerebral implantation of filtrate is impractical. Feeding this species on normal guinea pig blood immediately before killing and injecting the insects was not proven to be of particular advantage in such tests.

In studies of transmission of an eastern strain of virus by *A. aegypti* a total of eleven groups of these mosquitoes were used. Each group, containing from 75 to 350, was infected by feeding upon inoculated guinea pigs. Although the guinea pigs had been inoculated by several methods and the mosquitoes were fed at intervals of 18 to 96 hours following the inoculation of the guinea pigs, the disease was produced by but one group. Guinea pigs subjected to bites on the eighth, 14th and 35th days following the mosquitoes' infective meal developed typical encephalomyelitis but those exposed on the 21st, 28th and 52nd days failed to develop the disease. However, on the 52nd day, some of the surviving mosquitoes produced infection and death in a guinea pig when inoculated intradermically. The rarity with which this species of mosquito transmitted eastern type infection in our experience conforms with the findings of Ten Broeck, Lacaillade and Merrill.*

In contrast, these mosquitoes apparently quite readily, but not without some irregularity from time to time, transmit western type virus. It is our observation that there may be considerable variation in the facility with which western virus may be conveyed with lethal effect at various intervals in the laboratory life of the species. For example, the history of a group of *A. aegypti* is presented in table I.

Because of the suspicion of a possible relationship between the epitheliotrophic properties of this virus and its ready transmission by mosquitoes or other insects, the guinea pigs used for the infection of this particular lot of insects consisted of the second group in a series of guinea pigs inoculated in the plantar pads. Forty-four hours after inoculation of two guinea pigs, at which time a well developed vesicle was evident in the inoculated plantar tissue and temperatures of 106.4° and 106.6° F. obtained, the mosquitoes were allowed to feed on the clipped abdomens of the restrained animals within a screened cage. Promptly after re-
moval from the cage, cardiac blood from each of the guinea pigs was defibrinated and cultured. After overnight storage in the refrigerator, dilutions of the blood, later determined to be sterile by ordinary cultural means, were made in physiological salt solution.

Intracerebral inoculations of 0.2 cc of dilutions as high as 1:1,000 produced typical encephalomyelitis in guinea pigs. No greater dilutions of this particular blood were made but it has been observed that the infective titre, at or about the same interval of time following pad inoculation of guinea pigs, may exceed 1:10,000 in the same dosage. Following the engorgement with infective blood, all non-engorged mosquitoes were eliminated and sugar solution was provided for the daily nourishment of the infected individuals which were subsequently at intervals allowed to feed on one or two normal guinea pigs, which were usually of less than 300 grams weight.

**Table I**—Transmission of western strain of equine encephalomyelitis virus to guinea pigs by Aedes aegypti (colony 21) fed on pad-inoculated guinea pigs.

<table>
<thead>
<tr>
<th>Days after feeding on infective guinea pigs</th>
<th>7</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>23</th>
<th>30</th>
<th>37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>?</td>
</tr>
<tr>
<td>Days after feeding on infective guinea pigs</td>
<td>48</td>
<td>53</td>
<td>60</td>
<td>67</td>
<td>74</td>
<td>83</td>
<td>92</td>
</tr>
<tr>
<td>Result</td>
<td>?</td>
<td>P</td>
<td>?</td>
<td>P</td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

P indicates that the guinea pigs showed typical symptoms and died. (In some other tests occasional guinea pigs have developed suggestive symptoms and survived and when later tested by intracranial inoculations have been found to be resistant, presumably due to the immunity acquired from the infective mosquitoes.)

? indicates death after a protracted but otherwise more or less typical illness. Virus could not be demonstrated by attempts at passage in other guinea pigs.

N indicates failure of guinea pigs to develop typical disease; remained apparently normal for 30 days. (Usually found to be non-immune when later exposed by intracerebral inoculation of virus.)

The P guinea pigs died in 5 to 11 days after exposure to mosquitoes, and virus was demonstrated in the brain by serial intracerebral passages in guinea pigs. The average lapsed time from infection to death in this group was 6.7 days.

The ? guinea pigs died in 21 to 27 days, the average being 24 days.

In several trials, the progeny (first generation) of *A. aegypti* infected with western virus failed to convey the infection to normal guinea pigs either by direct feeding or by inoculation of the ground-up bodies of the mosquitoes.
The seemingly transitive power of mosquitoes of colony 21 to induce typical acute disease represents approximately a condition which has prevailed more or less commonly in our attempts at transmission with *A. aegypti*. This particular group has been selected for presentation because of the fact that it was used in attempting to infect a horse. One hundred and ten mosquitoes of the lot engorged on a normal horse on the 47th day after feeding on the infected guinea pigs. Subsequently, the animal showed no symptoms of infection except that he was noted to be slightly less alert and less eager for feed on about the fifth day after the mosquitoes had fed. His temperature never exceeded 101.0° F. Blood was collected at 12- to 24-hour intervals and the serum was injected intracranially (0.2 cc) into guinea pigs. At the 96th, 120th, 132nd, 156th and 168th hours, the serum was found to contain virus. No virus was demonstrated before the 96th hour or after the 168th hour and none has been demonstrated since. The last-mentioned determinations, 58 in number, have been made with serum samples collected at 1- to 112-day intervals within the now elapsed time of slightly more than a year since the animal was originally infected. In addition to these tests for virus, approximately a year after he was shown to have been infected, he was bled 17 times within an interval of three weeks and at each bleeding 70 to 80 cc of whole, unmodified blood was transferred subcutaneously to a normal horse, which has failed to show any evidence of infection, either by temperature or otherwise.

The fact that a certain number of horses on premises where cases of infectious encephalomyelitis have occurred may carry neutralizing bodies in their serum has been reported by Ten Broeck, Hurst and Traub and has been observed in our examinations of serum from South Dakota. However, it is believed that neutralizing powers may commonly be quite transient and may not be an accurate index of immunity or previous experience with the virus. We have record of a recovered field case, the serum of which neutralized virus for over 30 days, following clinical signs of the disease, but which later failed in this respect. However, the animal, when inoculated intracerebrally with virus of homologous type which killed a control animal, showed no signs of illness.

Although the presence of virus in the blood of infected animals was early believed by some to be uncommon, we have succeeded in a number of instances in demonstrating its presence during the first rise in temperature in animals showing a diphasic febrile reaction or during the fore part of the fever which occa-
sionally persists to the later stages of the disease. Ten Broeck Hurst and Traub have reported virus in the blood of febrile animals in an epizootic area. We have succeeded in recovering virus from several animals exposed by various modes of artificial inoculation, animals which have not developed fatal disease, as well as those which have, and that these occur in natural outbreaks of the disease can scarcely be questioned, in view of the experimental evidence that is rapidly accumulating from many sources. It serves to assist in the explanation of the apparent low rate of morbidity which is ordinarily encountered in this, so severe and acute a disease.

We have already referred to the experimental transmission of the disease by mosquitoes. The other means which have been effective under experimental conditions may also be found to apply in nature. The fact that no one has effected undisputed infection by contact tends to encourage belief in the absence of such transmission in nature. However, we have succeeded, we believe, by feeding large quantities of virus, in inducing infection of such extent in a horse that he resisted intracerebral inoculation, and reported studies show that infection is possible intranasally as well as through abrasions in the oral mucosa. Attempts at infection by way of the conjunctival membrane have failed, as reported by Records and Vawter, in two animals, and in our hands in one trial.

Because of possible implications in the spread or harboring of the virus by species other than solipeds, a study of the susceptibility of domestic and some wild animals was undertaken. The ease with which the virus adapts itself to parasitic life in some of these species may be shown by the following summary of results of intracerebral inoculation tests: Of the laboratory animals, the white mouse, guinea pig, pigeon, white rat, and rabbit are susceptible in about the order named to both eastern and western viruses. Meyer has also shown that the monkey is very susceptible. The sheep, goat, calf, duck, pig, dog, cat, hen, and European hedgehog have all developed typical encephalomyelitis following exposure to eastern virus, while limited tests show the opossum to be resistant to both viruses.

The goat and calf appear to be about equally susceptible to eastern and western virus and in one instance a goat, which recovered following a severe attack of the disease induced by western virus, later exhibited a typical disease picture after inoculation with eastern virus. The dog, cat, pig, sheep and European
hedgehog were resistant to the western virus. In our tests, the
hen was found more susceptible to the disease than chickens.

While the results of these experiments show a wide range of
animals susceptible to the infection, the exposure was much more
severe than that which would occur in nature and until it is
known how these creatures might react to naturally induced dis-
ease, the rôle they might play in acting as sources of natural in-
fection remains problematical. We have considered the possi-
bility of an animal such as the rabbit serving as a natural reservoir
of infection. The low degree of susceptibility of the rabbit
might mean that infected animals could act as carriers. On the
other hand, the very susceptible pigeon and duck might prove
sources of natural infection. These points, of course, indicate
the need for further investigation.

To return now to the reports received through the question-
aire previously mentioned, as regards in particular the out-
break this year. In the East, Virginia was the only state to
suffer appreciable losses and there the outbreak was very much
less severe than in the two preceding years. Minnesota was the
center of a very extensive epizootic far exceeding the 1934 at-
tack. The same may be said of North and South Dakota and
Idaho. All of these states as well as Colorado reported extension
of the disease to new territory. While all of the data are not yet
available, it is estimated that there were probably at least 25,000
cases, with a mortality ranging from as high as 97 per cent in
the East to a low of 10 per cent in the West. Doubtless, these
figures are much too low, since the disease is not reportable in
most states and in many instances veterinary service is either
not available or is not called.

An interesting point brought out by the answers to questions
regarding the proportions assumed by outbreaks from 1930 to
1935 was that in most states there appeared to be a period of
two or three years in which the disease occurred with great in-
tensity, usually with greatest losses in the middle year. This
period was followed by a decided lull or almost complete disap-
pearance of the infection. One explanation offered for this phe-
omenon is that during each outbreak there are many cases of
the so-called abortive type of the disease in which blood infection
occurs without involvement of the central nervous system, the
affected animals acquiring a certain degree of immunity enabling
them to resist subsequent infection for a time at least. It is
thus conceivable that within a period of a few years, practically
all the horses in an infected district may acquire an immunity
in this manner. We do not feel prepared, from the information now available, to predict how the waves or cycles of infection will proceed. Our present data, however, bring forth one point which may prove a decidedly complicating factor and one which must be dealt with by sanitary officials. We refer to the tendency of the infection to spread to new districts in some sections of the country.

Last year, through the active cooperation of Dr. Robert Sarde, of Delaware, and Dr. H. C. Givens, of Virginia, we conducted a field test of a formol-killed brain tissue vaccine on over 300 horses and mules in infected districts of the above states and while the procedure did not confer 100 per cent immunity the available data showed a higher incidence of the disease in non-vaccinated animals than in the treated stock. Reports thus far received this year show that a similar vaccine, prepared by licensed commercial firms, was used in at least nine states where the disease exists, a total of about 3,000 animals having been treated. In the East, where about 2,000 animals were vaccinated with this product, the disease occurred so sporadically, except in Virginia, that an evaluation of the vaccine was not possible and while none of the 500 vaccinated animals in Virginia contracted the disease, the outbreak was not considered sufficiently extensive to test the effectiveness of the vaccination. In the outbreak in Idaho, where 487 animals were vaccinated, the data gathered are considered worthy of reporting. Dr. W. T. Huffman, of the Bureau force at Salt Lake City, Utah, investigated the Idaho outbreak and writes as follows regarding the vaccination:

There were 487 horses on 108 premises given the formol-killed tissue vaccine, 12 of which developed the disease. There had been cases of encephalomyelitis on 16 of the 108 premises, and 8 of the 12 horses that developed the disease were on premises where disease had occurred previous to vaccination. Of 88 of the premises disease did not occur either before or after the use of vaccine. Of the 12 cases occurring after vaccination, 2 were @ two days, 2 @ three days, 4 @ four days (one of which died), 2 @ five days and 1 @ twelve days after the first vaccination, and one, that died, occurred 30 days after the second vaccination.

The above figures are open to question as they were obtained in September and the veterinarians furnishing the information probably did not have complete records of the outcome of all vaccinations.

The vaccine was used from about the middle of June to September and the disease was prevalent in most localities prior to vaccination. Some of the animals vaccinated may have been outside the infected areas and would therefore have escaped the disease. It is also probable that many of the horses had been in sufficiently close contact with the disease previous to vaccination to have acquired the resistance or immunity which occurred in about 92 per cent of all horses in the infected district.
Owing to the fact that the vaccine was not used before the outbreak became established, no definite knowledge has been gained regarding the immunizing value of the formol-killed vaccine. The information does, however, indicate that some benefit may have been derived from the use of the product during the outbreak. Vaccination did not increase susceptibility of animals to the disease, and the use of the vaccine during the incubation stage of the disease did not increase the virulence of the cases, as nine horses recovered out of ten that developed disease within five days after the first vaccination. Another horse recovered that showed symptoms twelve days after the first vaccination and one died that developed disease 30 days after the second vaccination.

**SUMMARY**

The epizootiology of infectious equine encephalomyelitis from 1930 to 1935 is briefly reviewed. The causative virus has been demonstrated in cases in 16 of the 48 states. The first recovery of virus was from the 1930-31 outbreaks in California and was followed in the next two years by positive virus findings in Nevada, South Dakota and Utah in the West and in New Jersey, Delaware, Maryland and Virginia in the East. In 1934, Minnesota was added to this list and during this year (1935) the following states were definitely proved positive: Idaho, Colorado, Texas, Iowa, North Dakota, Wisconsin and North Carolina. The eastern type virus has apparently remained confined in general to the original region along the eastern coast, while the western virus has gradually extended eastward from California to Wisconsin. There were 15 other states, Connecticut, New York, Georgia, Florida, Louisiana, Missouri, Nebraska, Kansas, Oklahoma, Montana, Wyoming, New Mexico, Arizona, Oregon and Washington, in which the disease has been diagnosed clinically but, as far as we are aware, virus has not as yet been reported.

Reports from the infected states agree in general as regards the seasonal occurrence of the disease. The outbreaks have occurred in areas favorable for insect life during the warmer summer and early fall months, the disease quite regularly subsiding with the appearance of killing frosts. Several states have reported sporadic cases of encephalitis clinically similar to the virus disease and some have experienced outbreaks of considerable proportions in the winter. The failure to recover virus from these cases or the absence of pathology indicative of virus activity tends to place these cases without the virus group.

There is strong experimental evidence that mosquitoes are vectors of the disease, there having been at least five species, *Aedes aegypti*, *A. sollicitans*, *A. cantator*, *A. nigromaculis* and *A. dorsalis* shown capable of transmitting the infection. The four last-mentioned species are native in encephalomyelitis areas. The
laboratory species *A. aegypti* quite regularly transmits western type virus but infrequently conveys the eastern infection. Thus far we have failed to demonstrate virus in mosquitoes in nature and with *A. aegypti* no evidence was obtained that the progeny of infected mosquitoes are capable of transmitting infection. Some variation in the ability of given lots of *A. aegypti* to produce clinical infection in guinea pigs has been experienced. During a lull in capacity to infect guinea pigs, one group of mosquitoes was fed on a normal horse which infected only to the extent that virus was demonstrable in the blood-stream from the fourth to the seventh day following the engorgement of the insects. This is presented as a possible example of the so-called abortive or occult type case in the field.

A considerable range of susceptibility to intracerebral inoculation of virus was found among species of domestic and wild animals other than the horse. White mice, guinea pigs, pigeons, white rats, rabbits, monkeys, sheep, goats, ducks, dogs, pigs, cats, hens and European hedgehog have all been infected with eastern virus, whereas western virus failed to infect sheep, pigs, dogs, cats and the European hedgehog, but did produce the disease in the other animals mentioned. The opossum was not found susceptible to either type in limited trials.

Aside from a moderate outbreak in Virginia this year, the four states in the East originally infected had relatively little or no infection. A new center of infection of small proportions was found in North Carolina. The western virus has been responsible for the great extension of the disease in other sections of the country. Minnesota, North and South Dakota, and Idaho experienced particularly severe outbreaks this year. From reports received, it is estimated that there were at least 25,000 cases of the disease during the outbreak this year.

This year, nine states used formol-killed brain tissue vaccine as an intended prophylactic in the field. Reports are not complete but indicate that at least 3,000 animals were treated. The available data are not sufficient for evaluation of the effectiveness of the product, since a number of the states where vaccination was practiced experienced a marked decline in incidence of the disease (probably natural). In one state the procedure appeared to have reduced the morbidity rate and encourages the further trial of the vaccine.

The writers are informed by Dr. L. Van Es, of Lincoln, Nebraska, that virus was recovered from both 1933 and 1935 outbreaks in Nebraska. Likewise, Dr. H. F. Lienhardt, of Man-
hannan, Kansas, reports that in Kansas positive virus findings were made in 1933 and 1935.

REFERENCES


DISCUSSION

Dr. C. E. Cotton: It was impossible for Minnesota to make any report when requested by the authors of this paper, for the reason that we had not succeeded in compiling our records.

In Minnesota, this disease appeared in the summer of 1933, in the western part of the state. The virus was not established, although I am satisfied now there were cases, but very few. In the summer of 1934, we had 299 farms involved. In this past season we had reported—and there were some instances in which it was not reported—3,549 farms, representing 18,781 horses, of which 3,337 were infected and 1,244 died. The percentage of deaths of total horses exposed was 6.62; the percentage of deaths of infected horses was 37.27. To my mind, the deductions to be made are interesting, to say the least. When the disease appears on the premises, it almost invariably affects only one or two animals, and thereafter no more animals contract the infection on the same premises. It makes no difference whether the exposed or contact animals are given serum or not.

We had only six farms on which the infection occurred in the summer of 1933 or 1934, and on which the disease appeared again this year. In other words, had we vaccinated the horses prior to the outbreak this summer, we would naturally have concluded the vaccination was the protector. (Applause.)

President Records: If there is no further discussion, we will move on to the next item, the report of the Committee on Miscellaneous Transmissible Diseases by Dr. A. W. Miller.

. . . Dr. Miller read the report and moved that it be approved. The motion was regularly seconded, put to a vote and carried. . . .

REPORT OF COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES

Dr. A. W. Miller, Chairman, Washington, D. C.

Dr. L. Enos Day, Chicago, Ill. Dr. Jacob Traum, Berkeley, Calif.
Dr. D. C. Hyde, Columbus, Ohio. Dr. E. A. Watson, Hull, Que., Can.

It has been the procedure of the Committee on Miscellaneous Transmissible Diseases in the past to submit a consolidated report dealing with the more important diseases in which there was a general interest.

This year it was decided to vary the program and have individual papers submitted. Accordingly, we planned for the presentation of
PULLORUM DISEASE IN TURKEYS

The occurrence of pullorum disease in turkeys has been reported in this country and abroad. Hewitt observed pullorum infection in turkey poults that were hatched in an incubator that had been used for hatching chicken eggs. According to Tittsler, Dalling, Mason and Gordon reported the isolation of Salmonella pullorum from a six-week-old turkey in England. The poult had been allowed to run with chicks from the time of hatching, which led these workers to consider the chicks as the source of the infection. These findings are not only of scientific interest, but they have stimulated investigators in various parts of the country to attempt to determine the importance of the disease in turkeys, as well as the effects of such foci of infection upon the programs in vogue at present for the eradication of pullorum disease in domestic fowls. Brunett reported the isolation of S. pullorum from the ovaries of mature turkeys. De Volt and Gow described the lesions in a young turkey affected with pullorum disease as hepatitis and enteritis. The liver is described as being enlarged and streaked with alternate bands of congestion and degeneration.

Within the past few years, certain laboratories have conducted agglutination tests with blood sera from quite a large number of turkeys and have found positive reactions, although in low dilu-
tions in many cases. Tittsler\textsuperscript{2} reported the isolation of an organism from young turkeys which gave all the reactions which characterize \textit{S. pullorum}. Johnson\textsuperscript{3} isolated \textit{S. pullorum} from the heart-blood of a four-day-old poult, and also from the atrophied testicles of a mature turkey.

In this paper I wish to report two rather extensive outbreaks in which the death of a large number of poults was due to \textit{S. pullorum} infection.

**DISEASE IN TWO FLOCKS OF POULTS**

The owners brought to the laboratory several week-old poults that were in a moribund condition. We were informed that the poults began to die at three days of age. In one flock this continued until the twelfth day, when all but one had died in the flock of 116 birds. The course of the disease in the second flock was similar as to duration, but only 46 poults died of the 140 in the flock. The two lots of poults came from incubators located in different towns, that had been used for hatching turkey eggs for two successive previous hatches. The affected flocks were located about five miles apart. The symptoms described by the owners, as well as those we observed, were as follows: droopiness, a tendency for the poults to crowd, white diarrhea in only a few, continued peeping noise or cries, loss of appetite, and finally, toppling over to die in a few hours.

**GROSS LESIONS**

The lesions observed at autopsy were quite similar in both groups. The most constant was slight duodenitis with occasional petechiae in duodenal mucosa. The livers were invariably enlarged, light brown, or nearly cream colored, with occasional hemorrhagic streaks on the surfaces. Unabsorbed yolk was a constant feature, even in the poults that died at ten days of age. The lungs were usually free from gross lesions. Only an occasional bird was found to have slight congestion of these organs. This feature seemed to be the only thing to differ at all from the lesions usually found in chicks dying from pullorum disease.

**BACTERIOLOGIC FINDINGS**

Smears from hearts, livers and yolks of affected poults on meat-infusion agar, and on liver-infusion agar with brilliant green added, resulted in growth of an organism in practically pure form which resembled \textit{S. pullorum}. On examination we found this to be a Gram-negative, non-motile, short rod, which in carbohydrate media produces acid and gas in dextrose, mannite, arabinose,
galactose, levulose, mannose, rhamnose and xylose. It produces neither acid nor gas in sucrose, dulcitol, lactose, maltose, dextrose, inositol, inulin, raffinose, salicin and sorbit. It was agglutinated with known positive pullorum serum in a dilution beyond 1:1,200. With known negative pullorum serum, it did not react.

**Breeding Flocks on Affected Farms**

The breeding flock on the farm that sustained the heavier loss consisted of eight females and two males. These birds all appeared healthy, but on an agglutination test of this flock one female was found to give a positive reaction in a dilution beyond 1:400 with a stock culture of *S. pullorum* as antigen, and similarly with the organism recovered from the poults. This bird was brought to the laboratory for examination. On autopsy slight edema was found about the heart, and also an ovary typical of pullorum disease in chickens. Numerous ova were dark, angular in shape, and of a cheesy consistency. Our bacteriologic examinations of this material also revealed an organism identical with the one recovered from the poults.

The breeding flock on the second farm consisted of 27 females and three males. The agglutination test on the sera of these revealed only one reactor. This, likewise, gave complete agglutination with *S. pullorum* in a dilution beyond 1:400, as well as with the organism recovered from the poults. On autopsy of this bird, no lesions were found, with the exception of two slightly discolored ova in the ovary. On streaking agar plates with these tissues, growth resulted which was typical of *S. pullorum*, but a contaminating spreader prevented us from making complete identification of this organism.

**Transmission to Chicks**

The pathogenicity of the organisms recovered from the two groups of poults was tested by feeding 0.6 cc of a 24-hour culture in saline suspension to chicks. The chicks that were used for this purpose were three days of age at the time of feeding, and came from blood-tested stock. Of the six chicks that were fed organisms isolated from poults where the greater losses were manifested, one died on the fifth day following feeding. This chick was typical of pullorum disease, and the causative organism was recovered in pure culture from various organs. One other became visibly sick on the eighth day and was killed. In this bird there were no marked lesions except retained yolk. *S. pullorum*, however, was recovered from the heart and yolk. The
four remaining chicks showed no marked symptoms, but were killed on the 14th day, and S. pullorum was recovered from two of these.

Of six similar chicks fed the organism recovered from the poults where the lesser outbreak occurred, one died on the sixth day, and the organism was recovered. The five others were killed on the 14th day, and the organism was recovered from one chick. Among the twelve control chicks kept under similar conditions, no losses occurred. Two were killed on the 14th day and examined bacteriologically. S. pullorum was not found.

AGGLUTINATION TESTS FOR PULLORUM DISEASE IN TURKEYS

Quite separate from the two outbreaks of pullorum disease in turkeys which are reported, we were interested in attempting to determine the significance, if any, of low-titre agglutination reactions with turkey sera and S. pullorum as antigen. This question is worthy of an answer based upon experimental procedure, since our testing laboratories are finding a large number of samples of turkey sera that agglutinate S. pullorum antigen in low dilutions, e.g., 1:25. In most of these flocks there is no history of marked loss among poults nor other manifestations of pullorum disease. Our experimental procedure consisted of using 14 mature turkeys whose blood sera agglutinated S. pullorum antigen in a dilution of 1:25. Thirteen of these were females, and one was a male. Eggs from these birds were collected and hatched in a small chick incubator from which 33 poults were obtained. These were raised in sanitary wire cages until several weeks old. None of these developed symptoms of pullorum disease. From two poults that were so weak that they were scarcely able to stand after being freed from the shell, we recovered an organism in pure culture from heart, liver and yolk. This organism will be designated as P₁, and its characteristics described.

An identical organism was isolated from the heart and liver of one of the adult females at the time of autopsy.

CULTURAL AND MORPHOLOGICAL CHARACTERISTICS OF P₁

On meat-infusion agar P₁ grows as small, discrete opaque colonies. It stains readily with aniline dyes, and was found to be a Gram-positive, motile diplobacillus. It produces acid but no gas in dextrose, mannite and sucrose at 37° C. for 48 hours. Dextrose and mannite are changed in 24 hours. With dulcitol it does not react, but acid is produced in lactose in 72 to 96 hours. It was found to be non-pathogenic for chicks and poults.
AGGLUTINATION REACTIONS OF P₁ AND S. PULLORUM

Since P₁ was isolated in pure culture from dead turkey poult's, it was thought advisable to study the agglutinability of the adult turkey serum toward this organism. Suspensions of P₁ and S. pullorum were standardized to MacFarland's nephelometer tube 1, and to pH 8.2-8.4. The dilutions of serum-antigen mixtures were 1:25, 1:50, 1:100 and 1:200. These results appear in table I. The symbols used in this table to signify the degree of agglutination, are as follows: N, when the antigen remains uniformly turbid and there is no agglutination. S, when the agglutination is only partial or incomplete. P, when there is distinct clumping of antigen, and the liquid above the agglutinated particles is clear.

TABLE I—Agglutination of P₁ and Salmonella pullorum by serum of poult's and adult turkeys.

<table>
<thead>
<tr>
<th>Serum Dilutions</th>
<th>Salmonella Pullorum</th>
<th>Culture P₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 1:25 1:50 1:100 1:200</td>
<td>C 1:25 1:50 1:100 1:200</td>
<td></td>
</tr>
<tr>
<td>T491 N N N N N</td>
<td>N N N N N</td>
<td></td>
</tr>
<tr>
<td>T499 N S S N N</td>
<td>N S S S N</td>
<td></td>
</tr>
<tr>
<td>T503 N P S N N</td>
<td>N P P P S</td>
<td></td>
</tr>
<tr>
<td>T518 N P S N N</td>
<td>N P P P S</td>
<td></td>
</tr>
<tr>
<td>T481 N S N N N</td>
<td>N S S N N</td>
<td></td>
</tr>
<tr>
<td>T1848 N N N N N</td>
<td>N S N N N</td>
<td></td>
</tr>
<tr>
<td>T35781 N N N N N</td>
<td>N S N N N</td>
<td></td>
</tr>
<tr>
<td>T860 N S S S S</td>
<td>N S S S S</td>
<td></td>
</tr>
<tr>
<td>T896 N S S S N</td>
<td>N P P P S</td>
<td></td>
</tr>
<tr>
<td>T1467 N P S N N</td>
<td>N P P S S</td>
<td></td>
</tr>
<tr>
<td>T1539 N S S S N</td>
<td>N P P P S</td>
<td></td>
</tr>
<tr>
<td>T853 N S S N N</td>
<td>N P P P S</td>
<td></td>
</tr>
<tr>
<td>T2990 T654 N S S S S</td>
<td>N P P P S</td>
<td></td>
</tr>
<tr>
<td>T399 P392 N S N N N</td>
<td>N S N N N</td>
<td></td>
</tr>
<tr>
<td>P385 P377 N P S S S</td>
<td>N P P S S</td>
<td></td>
</tr>
<tr>
<td>P358 N N N N N</td>
<td>N S N N N</td>
<td></td>
</tr>
</tbody>
</table>

In column 1, T = turkey and P = poult.
Agglutination reactions: C, control; N, negative; S, suspicious; P, positive.

The writer has carried out no experiments to see what results would be obtained with agglutination tests on sera of turkeys with fowl typhoid, but since it is known that chickens affected with this disease will also react to the pullorum test, it is very likely that turkeys would do likewise. From the work of Hinshaw, fowl typhoid is a fairly common disease in turkeys in California. It appears, however, that agglutinins disappear quickly after an acute attack, but chronic carriers of the organ-
ism also were found. These would probably react in sufficiently high titre to be eliminated on the same basis as birds affected with pullorum disease.

DISCUSSION AND CONCLUSIONS

The subject of pullorum disease in unusual hosts is worthy of special consideration, since no program for the establishment of pullorum disease-free flocks of poultry would be effective without due emphasis on these sources of infection. The two outbreaks of the disease herein reported impress us vividly with the seriousness of this infection in poults. From the previous reports in the literature, the mortality among poults affected with pullorum disease has been less marked. Certain investigators have even expressed doubt as to the pathogenicity of S. pullorum for turkeys. The outbreaks herein described should tend to remove all doubt as regards the seriousness of pullorum disease in poults. The question remains, however, as to whether the infection in these outbreaks came from the incubators used in hatching the eggs, or from the female in each flock affected with the disease.

Since two previous hatches of turkey eggs in these incubators had resulted in no disease among the poults raised in these groups, the evidence points clearly to the transmission of S. pullorum through the eggs of the affected female in each group. The fact that nearly 100 per cent mortality resulted in one flock does not discredit this view, as it is well known that a few affected individuals can easily spread the infection to a large number in a short time.

No information could be obtained to explain satisfactorily the source of the infection in the affected females in either flock.

The results of the agglutination tests run on these flocks, as well as the data obtained on tests of other flocks, give us information which we believe is important from the standpoint of removing breeders that would be potentially dangerous on the basis of the agglutination test. Our tests gave complete agglutination in dilutions beyond 1:400 with sera from the females that on autopsy had lesions of the disease, and from which S. pullorum was recovered. On the other hand, from poults obtained from the 14 turkeys whose sera gave only positive reactions in dilutions of 1:25, and in which there were no recognizable lesions on autopsy, nor S. pullorum recovered, we isolated an organism described as P₁. In running agglutination tests with this organism as antigen, we found, as shown in table I, that the sera of these birds agglutinated P₁ in higher dilutions than they did S. pullorum. These facts indicate that there is marked cross-ag-
glutination with this non-pathogenic organism which might, on
the basis of the test, lead to the removal of outstanding breeders
that harbor non-pathogenic organisms. From these results the
question arises as to what dilution with complete agglutination
should constitute the basis for the removal of dangerous breed-
ners. The information yielded from this work indicates that a
titre above 1:50 would be necessary to locate birds harboring S.
pullorum.

ACKNOWLEDGMENT

We wish to express our thanks to Dr. H. Van Roekel, of Massa-
chusetts State College, and to Dr. L. F. Rettger, of Yale Uni-
versity, for checking our identification of S. pullorum.

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sixth annual Conference of Laboratory Workers in Pullorum Disease Control
at Dover, Delaware (1933).

DISCUSSION

Dr. L. F. Rettger: The question of transmission of pullorum dis-
ease through the turkey has been a very important one for some time.
At several of the annual meetings of the Northern Conference on
Pullorum Disease, reports were handed in from various laboratories
and states, which seemed to indicate that pullorum disease is more
or less widespread in turkeys, but when those reports were analyzed
we had to conclude that there is not sufficient evidence, except in a
very few instances, to say that the disease these turkeys were sup-
posed to have, supposedly pullorum disease, was actually pullorum
disease. Salmonella pullorum had not been isolated from the birds
reported as reacting with the S. pullorum antigen. Recently, labora-
tories like that of Dr. Johnson have gone further into this subject, and
because it is a controversial subject, so to speak, in so far as the sig-
nificance of the turkey population on any farm is concerned, especially
when other chickens are exposed to it, I thought it important to put
on this program.

Dr. Henshaw has done a great deal of work on pullorum disease. He
was one of the prime movers in organizing information which was ap-
piled to the stamping out of pullorum disease, or attempts to stamp
out pullorum disease through the agglutination method. I discussed
this subject with him five or six weeks ago. I asked him for a brief
résumé to supplement Dr. Johnson's paper, and it happens it is a real
supplement to the paper and does not cross his conclusions at any
point.

. . . Dr. Rettger read Dr. Henshaw's discussion of pullorum dis-
ease of turkeys. . . . (Applause.)
DE W. R. HINSHAW: The following notes constitute a brief summary of the observations and results of investigation of pullorum disease among California turkey flocks during the past five years. By arrangement with the diagnostic laboratories of the California State Department of Agriculture, records of all outbreaks of pullorum disease in turkeys were reported to the writer. Whenever feasible, a personal investigation was made, and when this was impossible a questionnaire was sent to the owner of the infected flock.

By these methods, by agglutination testing of survivors, by means of autopsy and bacteriological examination of reactors, and by bacteriological examinations of eggs laid by reactors, we have been able to get data that may prove of interest as a supplement to the findings of Dr. Johnson.

The fact that only 17 outbreaks of the disease have been reported by the various diagnostic laboratories in the five years is an indication that the disease in turkeys is not yet widespread in the state. The principal source of infection has been found to be contact with baby chicks, either in the hatchery or in the brooderhouse. In no case has an outbreak been found to have originated from carriers in the turkey breeding flock.

The disease in poults, as we have studied it, has shown the same characteristics and manifestations as are seen in diseased chicks. The mortality is also comparable, as is indicated by the fact that in ten outbreaks where we were able to get fairly accurate data on mortality, the loss from the disease was 2,399 (34.41%) of the 6,971 poults in the combined broods.

The survivors from three outbreaks were tested at maturity by means of the tube agglutination test, and reactors as well as eggs from reactors obtained from the flocks have been examined for the presence of Salmonella pullorum infection. The number of reactors in these flocks compared favorably with the number usually obtained from chickens that have survived the infection. A large majority of the reactors obtained from infected flocks five to six months of age had titres under 1:100, and most of these, if kept for a year, became non-reactors.

We have been able to demonstrate the presence of S. pullorum in only a small percentage of the reactors examined. In one group of 17 reactors, which on the original test had titres ranging from 1:20 to 1:160, the organism was obtained from only two turkeys (11.76%). One of these was a male and the only one of the group that had a titre originally as high as 1:160. At the time it was killed, it reacted to a maximum dilution of 1:80. The second had a titre of 1:40 at the time it was killed (at one year of age).

From a second flock, nine reactors were autopsied and S. pullorum isolated from only one (11.11%). From a third flock, S. pullorum was isolated from only one of 51 turkeys that gave either a positive or a suspicious reaction to the original test.

From the first flock mentioned above, 463 eggs, laid by five turkeys that reacted positively on the original test, were examined bacteriologically and S. pullorum was isolated in only one instance. The reactor which laid this infected egg produced 71 eggs before it was killed, and the organism was isolated from its fourth egg. S. pullorum was isolated from its ovary at the time of autopsy. A total of 281 eggs and poults, hatched from eggs laid by reactors from the second and third flocks, were examined, and S. pullorum was not isolated from a single specimen.

In two of the three infected flocks discussed above, we made one re-test on each, and the progeny were kept under our observation during the past brooding season. The mortality in the progeny was very slight and no indications of pullorum disease have been seen. A few
poults that died during the first two weeks were examined and no cultures of \textit{S. pullorum} were isolated. Both of these flocks will be tested before the breeding season this year, to further check the results obtained.

From the data we have obtained to date, we are led to make the following conclusions concerning the present status of pullorum disease in turkeys:

1. Baby turkeys (poults) are as susceptible to pullorum disease as are baby chicks, and show the same manifestations.

2. The chief source of infection in poults is the hatchery where turkey eggs and chicken eggs are hatched in the same incubator.

3. Survivors from an acute outbreak apparently have a greater ability to abort the infection than do chickens, and consequently fewer permanent carriers remain in the flock.

4. Prevention of pullorum disease in turkey flocks can best be accomplished by the use of separate incubators for hatching turkey eggs and by avoiding all contact with chicks, either in the hatchery or in the brooder.

5. In the light of our present knowledge, a general testing program for turkeys is probably not justifiable. Flocks that have accidentally become infected should be tested, however, if they are to be used for the production of hatching eggs.

Dr. A. J. Durant: I think this paper is very interesting, and I should like to add a word or two in matters relating to it. We have had some experience with pullorum disease in turkeys in Missouri. We had several outbreaks in poults in which the mortality was very high. However, in none of those cases could we eliminate the possibility that this infection came from the incubator where chicks had been hatched previously from untested chickens. The mortality from all the outbreaks in which we definitely diagnosed pullorum disease was very high. Out of 65 poults, in one instance, 63 died. We have concluded from our own experience that there was something peculiar about the reactions in turkeys.

In Missouri, when flocks are tested for pullorum disease, at the first test on the farm, we require that everything be tested that is a fowl, and we have found in those flocks, turkeys in some cases, reacting rather high; that is, a high percentage of the birds. We tested a large number of flocks, in one case 400 birds, and in that flock we got a high percentage of reactors in dilutions of 1:25. We bought three of the highest reactors, that showed the greatest amount of agglutination at 1:25, and we isolated the germ of pullorum disease in two of the birds. In no case did they show any indications in the ovary that the birds were infected, but by grinding the organ we obtained cultures of \textit{Salmonella pullorum}.

We have come to the conclusion that a 1:25 reaction is not important. In the large flock, 36 per cent reacted, and we kept a record of the birds the following year and there was very little loss, none that we could attribute to pullorum disease. We have come to the conclusion that there may be some other factor in the turkey that made the reaction at 1:25, and I am glad to have this report from Dr. Johnson about this other organism he has discovered.

Dr. W. H. Hendricks: In our state we had some 1,200 birds practically ready for market. These birds became affected, and most of the 1,200 suddenly died, in a short time. We have two sources of investigation, and the samples from the birds were submitted to two different laboratories, one of which reported fowl typhoid, and the other, fowl cholera.

Dr. Johnson has made some mention of fowl typhoid in turkeys, and I wonder if, in his experience, he has come across any situation
wherein he had such losses as that in fowl typhoid, especially in an acute form.

Dr. Johnson: I haven't had very much personal experience with fowl typhoid in turkeys, but Dr. Hinshaw has done a great deal of work with fowl typhoid in turkeys. I do not recall how high the losses were in the cases with which he worked. However, I can readily see how you could have cases of fowl typhoid and fowl cholera in the same flock. Birds affected with fowl typhoid will also react to the pullorum test, and the report might indicate fowl typhoid, from cultures recovered in the organs, if they had laboratory facilities. It is likely you would have a high mortality among poults, especially with fowl typhoid. I do not know how high the mortality usually runs in mature turkeys with fowl typhoid.

Dr. Rettinger: I might call attention to one other thing in regard to turkey diseases, and that is the wide spread of the infection known as paratyphoid infection, and it might be that the low reactions with some of the Salmonella pullorum antigens are given by the turkeys because they are affected with paratyphoid. I believe that many so-called pullorum disease cases were really fowl typhoid in turkeys and were not diagnosed as such. They give the same reaction with one and the same antigen, S. pullorum antigen or the fowl typhoid. The reactions are given in the same way, but both of these organisms will react with blood of animals infected with so-called paratyphoid organisms, which are of an entirely different nature. While they do not react in the same high dilutions, they will react in low dilutions. That is the third type of infection, the fowl typhoid and the so-called paratyphoid, which is to be distinguished from the other.

Dr. Hendricks: I think in Dr. Johnson's paper he made some mention of the fact that if we took birds that reacted below 1:50, perhaps we might be eliminating valuable birds. I am wondering if anything has been done with respect to the rapid test. I suppose that was an agglutination tube test. Would there be any way of picking those out?

Dr. Johnson: We haven't done any work with the rapid test, the whole-blood test. It was the standard tube test. I should think it would be difficult to run dilutions with the whole-blood test, but if the test is accurate, as it is supposed to be, I see no reason why you should not get the low reactors with it and you would remove them the same as with the tube test, and if there happened to be cross-agglutination with some non-pathogenic organism, there is a possibility of removing a good breeder that does not carry pathogenic organisms.

Dr. I. D. Wilson: I should like to ask Dr. Johnson if he does not think there is a good possibility that the loss Dr. Hendricks reports was caused by a leucocyte protozoan which has been causing extensive losses in Virginia. In Virginia, a number of losses have been reported similar to Dr. Hendricks' report.

Dr. Johnson: As I understood the question, these losses were among mature birds. In our experience with this blood protozoan, the greatest losses have been in young turkeys. It is possible, though. Our work is very limited with that, so far. The serious losses that we have had have been in young turkeys from about one to three months of age. A good many of the older turkeys remain carriers of the protozoan, that is, they carry it in the blood-stream, but we have no record of serious losses in older birds, although there is a possibility.

President Records: Is there any further discussion? If not, we will proceed to the next paper, "Acid-Fast Organisms Found in So-Called Bumblefoot of Chickens," by Dr. Hubert Bunyea, of the U. S. Bureau of Animal Industry. Dr. Bunyea also has a report which he wishes to present before his paper.

... Dr. Bunyea presented the report.
The Antigen Control Project of the National Poultry Improvement Plan

U. S. BUREAU OF ANIMAL INDUSTRY

The National Uniform Program for the Poultry Industry of the United States, also known as the "National Poultry Improvement Plan," came into existence in response to a provision of the N. R. A. Code 8 which read:

"The Coordinating Committee shall work out, in cooperation with hatchery and breeder organizations, the U. S. Department of Agriculture and other interested agencies, and report to the Secretary of Agriculture for his approval at the earliest possible date and in any event within the next year, uniform terms, rules, and regulations for flock improvement." (Code of Fair Competition for the Commercial and Breeder Hatchery Industry, Code No. 8, Dec. 27, 1933, Art. VIII, Sec. 3, Subsection 9, p. 11.)

This Plan, with certain modifications, was approved by the U. S. Live Stock Sanitary Association a year ago, upon the recommendation of its Committee on Transmissible Diseases of Poultry. One of the provisions, as approved by this Association, and as finally embodied in the permanent draft of the Plan, was the equal recognition of the standard tube agglutination test, the stained-antigen rapid whole-blood agglutination test, and the serum rapid agglutination test as official diagnostic methods for the detection of pullorum disease carriers in connection with the pullorum control regimen of the National Plan.

Another feature of the Plan provides that "the antigen used in testing for pullorum disease shall be approved by the U. S. Department of Agriculture." It is the understanding of the Department that this provision does not include the antigens used for the standard tube test or the serum rapid test. In those states where these tests are employed, the respective official state agencies are, for obvious reasons, expected to assume entire responsibility for the antigens used.

Regarding the stained antigen for the rapid whole-blood test, however, it is recognized that a peculiar responsibility rests with the U. S. Department of Agriculture. This antigen was developed four years ago by scientific workers of the Bureau of Animal Industry. To safeguard the stained antigen from unscrupulous commercial exploitation, and to insure to the poultry industry uniformity of production and performance in commercial stained antigens, U. S. Patent No. 1,816,026 was secured by one of the inventors of the antigen, and assigned to the Secretary of the U. S. Department of Agriculture. The manufacture of this or any other stained antigen is thereby subject to the permission of the Secretary of Agriculture. Permittees are obliged to conform to definite regulations governing the preparation, labeling and advertising of the product. Up to the present time, 27 commercial concerns and four official state agencies have been granted permission by the Secretary of Agriculture to manufacture pullorum disease stained antigen.

In connection with the administration of the National Poultry Improvement Plan, funds have recently been made available for a system of inspection of commercial and official stained antigens made under U. S. Patent 1,816,026. Permittees are required to submit to the Bureau representative samples from every lot of antigen prepared. These samples are examined as to their sensitivity by testing fowls of various grades of reaction, and nonreacting controls. The Bureau's antigen is employed for comparative purposes on every test. Periodic tube agglutination tests also are conducted on the fowls. Other features of the examination include sterility, turbidity, dye content, preservative con-
tent, standardization of antigen-droppers and blood-loops, and a careful review of the label, literature and method of packing the product for distribution.

Antigens found to be unsatisfactory are withdrawn from sale. However, it has been the observation of the Bureau that relatively few of the samples examined have proved unsatisfactory. For the most part the cooperation of commercial concerns in an effort to manufacture a standard product has been exemplary. It is believed that this inspection system is having and will continue to have a salutary influence on the quality of stained antigens finding their way into the trade and that outstanding results will attend pullorum disease control campaigns depending upon the use of the stained antigen whole-blood rapid agglutination test.

. . . Dr. Bunyea then read his paper. . . .

ACID-FAST ORGANISMS FOUND IN SO-CALLED BUMBLEFOOT OF CHICKENS

By HUBERT BUNYEA, Washington, D. C.
Pathological Division, Bureau of Animal Industry

INTRODUCTION

There have recently come to the attention of the writer a number of cases of bumblefoot of chickens in which acid-fast organisms possessing morphological characteristics similar to those of *Mycobacterium tuberculosis* (*avium*) could be demonstrated microscopically. The lesions appear in the pad of the foot (fig. 1) or in one or more interdigital spaces (fig. 2). In some instances both pad and interdigital lesions occur, some of which appear to intercommunicate by means of a common abscess or by fistulous tracts within the foot. Many instances show enormous swelling of the foot, due to the accumulation of a great quantity of caseous pus, while others are practically limited to a superficial or restricted area without appreciable swelling. The external lesions sometimes present the appearance of a dark, wart-like scab.

LITERATURE

An examination of the literature, including standard reference works on poultry diseases, has disclosed few references to acid-fast organisms in tumefactions of the foot of domestic birds. An illustration showing foot lesions similar to these described appears in *Deutsche landwirtschaftliche Geflügelzeitung*, with the legend translated “Tuberculous abscesses of feet.” No reference to this type of lesion is made, however, in the article which accompanies the picture. Salmon gives a description of a tuberculous foot infection of parrots as follows:

There are at first small swellings, some of which soften, discharge their contents and become ulcers; others remain hard and
continue to enlarge; while still others are covered by a horny growth of considerable thickness.

An illustration of tuberculosis of the foot of a parrot accompanies the description.

Calmette\textsuperscript{3} presents an illustration of a tuberculous foot of a goshawk (*Astur maroccanus*) with wart-like scaly tubercles. Eber\textsuperscript{4} cites the occasional observation of diseased conditions of the toes, interdigital spaces and ball of the foot of chickens in association with tuberculosis and other infectious diseases of fowls. Blount\textsuperscript{5} states that some cases of bumblefoot are examples of localized tubercle inoculation, but believes that such cases are rare and purely accidental infections.

**EXPERIMENTAL**

Following the finding of acid-fast organisms in the lesions of several locally available bumblefoot fowls, a number of specimens of bumblefoot were obtained from poultry processing establishments through the courtesy of Dr. L. D. Ives, in charge of joint inspection of live and dressed poultry, Bureau of Agricultural Economics, New York City. Several live fowls affected with bumblefoot were obtained through the cooperation of the Tuberculosis Eradication Division of the Bureau of Animal Industry.
Studies were conducted with this material, including microscopic examination of smears stained for acid-fast microorganisms, tuberculin tests on affected fowls, histopathological examination of affected tissues, animal and fowl inoculations, and culturing of the lesions in an effort to determine the identity and pathogenicity of the acid-fast microorganism involved.

**Microscopic Examination for Acid-Fast Organisms**

Seventy-six cases of bumblefoot were examined for acid-fast organisms by grinding in sterile saline solution portions of the scabs and underlying purulent material, and staining by the usual technic for the demonstration of acid-fast microorganisms. Forty-five of these (59.2%) were found to contain acid-fast organisms of a size and shape suggestive of *M. tuberculosis* (*avium*). Figure 3 shows a photomicrograph of a smear made from a foot abscess in which acid-fast microorganisms appear. There seemed to be no relationship between the size and character of the lesion and the presence of the organisms.

**Tuberculin Tests**

Tuberculin tests were made on several fowls showing the presence of acid-fast microorganisms in foot lesions. Avian intra-
TABLE I—Tuberculin tests of fowls affected with bumblefoot in which acid-fast organisms were found.

<table>
<thead>
<tr>
<th>FOWL</th>
<th>SITE OF TUBERCULIN INJECTION</th>
<th>REACTION AT 48 HOURS AFTER INJECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1039</td>
<td>Wattle</td>
<td>Negative</td>
</tr>
<tr>
<td>1039*</td>
<td>Cloaca</td>
<td>Negative</td>
</tr>
<tr>
<td>59*</td>
<td>Both wattles</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Comb</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Cloaca</td>
<td>Negative (slight swelling in 24 hours)</td>
</tr>
<tr>
<td>62*</td>
<td>Cloaca</td>
<td>Negative</td>
</tr>
<tr>
<td>5357</td>
<td>Wattle</td>
<td>Negative</td>
</tr>
<tr>
<td>5358</td>
<td>Wattle</td>
<td>Negative</td>
</tr>
<tr>
<td>5364</td>
<td>Wattle</td>
<td>Negative</td>
</tr>
<tr>
<td>5361</td>
<td>Wattle</td>
<td>Negative</td>
</tr>
<tr>
<td>A</td>
<td>Wattle</td>
<td>Positive</td>
</tr>
<tr>
<td>B</td>
<td>Wattle</td>
<td>Positive</td>
</tr>
<tr>
<td>C</td>
<td>Wattle</td>
<td>Positive</td>
</tr>
<tr>
<td>D</td>
<td>Wattle</td>
<td>Negative</td>
</tr>
</tbody>
</table>

*Hens 1039, 59 and 62 were injected with tuberculin, March 7, 1935, by Dr. Elmer Lash, Assistant Chief, Tuberculosis Eradication Division, B. A. I. Hens A, B, C and D served as tuberculin controls.

dermic tuberculin for this purpose was obtained from the Biochemic Division of the Bureau of Animal Industry. A list of fowls tested and their reactions is given in table I.

The evidence derived from these tuberculin tests indicates that the presence of acid-fast microorganisms such as these observed in the foot lesions could not be detected by tuberculin-testing the affected fowl.

HISTOPATHOLOGICAL EXAMINATION

Stained preparations were made of tissues from several bumblefoot specimens for histological study. Microscopic examination of these sections showed that the lesions consisted of rather large caseated or necrotic areas, many of which were surrounded by cellular zones consisting of small round cells, lymphocytes, large mononuclear leukocytes and eosinophiles. In some areas groups of epithelioid cells were seen. No giant-cells were noted in any of the sections. There was a very marked proliferation of the fibrous connective tissue in the areas involved.

The invasion of the nodular lesions by masses of large eosinophiles was noted in all the sections examined, and would appear, therefore, to be a characteristic feature of such lesions.

The histological changes found in the various sections were on the whole rather similar, and were not considered characteristic of those generally observed in tuberculous lesions.
Inoculations were made into animals and fowls with suspensions of material from some of the bumblefoot cases to determine if possible the identity of the acid-fast organism involved, and to establish its relationship to the foot lesions described.

With material from each of three hens (1039, 59 and 62), two chickens, two guinea pigs, two rabbits, and two white mice were inoculated intraperitoneally. Some of these birds and animals died from intercurrent affections soon after inoculation. Those which survived were killed at intervals of two to four months after inoculation, and examined for lesions. All were negative excepting guinea pig 8107, which had been inoculated March 8, 1935, with bumblefoot material from hen 62, and which died April 17, 1935. A purulent orchitis was observed in this animal, and acid-fast organisms were demonstrated in stained material from the testicle.

A pool of bumblefoot material was obtained from three hens (5358, 5364 and 5367), all showing acid-fast organisms. With a suspension of this material, eight rabbits, seven guinea pigs, and six young chickens (broiler age) were inoculated intraperitoneally. Some of these died from intercurrent disease soon after inoculation. Those which survived were killed at intervals of 2½ to 3½ months after inoculation and examined for lesions. No lesions of disease were found. Six additional chickens of broiler age were inoculated into the pad of the foot. Two of these died soon after inoculation. Those that survived were killed 3½
months after inoculation. One of these showed a bumblefoot lesion similar in appearance to the clinical cases observed. In the material from this lesion, acid-fast organisms were demonstrated in stained smears.

Regarding the etiological relation of this unidentified organism to bumblefoot, nothing definite can be said at this time. The experimental foot-inoculation cases (chickens 3054, 3056, 3057, 3058, 3059 and 3060), when observed one week after inoculation, were very lame, and the feet were intensely swollen. Some of these cases persisted for many weeks, while others subsided more rapidly. To what extent the acid-fast organism was responsible for these symptoms, our studies did not reveal. Our inability to cultivate the organism obstructed efforts to determine its identity or pathogenicity. It is possible that the acid-fast organism may be but a secondary invader following infection with some other microorganism. If the acid-fast organism is the primary invader, its pathogenicity must be quite low, since there has been no evidence to indicate generalization or metastasis.

**CULTURING FOR ACID-FAST ORGANISMS**

Purulent material from the bumblefoot lesions of hens 59, 62 and 1039 was collected, pooled, and treated with antiformin after the method of Petroff, as outlined by Stitt, for the cultural examination of tuberculous sputum. The resultant material was seeded upon Dorset's egg medium and upon serum-agar slants. These cultures were rubber-stoppered and incubated at 37.5°C for a period of four weeks. No growths resulted.

Pooled material from the foot lesions of fowls 5358, 5364 and 5367, all showing acid-fast microorganisms, was treated with antiformin as above, and seeded upon Dorset's egg medium, stoppered and incubated at 37.5°C for four weeks. No growths resulted.

Purulent material from the testicle of guinea pig 8107, showing acid-fast microorganisms, was treated and cultivated on Dorset's egg medium as above. No growths resulted.

The writer is indebted to Dr. G. T. Creech, of the Pathological Division, for his assistance in the preparation and interpretation of the histological sections.

**SUMMARY**

Acid-fast microorganisms were demonstrated microscopically in a number of bumblefoot lesions of chickens.

Live fowls possessing such lesions failed to react to the tuberculin test.
Histopathological examination of affected tissues failed to show changes suggesting tuberculosis.

Efforts to cultivate the acid-fast organism were unsuccessful.

Animals and fowls were refractory to inoculations with material containing the acid-fast organisms. However, one case of bumblefoot was produced experimentally, in which the acid-fast organisms were subsequently demonstrated.

The etiological relationship of the acid-fast organism to bumblefoot is not known.

REFERENCES


DISCUSSION

DR. W. WISNICKY: I should like to ask Dr. Bunyea if he injected fowls with the acid-fast organisms he cultured from cases of bumblefoot and subsequently tested them for tuberculosis.

DR. BUNYEAA: None of the fowls that were injected with this material were subjected to the tuberculin test. Only fowls that were found to be naturally infected and actually containing the acid-fast organisms were so tested.

PRESIDENT RECORDS: Is there any further discussion? If there is no objection, gentlemen, we will depart a little from the sequence on the program, and have the report of the Committee on Transmissible Diseases of Poultry. Dr. Rettger has been very kind in doing a great deal of work on this report, in spite of being a very busy man, and it so happens he has to catch a train at or about noon, and we would like to make sure he is in a position to do so comfortably. If there is no objection, we will call on Dr. Rettger to give the report at this time.

... Dr. Rettger read the report. ... (Applause.)

REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY

DR. LEO F. RETTGER, Chairman, New Haven, Conn.

Dr. J. R. Beach, Berkeley, Calif.
Dr. E. L. Brunette, Ithaca, N. Y.
Dr. E. F. Johnson, Blacksburg, Va.

Poultry culture is one of America's major industries. To some it is merely an avocation, but to the great majority of owners it is a business beset with hardships and problems that require dauntless courage, and faith in an uncertain future.

The problems of feeding and egg-production should admit of an early solution, as a result of the great progress that is being made in the field of animal nutrition. The specter of disease, however, will long haunt the poultry industry, in spite of the vast amount of poultry disease research that has been carried on, and of the large measure of success which has already been attained.
Of the well-known infectious diseases which constitute a real menace to our poultry industry we need but mention the following, to impress on us all the gravity of the disease problem: fowl tuberculosis, fowl cholera, paratyphoid, fowl typhoid, pullorum disease, enterohepatitis or blackhead, laryngotracheitis (and other respiratory diseases), fowl-pox and coccidiosis.

Your Committee does not propose to go into a lengthy discussion of transmissible diseases of poultry, but wishes to call your attention to certain aspects of disease control which are receiving greater and greater recognition and on which the ultimate solution of many of the poultry disease problems must rest, namely, poultry hygiene. The term "hygiene" is used here in the broader and now generally accepted sense.

The importance of proper sanitation of poultry-houses and yards by frequent cleaning, removal of waste, and disinfection is being universally recognized. In recent years more and more attention has been centered on the living disease carrier as the real incriminating agent in infectious disease transmission. The full cooperation of poultrymen in the execution of programs of identification and elimination of carriers constitute a serious problem and often requires real effort and ingenuity on the part of animal disease control officials.

Some of the transmissible diseases whose solution is bound up with the carrier problem are discussed here briefly.

**Avian Tuberculosis**

This disease is widespread in some of the midwestern states, particularly in the small farm flocks. It is apparently of rare occurrence in New England and in the commercial poultry flocks of the Pacific Coast states.

The disease, as is well known, is readily transmitted from chickens to other fowl, to swine, occasionally to cattle, and rarely to sheep. The Van Es tuberculin test has served as a valuable means of locating infection in flocks, and much progress has been made by the United States Bureau of Animal Industry, utilizing the test in its adopted system of tuberculosis control. This work should be continued and extended, and efforts should be made by local veterinarians and sanitary officials to educate poultrymen to the need of eliminating the disease from their flocks by following the recommendations of the federal authorities. Any system of control must take into serious consideration the danger of transmission through infected litter, soil, etc.

It is understood that a movement to discard the old method of marketing undrawn fowls is being sponsored by the poultry meat industry. This movement will undoubtedly lead to veterinary inspection of dressed poultry, and should do much to aid in the elimination of tuberculous carcasses from our markets. This, in turn, should stimulate eradication of the disease on poultry farms. Your Committee, as have others before it, solicits your full support for this project as a potential means of aiding in the control of avian tuberculosis and other diseases of poultry, thus assuring the consuming public of better quality of poultry meat products.

**Blackhead of Turkeys**

Only a few years ago, this was looked upon as hopelessly beyond human control. It is regarded today as preventable, and the turkey is coming back into his own. Indeed, there are indications of overpopulation in some sections of the country, and the advisability of soon establishing measures of birth control in turkeys is becoming somewhat apparent.

The main secret of blackhead control is thorough segregation of turkeys from all other species of domestic fowl, particularly chickens. Investigations conducted at the Storrs Experiment Station over a
period of several years showed conclusively that grounds which are, or have recently been, occupied by chickens offer a fertile soil for transmission of blackhead to turkeys. Chickens are relatively insusceptible to serious injury by the causative agent of blackhead, but are apparently gross carriers of the disease-producing organism. On the other hand, turkeys are extremely susceptible, but do not appear to harbor the organism in such numbers as to make them function as highly dangerous carriers under normal sanitary conditions.

**Paratyphoid in Turkeys**

This disease, concerning which the chairman of this Committee had the privilege of presenting a paper here a few years ago, is another good example of the value of sanitation, and segregation of infected birds. The cause of this disease, which is rapidly assuming greater importance, is a paratyphoid organism known specifically as *Salmonella aertrycke* in some quarters and *Salmonella typhi-murium* in others. It has also been known by the name of *Bact. pestis-caucae.* This organism is perhaps the most widespread known paratyphoid agent, in so far as host distribution is concerned. It has been shown to cause paratyphoid infection in many species of animals as, for example, the mouse, guinea pig, bird (canary), turkey, chicken, pigeon and grouse, and in man. In man it usually causes the symptoms of food poisoning. Here again the complete isolation of turkeys from other barnyard and range animals is a problem of great importance. Proper sanitation also enters conspicuously into the problem of control.

**Fowl Cholera**

This poultry disease is caused by a bacterium which has long been recognized as the etiological agent, and on which Pasteur conducted some of his famous vaccination experiments. It belongs to the group of so-called hemorrhagic septicemia organisms now generally known by the generic name, *Pasteurella.* Bacteriological examination of diseased fowl constitutes a definite and reliable method of diagnosis. Fowl cholera is spread readily through the droppings, and hence through feces-contaminated food and water. It is also conveyed from bird to bird by secretions from the nares. It affects the various species of barnyard poultry, and does not confine itself to any particular age or ages. Young and maturing pullets appear to be particularly susceptible to the infection. Infected birds which survive the infection often become carriers, and hence constitute a serious menace to hitherto uninfected birds, especially young and maturing stock which is exposed to the carriers.

Evidence appears to be lacking that possible transmission of infection through the egg constitutes a problem in fowl cholera control. Prevention of contact of uninfected birds with living carriers and their discharges is now generally accepted as being the greatest safeguard against new infection. Various attempts have been made to carry out this principle by elimination of obviously infected birds and by rigid sanitation.

An expedient which promises much and which is being followed in some sections of the country is that of isolation of young and maturing birds from old breeding stock in which fowl cholera infection has been established, and disposal of the old stock as soon as the young stock has entered the full production period and disposal of the old stock becomes economically feasible.

**Fowl Typhoid**

In quite a number of the eastern states where pullorum disease has been eliminated from poultry farms, fowl typhoid has not been wide-
an urgent necessity, namely, uniform approved practice in the labeling and marketing of pullorum-tested poultry stock, and rules and regulations governing testing and advertising.

Your Committee believes that no effort should be spared in bringing about a general adoption of this plan, and that the problem of eradication, not only of pullorum disease, but of all other known preventable transmissible diseases of poultry, should be given much greater consideration by veterinarians and disease control laboratories and institutions than it has received, and that methods and procedures should be more generally adopted which aim at prevention, and ultimately at complete eradication of the diseases. Such procedures, including both the diagnosis and the mechanism of carrier elimination, should be left entirely in the hands of trained individuals who are responsible to higher state or federal authorities. No effort should be spared in bringing to the doors of poultry-owners information which will enable them to assume their full share of responsibility in the solution of the poultry disease control problem. Such information should be made available to all poultrymen.

Intensive training in poultry diseases and their control should constitute an important part of the curriculum of every veterinary college, and private practitioners should be prepared and willing to render the same service that they do in the treatment of horses, for example. Poultrymen should be educated to the importance of turning to such trained practitioners in the solution of their poultry disease problems.

Finally, although this report does not include a discussion of virus diseases, your Committee wishes to go on record as condemning indiscriminate distribution and use of laryngotracheitis vaccine. While we believe that little or no harm can be done by the administration of the vaccine to flocks which are known to harbor laryngotracheitis, it should not be used on farms which are free from the infection. Furthermore, the determination of existence of the infection in suspected flocks should be placed in the hands of competent, recognized authorities.

Dr. Retiger: Mr. Chairman, I move that this report be referred to the Executive Committee for adoption and inclusion in the proceedings.

. . . The motion was regularly seconded and carried. . . .

President Records: The next paper in this group is "Fowl-Pox Virus Vaccination of Day-Old Chicks—A Preliminary Report," by Drs. R. E. Lubbehusen, J. R. Beach and W. H. Busic, of the University of California. Dr. Erwin Jungherr will read a summary of this paper.

. . . Dr. Jungherr summarized the paper. . . . (Applause.)

FOWL-POX VIRUS VACCINATION OF DAY-OLD CHICKS

A Preliminary Report

By R. E. LUBBEHUSEN, J. R. BEACH and W. H. BUSIC
Veterinary Science Division, University of California
Berkeley, California

The present extensive use of virus vaccination for the control of fowl-pox infection reflects the general acceptance of this method of immunization. Many poultrymen, however, view fowl-pox virus vaccination with considerable disfavor because they are
fearful of its probable systemic effect upon the birds. Whether the existence of this fear should be attributed to the vaccine or to its injudicious application is a matter of some controversy. Field observations, such as decreased egg-production for variable periods following vaccination of laying flocks as well as the data of controlled experiments, definitely indicate that the local reaction from the cutaneous inoculation of a fowl-pox virus vaccine may be accompanied by a systemic response.

The proper age at which to vaccinate birds has long been a subject of considerable controversy. Almost all observers agree that, on previously infected premises, vaccination should be done before birds come into production. Some discourage vaccination of birds less than three months of age except under unusual circumstances.

Experiment data presented by Lubbehusen and Ehlers, in 1932 and 1933, provided evidence of a systemic post-vaccination reaction manifested by an interruption of growth gains in normal birds which were vaccinated when older than 120 days. A reaction of this nature did not occur, however, following vaccination of birds from 30 to 90 days old. These data did not include observations on chicks less than 30 days old.

In 1932, Dunn and Sherwood reported the successful immunization of day-old chicks by applying a fowl-pox virus vaccine to a small area of slightly scarified skin on the breast. No constitutional or systemic symptoms were noted in birds vaccinated when reasonable care was used in applying the vaccine. These investigators concluded that "healthy and vigorous day-old chicks (and poults) can be safely and successfully vaccinated against fowl-pox, using fowl-pox vaccine without causing any apparent constitutional disturbance." The possibility of immunizing day-old chicks has attracted the interest of poultrymen who had experienced undesirable vaccination sequelae, and of hatcherymen who were impressed by the commercial aspects of selling vaccinated chicks. As a result, "day-old chick" vaccination has been tried by a number of California poultrymen.

FIELD OBSERVATIONS OF DAY-OLD CHICK VACCINATION

During the spring of 1934, one of us (W. H. B.) had the opportunity to participate in and observe the results of the vaccination of 36,691 chicks in 45 groups on twelve farms. The number of chicks per group varied from 120 to 3,055 and the number of groups per farm from one to 15. All groups came from commercial hatcheries and were vaccinated just prior to being placed under brooders. Although varying in type on the various farms,
the brooding conditions were viewed as favorable on all except one farm, where a newly-installed system failed to give complete satisfaction during periods of sudden climatic temperature changes.

**The vaccines:** The chicks of 41 of the 45 groups were vaccinated with standard commercial unattenuated fowl-pox virus vaccines in the concentration recommended for older birds. Four groups, comprising 2,724 chicks, were vaccinated with a special commercial vaccine of greater virus concentration, which was prepared and distributed especially for use on day-old chicks.

**The vaccination technic:** In the first three groups, comprising 1,551 chicks, vaccination was by means of the "stick" method on

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**Fig. 1.** Method of vaccinating day-old chicks.
the medial surface of the wing. For reasons which will be discussed later, this site of inoculation was abandoned. Thereafter, all chicks (42 groups) were vaccinated by the “stick” method on the outer surface of the loose fold of skin anterior to the thigh (fig. 1). A taped Bard-Parker knife was used as the inoculating instrument for the first two groups to be vaccinated, a double needle spaced at one-eighth inch for the third and fourth groups, and inoculation of the remaining 41 groups of chicks was accomplished by one stick of a teasing needle. The use of this latter instrument gave a percentage of positive inoculations as high as the others and did not carry so much surplus of virus to the surrounding tissues.

The chicks were held by an assistant who used the utmost care to prevent the virus from getting on his hands and thereby transferred to parts of the chick other than the site of vaccination. Carelessness in this respect had been claimed to have resulted in a high incidence of generalized pox lesions in some lots of chicks which had been vaccinated previously by others. In case of accidental contact with virus at the point of inoculation, the assistant washed his hands in a mild antiseptic solution.

Observations: All chicks were examined on the tenth, 30th and 45th days after vaccination, to determine (a) the percentage of chicks which had “takes”; (b) the percentage of chicks which showed secondary pox lesions and the mortality incident thereto; (c) the total mortality and culls at six weeks; (d) the degree to which other factors contribute to unthriftiness or mortality, and (e) the condition of the surviving chicks. There were no non-vaccinated control groups for comparison. The results are summarized in table I.

It will be noted that, in 17 groups, comprising 17,433 chicks, the vaccination was regarded as successful and the chicks were apparently normal at the six-week observation. All chicks were inoculated by means of a single needle stick. The vaccine for two of these groups, comprising 919 chicks, was the special chick vaccine with a virus concentration twice that of the standard fowl-pox vaccine from three commercial laboratories which was used on the remaining 15 groups. The two groups vaccinated with the concentrated virus had the largest percentage of chicks with secondary lesions of pox and suffered the highest percentage of mortality (3.6 and 3.5, respectively) from this cause.

Eight of the 15 groups vaccinated with standard vaccine suffered no mortality from pox, although some chicks of four of these groups showed secondary pox lesions. The highest percentage of mortality and culls to six weeks occurred in a small group
## Table I—Results of vaccinating 36,691 chicks with standard commercial chickenpox vaccine by the stick method.

<table>
<thead>
<tr>
<th>Nature of Results</th>
<th>Groups</th>
<th>Chicks</th>
<th>Takes (%)</th>
<th>Developed Pox on Head (%)</th>
<th>Mortality from Pox (%)</th>
<th>Total Mortality to Six Weeks (%)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccination successful and chicks normal to 6 weeks</td>
<td>17</td>
<td>17,433</td>
<td>97 78 89.2</td>
<td>5 0 0 2 1</td>
<td>3 6 0 0 8</td>
<td>13.4 2.0 6 3</td>
<td></td>
</tr>
<tr>
<td>Vaccination successful but results complicated by concurrent disease and unfavorable conditions</td>
<td>15</td>
<td>9,055</td>
<td>96 80 86.1</td>
<td>10 0 0 6</td>
<td>3.2 0 0 2 1</td>
<td>54 6 12 0 24 4</td>
<td></td>
</tr>
<tr>
<td>Vaccination seemed to be harmful to chicks</td>
<td>9</td>
<td>5,263</td>
<td>99 83 91.5</td>
<td>35 8 17.1</td>
<td>10 3 8.7</td>
<td>46 12 20 1</td>
<td>All groups were very unevenly developed</td>
</tr>
<tr>
<td>Vaccination not successful</td>
<td>4</td>
<td>4,940</td>
<td>50 0 16.5</td>
<td>15 0 0 7</td>
<td>5 6 0 1 3 1</td>
<td>35 2 4.9 13 8</td>
<td></td>
</tr>
</tbody>
</table>

1 Specific vaccine of greater virus concentration used for 4 flocks comprising 2,724 chicks.
2 Site of inoculation was fold of skin between thigh and wall of abdomen. Instruments used:
   (a) Bleeding-knife for 2 flocks comprising 920 chicks.
   (b) Two needles fixed close together for 2 flocks comprising 972 chicks.
   (c) Single-point teasing-needle for 41 flocks comprising 34,799 chicks.
3 Flock re-vaccinated with no harmful effect.
4 Concurrent diseases present:
   (a) Simple colds in two flocks.
   (b) Pullorum disease in one flock.
   (c) Acute coccidiosis in one flock.
Other unfavorable conditions were:
   (a) Chilling in one flock had caused the chicks to crowd.
   (b) Unfavorable brooding conditions, such as low temperatures, floor drafts, etc., in 9 flocks.
of 141 chicks, of which 19 (13.4 per cent) apparently succumbed as the result of improper brooding, none of which were affected with pox lesions or concurrent disease. With this one exception, the brooding conditions were viewed as satisfactory and the mortality, not directly attributed to the development of pox lesions, did not exceed normal expectancy.

In 15 groups, comprising 9,055 chicks, vaccination was also viewed as successful in that, with standard vaccines, an average of 96 per cent of "takes" was obtained and the percentage of chicks which developed secondary pox lesions and the mortality incident thereto, although higher than in the previous groups, was not excessive. However, these groups experienced a high average mortality (24.4 per cent), which apparently was caused by unfavorable environment or concurrent disease.

While environmental conditions always have a significant bearing on the chick mortality, this factor assumes added importance in considering the post-vaccination losses, in that eleven of the 15 high-mortality groups were subjected to poor brooding conditions to the exclusion of a concurrent disease factor. Ten of these groups represent the population of a single farm on which mortality in non-vaccinated chicks previously raised on this farm and subjected to the same brooding conditions, while admittedly high, had never approached the average of those vaccinated. This observation, together with the results of controlled experiments to be described later, suggests at least that the mortality in these groups was influenced by a temporary lowering of the resistance of day-old chicks.

A group of 1,000 chicks in which pullorum disease was diagnosed showed an unusually high mortality of 50 per cent, less than 0.5 per cent of which was attributed to secondary lesions of pox. Another group of 1,000 chicks developed an *Eimeria tenella* infection during the fifth week and suffered a 25 per cent mortality within a period of ten days. The two remaining of the 15 groups developed a respiratory infection (chick bronchitis) during the first week, which persisted for a period of one month and was accompanied by a much higher mortality than has been observed in other similarly affected flocks.

These observations, with respect to the greater than average mortality in the 15 groups of vaccinated chicks subjected to unfavorable environment or concurrent disease, suggest that an important contributing factor in the mortality may have been a post-vaccination lowering of chick vitality. The uneven development in nine groups, in the absence of other contributing factors, suggests that vaccination itself may result in definite injury.
The observation of results with five of the nine groups indicates that such injury may be associated, in part, with a technic or vaccine which favors the development of secondary lesions or a virus which produces vaccination takes of exceptional severity. The first three of these groups were vaccinated on the web of the wing and a high incidence of secondary pox lesions (18 to 20 and 35 per cent) was caused by direct contact of the head with the site of vaccination.

While the major portion of the mortality to six weeks was due to the secondary pox lesions, the unthrifty condition of the survivors seemed to bear a very direct relationship to the severity and extent of the local reaction at the point of inoculation. A further significant correlation between the severity of the local vaccination reaction and retarded growth is seen in two groups vaccinated with the special vaccine having double the virus concentration of the standard product. The chicks of both groups were inoculated in the flank and showed 98 and 99 per cent takes, respectively, in the major portion of which the vaccination takes were very large and healed very slowly. Nearly all of the chicks showing this type of reaction also showed arrested development.

The vaccination of four groups was viewed as unsuccessful in that takes were produced in only 0, 5, 20 and 50 per cent of the chicks, respectively. Inasmuch as revaccination of these chicks by the same vaccination technic with another vaccine gave positive results, we are justified in assuming that the original vaccines contained virtually no viable virus.

Although these field observations may not justify any definite conclusions concerning the effect of fowl-pox vaccination on day-old chicks, they do indicate a need for detailed and controlled experimental studies before the procedure is adopted by poultrymen.

In considering the question of post-vaccination chick mortality, it was apparent that the mortality attributed to pox was related to the vaccination technic by the extent to which errors in this respect may have favored the development of severe takes and secondary pox lesions. Thus, a need for the development of a vaccination procedure which would assure a high average percentage of takes without favoring an increase of secondary pox lesions was indicated. A second significant observation was that the high average post-vaccination mortality in those groups subjected to unfavorable environment or concurrent disease, and the uneven development in other groups not subjected to such factors very strongly suggested a lowered vitality following vaccination.
CONTROLLED EXPERIMENTS

These studies, which were conducted under both laboratory and field conditions, were directed toward determining (a) if a vaccination technic might not be perfected which would assure a high percentage of takes without causing a proportionate increase in the incidence of secondary lesions; (b) whether fowl-pox virus vaccination of day-old chicks is followed by a systemic reaction as reflected in a retardation of normal growth gains; (c) to what extent post-vaccination mortality may be attributed to a lowered vitality incident to post-vaccination reaction; and (d) whether vaccination of day-old chicks confers an adequate and lasting immunity to subsequent contact exposure to the virus.

Vaccine and vaccination technic: The results of the field observations just described indicate that the regular commercial vaccine was suitable for use on chicks, and that a special chick vaccine of greater virus concentration was not only unnecessary but contraindicated. Accordingly, the standard virus concentration for commercial vaccines, 10 mgm of virus per cc of diluent, was used throughout these experiments.

The variability with respect to percentage of takes in some instances and the production of too severe takes in certain others appeared to be related to the method of applying the vaccine rather than to differences in the potency of vaccine. Therefore, attention was given to devising a vaccinating instrument which would deliver a constant amount of virus to the intracutaneous tissue without leaving an excess on the skin surface. The vaccination needle which was devised and used exclusively in these experiments is illustrated in figure 2. When dipped in vaccine it carries away a tiny bead of vaccine between the two points which are 1 mm apart and thus assures the deposit of a constant amount of virus at the point of the "stick" in the skin. The efficiency of the needle was demonstrated in a preliminary field trial in
which it was compared with a sharp rat-tooth forceps as a vaccinating instrument.

In this study, 885 day-old chicks were vaccinated by grasping the fold of skin in the flank between the sharp teeth of the forceps which were dipped into the vaccine before each inoculation. Another group of 1,090 day-old chicks were inoculated in the flank by means of the specially-devised needle. When examined on the ninth day, 303 of the group of 885 inoculated by means of the forceps method failed to show takes, while the needle was found to have successfully inoculated 100 per cent of the 1,090 chicks vaccinated with it. Since the virus was viable and the chicks without takes proved to be susceptible on re-vaccination, the difference with respect to production of takes in the two groups could be due only to the difference in vaccinating instrument used. Since the conditions on these premises did not favor the collection of closely controlled experiment data, no further reference to the vaccination results in these two groups of 1,985 chicks will be made except to state that the owner was satisfied that the chicks had shown no harmful post-vaccination reaction.

As the results of this field trial clearly demonstrated the efficiency of the special inoculating needle, it was used exclusively in the experiments to be reported and never failed to produce 100 per cent takes with standard fowl-pox vaccines having a virus suspension of 10 mgm per cc of diluent. All inoculations were made in the region of the flank. Less than 0.5 per cent of the chicks showed secondary pox lesions and in not a single instance was mortality attributed to this cause. The precautions at vaccination to avoid the mechanical transfer of virus to other parts of the body were no greater than used under field conditions.

*Effect of vaccination on growth:* In experiments with chicks, comparative weight gains have often served as an index of the effect of various factors in causing a deviation from normal health. This deviation from normal weight gains may be temporary and of little practical importance, or prolonged, with attendant lowering of resistance. In these studies, the systemic reaction incident to fowl-pox vaccination of day-old chicks is, therefore, measured on the basis of weight gains and mortality as compared with non-vaccinated controls.

*Laboratory Trial 1: A comparison of weight gains and mortality of chicks vaccinated when one day old and non-vaccinated controls.*

On April 25, 1935, 196 day-old, commercially-hatched (sexed) male chicks were divided into three groups. Group 1, comprising 65 chicks, was vaccinated with fowl-pox virus vaccine prepared at the laboratory, while group 2, consisting of 66 chicks, was inoculated with a commercial vaccine. As previously indicated, all inoculations were made in
the flank by means of the specially-devised needle. The 65 chicks of group 3 comprised the non-vaccinated controls. All groups were maintained under identical conditions with respect to brooding, diet and general care. Each group was weighed at 7-day intervals and examined for vaccination takes and secondary pox lesions at each weighing.

All chicks of groups 1 and 2 showed definite takes on the seventh day. The chicks of group 1 presented a more severe local reaction; 37 of the number still showed vaccination scabs on the 14th day, when all but eight of those of group 2 were completely healed. This relative severity and persistency of the local reactions produced by the two vaccines may have had a significant bearing on the difference in weight gains exhibited by each group. In comparing these gains with that of the non-vaccinated controls (fig. 3), it will be noted that each vaccinated group showed a definite inhibition of growth, causing a marked deviation from the growth curve of the normal controls.

The difference was apparent the second week and continued in increased proportion to the age of 29 days, when the control chicks averaged 164.3 gm as compared with 97.2 gm for group 1 and 113 gm

![Graph showing weight gains and mortality in fowl-pox vaccination of day-old chicks compared with non-vaccinated controls.](image-url)
for group 2. Stated differently, at the age of 29 days, the weight of the chicks in group 1 averaged approximately 40 per cent less, and that of group 2, 30 per cent less than the non-vaccinated controls. Unfortunately we were unable to continue observations of these groups to determine whether this inhibition in growth gains of the vaccinated chicks was temporary or would be prolonged and result in permanent injury. Because of the brief period of these observations, the mortality had no comparative significance and does not reflect any post-vaccination lowering of the resistance in these disease-free groups.

Laboratory Trial 2: A comparison of the weight gains and mortality of chicks vaccinated when one day old with that of controls vaccinated when 56 days old.

On May 8, 1935, 55 day-old chicks were vaccinated in the region of the flank with a commercial vaccine. Fifty-four non-vaccinated controls were permitted to cohabit with those which were vaccinated, thus subjecting vaccinated and control chick alike to identical environmental factors. Vaccinated and control chicks were weighed at slightly irregular intervals.

The vaccination takes were observed on the eighth, 15th and 21st days. In contrast to the previous trial, the local reaction was slow in developing, reaching its greatest intensity about the 15th day, with 25 per cent of the chicks still showing vaccination scabs on the 21st

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**Fig. 4.** Graph showing results of vaccination of day-old chicks against fowl-pox compared with results in control chicks vaccinated at the age of 56 days.
day. An observation of probable significance in this connection was the presence of secondary pox lesions in 10 per cent of the vaccinated chicks on the 21st day. This was the only group to develop head lesions in these experiments and the only one in which the development of the local reaction was delayed and healing prolonged.

In comparing the weight gains of the vaccinated and control chicks, we find no significant difference until the fourth week, after which there is a marked and continuous deviation. At the age of 56 days, the average weight of the vaccinated chicks was 163.7 gm and that of the controls, 271 gm, a difference in average weight of 107.3 gm. At this time, the controls, numbering 40, were vaccinated by the same method as had been employed for the day-old vaccinated group. Examination 16 days later showed 100 per cent takes, which demonstrated that, although intermingling, there had been no cross-infection to the controls during the 56 days of exposure.

Referring to figure 4, it is seen that the growth curve of the controls continued uninterruptedly after vaccination, thus confirming and supporting the previously mentioned findings of Lubbehusen and Ehlers, that vaccination of chicks from 30 to 90 days old is not accompanied by evidence of a systemic reaction.

All chicks which died were autopsied and examined bacteriologically. Examination of the mortality curves in figure 4 shows a loss, during the first four days, of nine controls from non-specific causes. Following these initial losses, only four additional control chicks had succumbed up to the age of 47 days (June 24), when the control group was represented by 41 chicks. During the same period, 15 vaccinated chicks had died, leaving a total of 40. Attention is called to the nearly equal number of chicks remaining in each group on June 24, because, on that date, the death of a vaccinated chick was due to acute coccidiosis (Eimeria tenella). Although the presence of this disease factor was rather disconcerting, because of its probable influence on the future weight gain data, it served to demonstrate the relative resistance of the vaccinated and control chicks to the disease since, by cohabitation, all were subjected to like exposure.

During the nine-day period following its initial appearance, coccidiosis was responsible for seven of the nine deaths that occurred in the vaccinated group, as compared with one in the controls. Despite the fact that the controls were vaccinated at this point (56 days), only six of the number succumbed during the following 16 days, as compared with a mortality of 15 in the day-old vaccinated group.

At the conclusion of these observations, the original group of 55 chicks, inoculated when one day old, was represented by six survivors, having an average weight of 380 gm, while in the control group, vaccinated at the age of 56 days, there remained 26 chicks, averaging 691.1 gm. These data may be summarized as follows: (a) Vaccination of the day-old chicks resulted in inhibition of normal growth gains and also seriously impaired their normal resistance to concurrent disease; (b) Vaccination of chicks at the age of 56 days did not appear to result in any systemic shock nor to lower significantly their resistance to concurrent disease.

Field Trial 2: A comparison of the weight gains and mortality of chicks vaccinated when one day old with those of controls vaccinated when 22 days old.

On May 22, 1935, 560 day-old (sexed) pullet chicks, having an average weight of 38.7 gm were vaccinated with a fowl-pox virus vaccine prepared in the laboratory. A group of 563 non-vaccinated control chicks from the same hatch and averaging 38.5 gm was maintained under separate but identical brooding and environmental conditions as the vaccinated group. All of the vaccinated chicks showed definite takes on the ninth day, when the average weight of the vaccinated
chicks was 66 gm, and that of the controls 62.7 gm. Examination of the vaccinated group on the 22nd day (June 13, 1935) showed that 44 of the 546 chicks retained a vaccination scab, with four of these presenting minor secondary pox-lesions. At the age of 22 days, the vaccinated group had an average weight of 135.2 gm and a mortality of eleven, as compared with an average weight of 137.7 gm and a mortality of 27 for the control group. The increased mortality in the control group is without significance, inasmuch as neither of the two groups represented selected chicks and it was apparent from the beginning that the control group contained the larger number of weak chicks.

It has been the established practice on this farm to vaccinate the chicks when they are removed from the brooder-house and placed on range at the age of six or seven weeks. It was decided, therefore, to vaccinate the controls at the age of 22 days in order to procure post-vaccination weight gain data up to the age of six weeks without interrupting the routine rearing practice. On June 13, the 536 surviving members of the control group were, therefore, vaccinated with the same vaccine and method as used for the day-old chicks.

Examination on the eleventh day (June 24, 1935) revealed 100 per cent takes, with no evidence of secondary pox lesions. The average weight of the vaccinated controls at this time was 201.5 gm and that

**Fig. 5.** Graph showing results of the vaccination of day-old chicks against fowl-pox compared with results in control chicks vaccinated at the age of 22 days (field trial 2).
of those vaccinated as day-old chicks, 203.2 gm. This insignificant difference of 1.7 gm in average bodyweight had increased to 15.5 gm when these chicks were placed on range, on July 12, 1935, which suggests that the chicks vaccinated at the age of 22 days suffered some post-vaccination reaction which inhibited their growth.

While there was a slight advantage in the weight gain of the chicks vaccinated when one day old over that of those vaccinated at the age of 22 days, the mortality in the former group was considerably greater, particularly during the third to fifth weeks. These losses occurred in the absence of a concurrent disease, and under favorable brooding conditions. In fact, during this period the appearance of the day-old vaccinated group was such that the owner suspected coccidiosis, which numerous examinations failed to reveal. After being placed on range, the mortality was the same in each group up to October 22, 1935, when the latest observations were made.

**Laboratory Trial 3: Additional comparison on the vaccination of chicks when one day old and at the age of 22 days.**

Ninety-nine (sexed) male chicks from the same hatch as those used in the above-described field trial were brought to the laboratory and divided equally into three groups. The chicks of group 1 were inoculated with a fowl-pox vaccine prepared in the laboratory, and those of group 2 with a commercial product. Both groups showed 100 per cent vaccination takes. Group 3 served as a non-vaccinated control until

![Graph showing results of vaccination of day-old chicks against fowl-pox compared with results in control chicks vaccinated at the age of 22 days.](image-url)
the 22nd day, when it was vaccinated with the same virus as was used for group 1. The average body weights of the two vaccinated and one control group were the same on the seventh day, namely 62 gm. There was a slight deviation in weight up to the 22nd day, when the controls, averaging 96.4 gm, were vaccinated. The comparison of the post-vaccination weight gains of the three groups show no significant difference. This supports the field trial data which indicated that the systemic reaction incident to vaccination at the age of 22 days is comparable to that observed in chicks vaccinated as one day old. Contrary to those of the field trial, the mortality data of the three groups show no significant difference.

**IMMUNITY STUDIES**

At variable periods, representative birds were selected from those used in the laboratory and field trials, and were tested to determine the degree and duration of the immunity incident to vaccination of day-old chicks. These birds were exposed to fowl-pox by cage contact with artificially-infected birds. The degree of resistance was compared with that of similarly exposed non-vaccinated controls. Birds which did not become infected by contact exposure received a follicle and comb inoculation with fowl-pox virus. The severity of the subsequent local reaction, if any, was compared with that produced in controls. Although the immunity studies are still incomplete, our present data indicate that fowl-pox virus vaccination of day-old chicks has conferred adequate resistance to infection by contact exposure for a period of five months, the longest interval after vaccination at which tests have been made. The comparative severity of the reaction following the follicle and comb inoculation of those birds which did not become resistant to infection by contact exposure suggests, however, that the immunity incident to day-old chick vaccination is less stable than that following vaccination at a later date.

**SUMMARY**

Although the experiments which have been reported must be regarded as only a preliminary study, some of the findings, nevertheless, appear to be of significance with respect to the practice of vaccinating day-old chicks on poultry farms. The vaccination technic, including the choice of virus concentration which was used, resulted in the production of a take in all chicks vaccinated and an incidence of secondary pox lesions so low that it was not a factor responsible for post-vaccination mortality.

The controlled experiment data indicate that a vaccination take, even in vigorous day-old chicks, is accompanied by a systemic reaction which manifests itself by at least a temporary inhibition of normal weight gains and a lowering of vitality, the degree of which is influenced by the severity and duration of the local reac-
tion and which, in the presence of unfavorable environmental conditions and concurrent disease, may contribute to excessive mortality. This point was illustrated by the relative resistance of the vaccinated and control groups exposed to coccidiosis in laboratory trial 2, and by the high post-vaccination mortality in those field groups which were exposed to disease and unfavorable brooding factors.

In measuring the post-vaccination reaction in terms of growth gains and mortality, there are indications that this reaction occurs, but that it is less pronounced in chicks vaccinated at the age of three weeks, and is entirely absent at eight weeks. These observations are in accord with those of Bice who found "vaccinations with chicks ranging in age from four to twelve weeks to be successful, and mortality in chicks vaccinated at less than four weeks of age to be high."

These studies are to be continued by controlled experiments conducted under field conditions, to obtain additional comparative data on the effect of fowl-pox virus vaccination on day-old chicks and chicks of greater age.

REFERENCES


DISCUSSION

PRESIDENT RECORDS: Is there any discussion of this paper?

DR. RETTGER: I want to thank Dr. Jungherr, on behalf of the Committee, for the tremendous job he undertook. This paper came to us as a 32-page manuscript with four charts. I was dismayed. I gave it to Dr. Jungherr, and you see what he has done with it. He has presented it as though it were a report on his own work, and he had nothing to do with it. (Applause.)

DR. A. E. CAMERON: I am sure we will all agree this is a valuable contribution on fowl-pox vaccination, but I am just wondering if this would not be a good time, since extensive vaccination against fowl-pox is comparatively recent, to try and effect the eradication of the disease by eliminating the affected birds. I should like to remind you that vaccination never eradicated any disease. In Canada, the prohibition of the use of hog cholera virus in the country has been, so far at least, eminently successful. We have some cases of hog cholera, but not many. We are endeavoring to prevent the manufacture and importation of fowl-pox vaccine, and while we anticipate there would be considerable loss of poultry to start with, in a comparatively short time, we are under the impression that with proper sanitary care, the disease will be controlled in a manner more effective in the long run.

PRESIDENT RECORDS: If there is no further discussion, we will proceed to the next paper, "Laryngotracheitis," by Dr. Charles S. Gibbs, of Massachusetts State College.

... Dr. Gibbs presented his paper. ...
LARYNGOTRACHEITIS

By CHARLES S. GIBBS, Amherst, Mass.

Massachusetts Agricultural Experiment Station

The early writers on poultry diseases recognized a malady similar to laryngotracheitis which they called bronchitis. The name bronchitis is still used, indicating that the teachings of the early writers have been pretty thoroughly disseminated. Sanborn, Salmon, Woods, Korinek, Robinson, Pearl, Surface and Curtis, and Ward and Gallagher distinguished between colds and the so-called bronchitis, but thought that both were caused directly by exposures to cold drafts, or irritation of the mucous membrane by inhaling irritating vapors, dust or foreign particles. Kaupp recognized a contagious type of bronchitis but claimed that cold drafts were a predisposing factor. May and Tittsler described an outbreak in which the disease appeared to be contagious, but the birds were exposed to cold weather, and it was difficult to transmit it artificially, as most birds appeared to be immune. Beach was the first to state that laryngotracheitis or bronchitis is readily transmitted to healthy fowls by the introduction into the trachea of tracheal exudate from affected birds.

ETIOLOGY

Beaudette was the first to state that laryngotracheitis was due to a filter-passing virus, but did not present any experimental data. Beach stated definitely that a virus in the inflammatory exudate of chickens dying of this disease passed through Berkefeld N and V filters, but did not pass through Seitz filters. Beach’s findings have been confirmed by Gibbs, Graham, Thorp and James, and others, so that it is agreed among poultry pathologists that bronchitis, or laryngotracheitis, as it is now called, is due to a filter-passing virus.

Seifried described characteristic intranuclear inclusion bodies in the epithelial cells of the trachea. Using the technic devised by Behrens and Morgan and Behrens and Nielson for liberating the inclusion bodies from the nuclei of the cells, and separating them from the cellular débris by flocculation with weak organic acids; and using a graded series of collodion filters prepared according to the method of Cox and Hyde, the particulate size of the inclusion bodies is found by Gibbs to be less than 0.082 μ in diameter. At best this physical measurement of the inclusion body in laryngotracheitis is only an approximation. But even so the mature inclusion body must be considerably re-
duced in size to pass the pores of ultra-filters. Microscopic examination of the inclusion bodies in stained histological sections indicates that there is considerable variation in shape and size of these bodies. The appearance and arrangement of these forms in the nuclei and their relation to different stages of infection indicate that the virus passes through some kind of a developmental cycle. Apparently the inclusion body in laryngotracheitis differs in size, shape, location and in the manner of development from similar bodies observed in chicken-pox by Woodruff and Goodpasture, and in chicken coryza by Gibbs. The inclusion bodies in chickenpox and coryza are extranuclear.

**METHOD OF TRANSMISSION**

The next important step in the development of knowledge concerning laryngotracheitis resulted from transmission studies of the virus from affected to unaffected susceptible chickens. A knowledge of the method of transmission is important because the blind following of any treatment for the control of diseases is rarely successful. If the biology of the disease in question is unknown, then the chances are that the most favorable point of attack is unknown, and a successful line of treatment can not very well be applied.

Isolation and sanitation applied in the manner recommended for contagious diseases in general failed to control laryngotracheitis, and reasons for this could not be accounted for until it was demonstrated by Komarov and Beaudette and Gibbs that birds apparently recovered from all symptoms and lesions of the disease, remained carriers for two weeks to two years. With this information in hand it was possible to outline a sanitary program for the control of laryngotracheitis that would work under farm conditions.

**ERADICATION AND CONTROL**

The plan outlined by Gibbs recognizes the possible existence of laryngotracheitis carriers either in the flock having the disease or recovering from it. The fundamental points of this plan are: (1) the eradication of carriers from the premises; (2) the destruction of the virus in the houses, on the equipment, and grounds occupied by the diseased flock, and (3) the prevention of the reintroduction of the disease into the clean flock. This plan is the most comprehensive method known up to the present time for the treatment of infectious laryngotracheitis. Also, it has been found that flocks from which infectious laryngotracheitis has been eradicated are remarkably free of parasites and other infectious diseases. Some poultrymen, after
eradicating laryngotracheitis from their flocks by this plan, have been leading in egg-laying contests.

**Vaccination**

Another important step in the control of laryngotracheitis is vaccination, which was discovered independently by Hudson and Beaudette,28 Beaudette and Hudson,29 and Gibbs.30 The discovery that the virus of laryngotracheitis inoculated into the cloaca and bursa of Fabricius of the chicken will cause lesions to appear in this region and produce immunity is a novel and important contribution to the control of this disease. When birds have laryngotracheitis naturally in the larynx and trachea, the respiratory tract is often plugged by the formation of a pseudomembrane and some of them die of asphyxiation. But when the disease is introduced into the cloaca and bursa of Fabricius, even though a pseudomembrane is formed, the results are not serious.

The degree of immunity produced by cloacal vaccination depends upon the severity of the reaction, which is indicated by an inflammation known as a take. Field experience has demonstrated that takes may be evident from the third to the eighth day, but the fourth or fifth day is the best for estimating the probable degree of immunity produced in the birds by vaccination. Gibbs30 has arbitrarily classified takes into five groups. It is understood that this attempt to classify takes in vaccinated birds is relative, because many of them grade into each other in such a manner that there are no sharp limits of demarcation. But the attempt to be systematic and thorough in the reading of takes has considerable value in training the eye and the judgment in discerning the different degrees of inflammation and in developing precision and speed in handling the birds. Experience and training of this nature sharply distinguishes the practitioner from the novice, and determines very largely as to whether the vaccination method for the control of laryngotracheitis will be a success or a failure.

**Classification of Takes**

The five takes or five degrees of inflammation recognized in birds vaccinated for laryngotracheitis are as follows:

1. Indifferent take. In these cases the mucous membrane of the cloaca and the orifice of the bursa of Fabricius may be slightly inflamed, but the inflammation is transient, indicating that the injury is confined entirely to the epithelium. This is recognized as desquamative epithelial inflammation, and it is due to swabbing.
2. A poor take is indicated in those cases in which the mucous membrane of the cloaca or opening into the bursa of Fabricius, or both, is moist from the exudation of mucous and serous fluids. Sometimes the feathers around the vent are moist and soiled. This is called serous inflammation and indicates that the mucous glands are involved.

3. A fair take results when the exudate is fibrinous and the mucous membrane may show petechial hemorrhages in the bursal groove and the orifice of the bursa of Fabricius. This is designated as fibrinous inflammation.

4. A good take shows all of the characteristics of a fair take plus a diphtheritic plug in the opening into the bursa of Fabricius, and possibly ecchymosis of the mucous membrane of the bursal groove. This is mild diphtheritic inflammation.

5. An excellent take is distinguished from a good take by the presence of a diphtheritic plug in the orifice of the bursa of Fabricius, and a pseudomembrane on the mucous membrane of the bursal groove and the cloaca similar to that occurring in the larynx and trachea of birds suffering from natural infections. Sometimes hyperemia and hemorrhage of the mucous membrane of the bursal groove are evident. This is termed either severe diphtheritic or hemorrhagic inflammation depending upon the condition most prevalent.

No evidence has been presented to indicate that cloacal and bursal carriers exist longer than two weeks after vaccination. This is probably due to the fact that the cloaca and bursa of Fabricius are subject to comparatively rapid growth and development, and it is apparently impossible for the virus of laryngotracheitis to maintain itself in the mucous membrane of these parts sufficiently long to constitute chronic carriers.

However, if the virus used as a vaccine is not virulent enough to react in the cloaca, or the vaccination is carelessly done, some of the birds may contract the disease in the respiratory tract and chronic carriers be produced as in natural outbreaks. Accidents of this kind are inexcusable.

THE BEST WAY TO VACCINATE

The ideal way to vaccinate a flock against laryngotracheitis is to secure such a percentage of good and excellent takes that post-vaccination breaks and chronic carriers do not occur. Since natural resistance to laryngotracheitis varies with the age, the percentage of takes insuring a satisfactory degree of immunity for the various age groups has been determined, and found to hold in field practice. The percentages of takes for the age groups computed are shown in table I.
LARYNGOTRACHEITIS

TABLE I—The percentage of takes insuring a satisfactory degree of immunity against laryngotracheitis.

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<thead>
<tr>
<th>AGE IN WEEKS</th>
<th>PERCENTAGE OF TAKES</th>
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<td>85</td>
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<td>8 to 10</td>
<td>90</td>
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<td>12 to 14</td>
<td>94</td>
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<td>16 to 20</td>
<td>96</td>
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<td>22 to 24</td>
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<td>26 to 32</td>
<td>88</td>
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<tr>
<td>34 to 40</td>
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</table>

As indicated in table I, the most favorable time to vaccinate for laryngotracheitis is at the 16 to 20 weeks age period. At this time the chicken is most susceptible to laryngotracheitis, and the cloaca is large enough to be easily swabbed with the vaccine. Since it is not always convenient to vaccinate at this age, satisfactory results may be secured from the eighth to the 24th week, but the most favorable period, as indicated in table I, should be adhered to as much as possible. However, when vaccination is once started, all of the birds on the premises must be vaccinated without delay.

An increase in the virulence of the virus and the number of takes may be secured, if the vaccine is thoroughly ground up with pyrex glass in a saline-glycerin solution. The reason for this may be due to the liberation of a large number of the inclusion bodies from the cells so that they are free to enter the epithelial cells of the mucous membrane at the time of swabbing the cloaca and the bursa of Fabricius. The virus should be ground until the glass is completely pulverized and no pieces large enough to cut the tissues are left. The glycerin, in addition to its preservative qualities, possesses adhesive properties responsible for sticking the virus particles onto the mucous membrane.

DISCUSSION

Two methods are advocated for the control of laryngotracheitis, both of which have places in the control of this malady. In regions in which the disease is not very prevalent the eradication and control plan should receive first choice. In other places in which it has existed for a long time and practically all of the flocks are affected, one may resort to vaccination. The object in vaccination should be to develop an immune poultry population so that the disease will automatically die out, because there are no susceptible birds in which it can spread. In order to accomplish this, the vaccine should be in the hands of responsible persons of experience and skill, and the vaccination campaign systematically carried out in order to produce the desired results.
In conducting such a campaign laryngotracheitis should be distinguished from colds. There are two types of colds, one confined largely to the trachea and the other to the nostrils, infraorbital sinuses and turbinates. Both of these colds are due to filtrable viruses Gibbs, and may simulate laryngotracheitis at the onset. If a flock of chickens having a cold is vaccinated for laryngotracheitis the condition of that flock is not improved. In themselves colds are insignificant for they do not last long, although production is reduced for the time being. But if colds are complicated by secondary microorganisms such as Staphylococcus albus, Streptococcus bronchitis, Hemophilus gallinarum and possibly other microorganisms, a chronic condition results which is serious indeed, for the birds are put out of condition for several months and some of them may die of complications. Vaccinating flocks with laryngotracheitis vaccine tends to lower resistance and to encourage secondary infection.

Birds having colds may be vaccinated with saline-glycerin suspensions of the virus, free of secondary microorganisms. In some field experiments we have secured as high as 100 per cent takes with cold vaccines and the immunity has lasted for a year, in other experiments 20 per cent of the vaccinated birds failed to present takes and had neutral attacks of colds. The reasons for these discrepancies have not been determined. In general vaccinating for colds lowers the incidence of cases over outbreaks allowed to run natural courses, and reduces the loss in production. However, it is not entirely satisfactory and should not be recommended in its present stage of development, except in emergencies. Vaccination for colds is particularly useful on the range when it is desired to bring in pullets and cockerels and place them with or near birds having colds, or having had colds the year before.

While it is impossible to do much with colds at the present time, the situation in regard to laryngotracheitis is different. We have the scientific means for controlling this disease. It seems that a disease so widespread and responsible for so much financial loss and disappointment should receive more concerted action on the part of sanitary officials.

References

1Sanborn, N. W.: Farm Poultry Doctor. (I. S. Johnson & Co., Boston, 1896.)
LARYNGOTRACHEITIS

Dr. Gibbs: The dangers of vaccination are two: first, danger to the vaccinator's own flock, through improper handling of the vaccine. I think I can present that to you best by speaking of the Axton case. Here was a man who had infectious laryngotracheitis break out in his range flock last summer. The birds in the laying-house did not have the disease. He vaccinated the birds on the range. That was successful and stopped the disease, but in some way the virus was carried into the house and got into the laying birds, and I have never known of mature birds being so seriously affected with laryngotracheitis as those birds were, so the vaccine was certainly virulent in that case. It would have been far better if some capable person had carried out the vaccination in a systematic way, by vaccinating all the birds, than to have had the difficulty he did.

The second one was the Medway case. This poultryman had two ranges, six miles apart. The disease broke out on one range and not
on the other. He vaccinated the birds with the disease, but did not vaccinate the birds on the other range. In the fall, when he brought the pullets in, laryngotracheitis was again breaking out. He asked for an investigation. It was found that while he was vaccinating the birds, some 20 or 25 of the chickens got away, and were not vaccinated at all, so they ran among the vaccinated birds, and probably all of them, or some of them, came down with the disease, became carriers, and they were probably responsible for the outbreak in the laying-house.

There are dangers to unvaccinated flocks in the vicinity. Berkshire County, a large county in the western part of Massachusetts, did not have any laryngotracheitis up to last year. This is the way the disease was introduced into that county: A man up near North Adams had been troubled with colds in his flock, and some traveling agent came around and told him it was infectious laryngotracheitis, and sold him vaccine. He vaccinated the flock, and got into serious difficulty. The loss was very heavy, and the disease spread from this flock into others in the neighborhood, so we know laryngotracheitis was introduced into Berkshire County by vaccination. Here we have a perfectly good thing that can be used for the control of this disease in heavily infected areas, and yet it is not being intelligently used. (Applause.)

PRESIDENT RECORDS: Is there any further discussion?

DR. A. F. SCHALK: In case of the already established infection in the flock, do you recommend vaccination of the infected birds?

DR. GIBBS: No, we have tried that time and again. Take a pen of birds in which laryngotracheitis has broken out, even though not all of them show symptoms of the disease, vaccination will not help. The only way you can make vaccination work in such a flock is this: Conditions might not be the same in all parts of the country, but in Massachusetts we have great, long laying-houses. Sometimes the disease will break out in only one room, in one flock. We do not pay much attention to that flock, but we vaccinate all the others, to stop it. It does not pay to vaccinate the ones already infected. It will not help the birds already showing symptoms.

DR. H. W. SCHÖNENING: How soon does immunity appear after vaccination?

DR. GIBBS: Immunity becomes evident three or four days after vaccination. It is not a complete immunity, but immunity to protect the birds is complete in nine days, and immunity will last, provided you have a good take, for the life of the bird.

There is one thing rather peculiar about this disease, and it is this: I told you about these takes, five different degrees of takes. If you get a mild take, the immunity apparently wears off in some of the cases and the bird becomes susceptible again. Immunity is enduring only when you get a good or an excellent take.

DR. E. JUNGER: Are you able to get good takes in all birds? I should like to relate one experience we had. We vaccinated at an egg-laying contest. All these birds were already in production or ready to go into production. We used fresh commercial vaccine, and it produced a lesion during vaccination, but the takes on the fourth and fifth days rendered a large percentage of the birds' hardly susceptible. According to the data given in the table, you see the number of takes begins to drop off after the 20th week. We have vaccinated birds that have been brought into the laying-house and are in production, and we get around 80 per cent of takes, and have never had any trouble.

DR. JUNGER: What grade of take?

DR. GIBBS: These were all first-class takes, either good or excellent.

PRESIDENT RECORDS: Is there any further discussion? If not, and there are no objections, we will recess until 1:30.

. . . The meeting recessed at 12:25 p.m. . . .

RECESS
The sixth and final session convened at 2:10 p.m., President Records presiding.

PRESIDENT RECORDS: The meeting will kindly come to order. The first item on this afternoon's schedule is the report of the Committee on Parasitic Diseases. Is Dr. Ward Giltner here?

I do not know whether Dr. Giltner planned to come back this afternoon. I do not believe he planned to read his committee report. It is practically unreadable. I do not mean that it is not worth reading. He has submitted it to the Executive Committee and it has been approved and it will be turned over to be printed in the proceedings, but the nature of the material is such that it would be difficult to read it, since it consists mostly of tabulations. I do not suppose, since it is not read in open meeting, it will need any action here. It will be printed in the proceedings after changes necessary to make it possible for it to be set up in type.

* * *

REPORT OF COMMITTEE ON PARASITIC DISEASES

DR. WARD GILTNEN, Chairman, East Lansing, Mich.

DR. JAMES E. ACKERT, Manhattan, Dr. H. M. MARTIN, Philadelphia, Kan.

DR. W. T. HUFFMAN, Salt Lake City, Dr. J. E. SHILLINGER, Washington, Utah.

Dr. W. T. Huffman, Salt Lake City, Dr. J. E. Shillinger, Washington, Utah.

An attempt was made to survey the situation in the United States. The following questionnaire was addressed to the Directors of the Agricultural Experiment Stations:

1. What parasitic disease of livestock are common in your state?

2. In your state, do you consider parasitic diseases (a) more important than, (b) less important than, (c) or of equal importance to infectious diseases?

3. How many parasitologists are employed in the study and control of animal parasites in your state?

4. To what types of parasitism have you given special study in your state?

5. What types of parasitism in your state have you (a) successfully combated and (b) unsuccessfully combated?

6. In your mind, what should the United States Livestock Sanitary Association undertake to do in the matter of assisting in the control of parasitic diseases of animals?

Replies to question 6 are presented here:

California—Emphasize the importance of parasite control where stock-raising activities are being concentrated on smaller and smaller areas.

Colorado—Develop sentiment in support of those methods aimed at area control of parasitic diseases and conditions.

Connecticut—Establish regional committees to report on the following: (a) Occurrence of animal parasites. (b) Relative economic importance. (c) Education of stockmen on parasitic problems. (d) Standardized control measures.

Georgia—Extend in a definite way the methods already worked out for parasite control.

Idaho—Assistance of federal inspectors at the different packing-plants.

Illinois—Properly organized efforts in research, development of diagnostic skill on the part of the veterinarian, together with a better appreciation of preventive measures by stockmen.
Iowa—See Proceedings of 1932 and 1933, when constructive measures were proposed and well under way, then abandoned because the Association refused to contribute a modest amount of money to finance the plan. The Association cannot accomplish much without the aid of funds.

Kansas—Place a well-trained parasitologist at each Agricultural Experiment Station, suitable assistants, good equipment, and no teaching or administrative duties—only research.

Kentucky—The adoption of control and preventive measures on each individual farm where live stock is raised. The only solution is to produce live stock under conditions that prevent the occurrence of parasitisms in the young growing animals.

Maine—Promote an educational campaign to make the agricultural people conscious of the prevalence of an injury done by animal parasites. Placing approved control programs for each particular type of parasite.

Maryland—Education on the subject; the profession needs strong stimulation.

Massachusetts—A modus operandi for obtaining accurate and complete distribution of data should be encouraged. Then uniform methods for control might follow.

Michigan—Survey of animal parasites in the normal flock or herd. A study of the economic importance of the various parasites found. Correlate the activities of the potential forces which could bring about the control of these parasites: (a) veterinarian, (b) county agricultural agent, (c) farmer, (d) State College, (e) State Department of Agriculture, (f) Federal Bureau.

Minnesota—Have a better knowledge of the fundamental principles under which parasitism can successfully be combated. By instituting a campaign of education for those in the control of animal diseases in the United States, this education plan to be adopted and fitted for the particular state in which the work is to be carried out.

Missouri—A general survey of the whole parasite problem over the United States. In encouraging the Experiment Stations to carry on more investigations and helping them in any way possible to organize regional projects.

Montana—More effective control in the movement of purebred cattle with sarcoptic scabies.

Nebraska—Promote sanitary management of live stock on farms by educational effects and to stress it more than purely therapeutic measures.

Nevada—Continue the Committee on Parasitic Diseases and see that it functions from a practical angle. Continue to stress the economic importance of parasites. Report yearly on any new developments in the field of actual or threatened economic importance or public health menace and improved control measures.

New Hampshire—Give fellowships to graduate veterinarians to carry on parasitic control investigations in connection with state universities and institutions where they were equipped for such work.

New Jersey—Proper agencies should be brought to understand the need for such investigation.

New Mexico—Should attempt to get a permanent appropriation for the establishment of laboratories of the U. S. Bureau of Entomology and Plant Quarantine at advantageous locations along the Mexican border from East Texas to California.

New York—A more serious attempt to determine the losses caused directly and indirectly as a result of uncontrolled parasitism of live stock.

North Carolina—Encourage appropriations for research.

North Dakota—Get the methods applied on the farm.
Ohio—Place more emphasis on parasite subjects on their programs. Secure appropriations to conduct research and control measures.

Oklahoma—An educational campaign.

Oregon—That some veterinary college give a real training in parasitology.

Pennsylvania—Collect data and recommend the best known methods, or methods which have been successful experimentally and which are based chiefly on sanitation.

Puerto Rico—Make a general survey of parasites.

Tennessee—Should give similar consideration to important animal parasites as to problems of infectious diseases.

Texas—Will leave the answer to this to the Live Stock Sanitary Commission.

Utah—Concentrate on program until completed. Attack two or three parasites at once and eliminate them, in the meantime holding all other parasitic diseases within our control.

Vermont—No special needs in Vermont.

Virginia—Stimulate interest on the part of the Directors of Experiment Stations by pointing out the importance of parasitic diseases and indicating to them the importance of employing men with proper background for investigational work in parasitology.

West Virginia—Have more papers and reports in the meetings to give this field more publicity—to interest sanitarians.

Wisconsin—Propaganda.

Wyoming—Determine the life-cycle of tapeworms of herbivorous animals. Discourage promiscuous worming of dogs, cats, chickens and sheep.

Parasites in Wildlife*

Various organizations and individual workers are engaged in making investigations of a limited scope in parasites of wildlife. Most of these studies are, however, in the field of taxonomy or conducted incidental to investigations on the welfare of human beings or domestic live stock. It appears that the Bureau of Biological Survey, U. S. Department of Agriculture is the only agency making a general study of the diseases and parasites specifically for the benefit of wildlife. This work is carried out largely through cooperation with other organizations situated in favorable positions to study local conditions and a special effort is made to determine the role played by parasites in the actual losses of wildlife.

Examination of animals, especially rabbits and grouse, where they can be found at present in the Great Lakes States, reveals unbelievable numbers of ticks. Small game has recently become suddenly very scarce in most of this region where excessive numbers of ticks were reported last year. It was then anticipated that the great populations of these disease-transmitting parasites would presage the die-off which had occurred. Most of the ticks examined in these studies have been identified as *Haemophysalis leporispalustris* although other forms were not uncommon. The tick *Dermacentor albipictus* was found in great abundance by Fitch and his associates on the moose in Minnesota during the last few years.

Another species of big game, the mule deer, in an extensive range covering a great part of the Rocky Mountain region, has been noted frequently affected with a nematode, *Onchocerca fenzli*. This parasitic worm, the life history of which is unknown, becomes embedded beneath the skin of the feet or lower part of the legs, causing abscesses and inducing lameness and other destructive sequelae. Rush reports a high percentage of the deer in the vicinity of Paradise, Montana, thus affected.

Heretofore bubonic plague has been almost constantly present in the rodents west of the Rocky Mountains, confined largely to California, but it has recently been found that this disease has appeared in

*Prepared by Dr. J. E. Shillinger, U. S. Bureau of Biological Survey.*
the ground squirrels east of the Rockies in Montana. Since fleas are so intimately concerned with the spread of plague and since fleas are found in considerable numbers on ground squirrels and associated animals, it is highly probable that it will be only a matter of time until bubonic plague is distributed over their entire range. It has been shown, however, by Francis, and by Green and Shillinger, that fleas are of no importance in the spread of tularemia.

The recent finding of *Dirofilaria sp.* by Shillinger in the hearts of muskrats raises the question of the possibility of these animals being the original native host of this parasite. These were collected in the South Atlantic States where great numbers of mosquitoes were present.

Of interest to the sportsmen in the northern part of the continent is the finding of a Leucocytozoon in the blood of grouse in Canada by Clarke and also by Allen in the ptarmigans. The degree of pathogenicity of these organisms has not yet been determined but local reports describe a decrease of birds where this protozoan is prevalent.

An interesting report is also recorded by Manwell, in New York, of the presence of a malaria-like parasite in the blood of migratory birds such as robins and cliff swallows. Only the adults which had migrated to and from the South for a winter's sojourn were affected, indicating that the source of the infection was not present in New York but was being transported there from a more southern latitude.

In a survey of wild cottontail rabbits in the eastern states a high percentage showed sarcosporidiosis. These parasites are being recorded more frequently each year. It is not believed that they are necessarily becoming more plentiful but a more systematic search for abnormalities in wildlife is bringing them to our public attention.

What may be described as an outbreak of a fatal form of parasitism was a more or less extensive loss of waterfowl in British Columbia during the past year. Wild ducks (mergansers) on several lakes showed a serious infestation with a high rate of mortality resulting from the presence of great numbers of *Eustrongyloides mergorum* in the walls of the proventriculus. The action of these worms causes great proliferation of tissue so that the organ loses its structural identity and function.

A species of small red ant, reported by Stoddard, *Solenopsis molesta*, which causes widespread destruction of bob-white quail in the nests in the southeastern states, appears to be spreading and becoming more numerous. These pests swarm into the nests in immense numbers just at hatching time and destroy the young after the shells are broken and before the helpless chicks are able to protect themselves or leave the nests. As yet there appears to be no satisfactory control measure.

Screw-worm infestation in deer and other wild animals in the southern states has been marked during the past several years. Just what factors other than unusually dry seasons are involved in bringing about these conditions can not be stated.

Saunders, working in Michigan, observed a species of eyeworm affecting the ruffed grouse there. While the cockroach has been found to be the intermediate host of eyeworms of domestic chickens in the southern states, the native environment and habits of wild grouse preclude the possibility of this insect serving as the secondary host in this instance.

In summarizing the situation of parasitism in wildlife as it has been observed there is evident a serious lack of specific data on the subject. Especially is there a dearth of factual information on the life histories of many important parasites. This field of research is very inviting to young biologists doing graduate work in biology. Assistance in the form of collaboration and information is offered by the Division of Wildlife Research, Bureau of Biological Survey, in Washington whenever possible. The growing importance of wildlife and our American conservation policies are such that activity in this field should be encouraged in our veterinary colleges and research institutions.
### Answers to questions 1 to 5.

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<th>State</th>
<th>Questions 1, 4 and 5: Parasitic Diseases Common in</th>
<th>Question 2: Relative Importance of Parasitic Diseases</th>
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<td></td>
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<tr>
<td></td>
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<td>Lice*</td>
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</table>

* Asterisk (*) indicates diseases that are more common. † Double asterisk (†) indicates diseases that are less common. Following are the data for the remaining states:

- **California**: More in sheep, equal in poultry, less in all other livestock.
- **Colorado**: More in sheep, equal in poultry, less in all other livestock.
- **Connecticut**: More in sheep, equal in poultry, less in all other livestock.
- **Delaware**: More in sheep, equal in poultry, less in all other livestock.
- **Florida**: More in sheep, equal in poultry, less in all other livestock.
- **Georgia**: More in sheep, equal in poultry, less in all other livestock.
- **Idaho**: More in sheep, equal in poultry, less in all other livestock.
- **Louisiana**: More in sheep, equal in poultry, less in all other livestock.
- **Michigan**: More in sheep, equal in poultry, less in all other livestock.
- **Minnesota**: More in sheep, equal in poultry, less in all other livestock.
- **Mississippi**: More in sheep, equal in poultry, less in all other livestock.
- **Missouri**: More in sheep, equal in poultry, less in all other livestock.
- **Montana**: More in sheep, equal in poultry, less in all other livestock.
- **Nebraska**: More in sheep, equal in poultry, less in all other livestock.
- **New Hampshire**: More in sheep, equal in poultry, less in all other livestock.
- **New Mexico**: More in sheep, equal in poultry, less in all other livestock.
- **New York**: More in sheep, equal in poultry, less in all other livestock.
- **North Carolina**: More in sheep, equal in poultry, less in all other livestock.
- **North Dakota**: More in sheep, equal in poultry, less in all other livestock.
- **Ohio**: More in sheep, equal in poultry, less in all other livestock.
- **Oklahoma**: More in sheep, equal in poultry, less in all other livestock.
- **Oregon**: More in sheep, equal in poultry, less in all other livestock.
- **Pennsylvania**: More in sheep, equal in poultry, less in all other livestock.
- **Rhode Island**: More in sheep, equal in poultry, less in all other livestock.
- **South Carolina**: More in sheep, equal in poultry, less in all other livestock.
- **South Dakota**: More in sheep, equal in poultry, less in all other livestock.
- **Tennessee**: More in sheep, equal in poultry, less in all other livestock.
- **Texas**: More in sheep, equal in poultry, less in all other livestock.
- **Utah**: More in sheep, equal in poultry, less in all other livestock.
- **Vermont**: More in sheep, equal in poultry, less in all other livestock.
- **Virginia**: More in sheep, equal in poultry, less in all other livestock.
- **Washington**: More in sheep, equal in poultry, less in all other livestock.
- **West Virginia**: More in sheep, equal in poultry, less in all other livestock.
- **Wisconsin**: More in sheep, equal in poultry, less in all other livestock.
- **Wyoming**: More in sheep, equal in poultry, less in all other livestock.

*Note: The information provided is an excerpt from a larger table. The full table contains detailed data for each state and disease, including the number of parasitologists employed and the relative importance of parasitic diseases.*
### Answers to questions 1 to 5—continued.

<table>
<thead>
<tr>
<th>State</th>
<th>Strongylids*†</th>
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<th>Round worms*†</th>
<th>Round worms*†</th>
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<th>No full-time</th>
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* These parasites are common in sheep and horses, others equal. ** These parasites are more in sheep, less in hogs.
<table>
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<th>State</th>
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<th>Question 2: Relative Importance of Parasitic Diseases</th>
<th>Question 3: Number of Parasitologists Employed</th>
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### Answers to questions 1 to 5—concluded.

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**Note 1.** All of the common parasitic diseases of this climate.
**Note 2.** Nearly all parasitic diseases; those of sheep and poultry studied.
**Note 3.** Practically all the common ones to horses, cattle, sheep, hogs and poultry.
**Note 4.** Lice and ring worm are most common in Vermont.

* = Given special study.
† = Successfully combated.
‡ = Unsuccessfully combated.
PRESIDENT RECORDS: The next is the report of the Committee on Tick Eradication. The report was submitted by mail. Dr. Cary, the chairman of the Committee, died since the last meeting, and the chairmanship was then taken by Dr. W. M. MacKellar.

By some coincidence, no member of the committee is here. I think it is a nice report. I have read it, and it has been approved by the Executive Committee. If he is willing, I should like to call on Dr. A. W. Miller to read the report, since he is of Dr. MacKellar’s organization.

... Dr. Miller read the report. ... (Applause.)

REPORT OF COMMITTEE ON TICK ERADICATION

Dr. W. M. MacKellar, Chairman, Washington, D. C.
Dr. J. V. Knapp, Tallahassee, Fla.  Dr. W. K. Lewis, Columbia, S. C.

Your Committee on Tick Eradication reports that the systematic drive to eliminate the cattle fever tick from the infested areas of the United States continued throughout the year, the net results for the work of the season being a reduction of 2,088 square miles, all in the state of Florida, in the area held under federal quarantine for splenetic or tick fever in cattle. This action is covered by Bureau of Animal Industry Order 358, effective December 1, 1935, by which order the counties of Hardee, Hillsborough, Pasco, Pinellas, Sarasota, Manatee, and part of Polk, are released from federal quarantine, and the counties of Orange, Osceola, Seminole, and part of Polk, are requarantined. This order also continues unchanged the quarantine on 22 parishes and part of two parishes in Louisiana; 34 counties and part of two counties in Texas; and on the territory of Puerto Rico.

During July, this project received an allotment of funds under the Emergency Relief Appropriation Act of 1936, totalling $1,454,000, to be expended in the States of Florida, Louisiana and Texas. As the tick eradication season was well advanced before this allotment became available, and as a number of restrictions had to be met and adjusted, there has been some delay in getting this emergency project in full swing. These matters are being adjusted and it is believed that the project will be greatly advanced by this assistance during the coming year.

The territory of Puerto Rico, the last infested area of the United States to undertake a systematic tick eradication campaign, has also received an allotment of emergency funds and plans to begin eradication work at an early date.

Reinfestations in the released area this season have been more numerous and extensive than at any time in recent years. They were found in Arkansas, Florida, Georgia, Louisiana, Mississippi and Texas. These occurrences not only indicate the need for the closest supervision of movements from the quarantined area but again emphasizes the fact that as long as any section is tick-infested, there is danger of the spread of this pest to the free area. The ever-increasing number and distance of truck movements of live stock are undoubtedly important factors in this as in other live stock sanitary problems. There should be no let-down in the interest in this project and its problems, particularly in states adjacent to the infested area.

In certain areas in Florida, it has been found that infestation is being perpetuated by ticks which develop on deer. In this state, the tropical variety of fever tick, *Boophilus annulatus* var. *australis*, is generally found and this species of tick, coupled with several large deer ranges, provide a special problem there. The requarantine of area in this state, referred to above, was made necessary to better control this situation.
The attached statement of the Bureau of Animal Industry, giving the status of this work as of December 1, 1936, is appended for the records of the Association.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry
Washington, D. C.

Progress in Tick Eradication—July 1, 1906, to December 1, 1935

<table>
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<th>State</th>
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<th>Counties Released to Dec. 1, 1935</th>
<th>Area Quarantined on July 1, 1906</th>
<th>Area Quarantined on Dec. 1, 1935</th>
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Area released December 1, 1935: 5,323 square miles
Area quarantined December 1, 1935: 3,235 square miles

(Dr. Miller: I move the report be accepted.

The motion was regularly seconded, put to a vote and carried.

President: Next is the Committee on Revision of Constitution and By-laws. Dr. T. E. Munce is chairman, but neither he nor none of the committee members is present at this meeting. No report has been received by mail. Unless someone here has it for transmittal, I presume there is none.

Next is the report of the Committee on Unification of Laws and Regulations, Dr. H. A. Seidell, Chairman. This report also has been approved by the Executive Committee.

Dr. Seidell read the report...
REPORT OF COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

Dr. H. A. Seidell, Chairman, Des Moines, Iowa

Dr. J. H. McNeil, Trenton, N. J. Dr. W. H. Hendricks, Salt Lake City, Utah
Dr. C. T. Guilfoyle, Phoenix, Ariz. Mr. J. H. Mercer, Topeka, Kans.

In the 1934 convention of the United States Live Stock Sanitary Association President Robinson, in his address, mentioned the fact that a very unsatisfactory condition exists with respect to the control of hog cholera. After discussion of this subject in the Executive Committee meeting, the problem was referred to the Committee on Unification of Laws and Regulations; this Committee to report at the 1935 meeting. As a result of this assignment, your Committee, after deliberating, find the following conditions to exist with respect to this problem:

The control of hog cholera depends largely upon the proper supervision of the sale and administration of hog cholera virus; another factor is the proper supervision over the movement of hogs after vaccination, and also proper supervision over the so-called public sales.

Another condition which seems to contribute very much to the spread of hog cholera is the indiscriminate moving of hogs to market immediately after the owner finds that his hogs are infected with or exposed to hog cholera.

We find that the various states are not handling this situation on a uniform basis. Some states have regulations of laws placing some restriction on the sale and administration of hog cholera virus, while others seemingly have no supervision over this at all. A number of states permit the use of virus by laymen, others issue permits to laymen to use virus on their own hogs; while still others permit the sale and use of hog cholera virus indiscriminately.

Your Committee feel, with this situation existing, it is quite impossible to properly control hog cholera, and as a result, the indictment made by President Robinson and others, we find to be wholly justified. We feel that the situation has developed to a point where this Association should take some unified action looking to the solution of this important problem.

Your Committee feel that in order to control hog cholera and eliminate the unsatisfactory conditions existing with respect to this disease, that

1. A uniform law or regulation which would be effective in each state, should be adopted, providing for the supervision over the sale and administration of hog cholera virus. We feel that the use of hog cholera virus should be completely in the hands of the qualified veterinarians.

2. Your Committee recommends that each state work for the adoption of a uniform law or regulation providing for the use of hog cholera virus by competent veterinarians only.

3. Your Committee also recommends that all hogs receiving simultaneous treatment shall be held in quarantine for a period of not less than 21 days from date of vaccination.

4. Your Committee further recommends that the Live Stock Sanitary officials of each state endeavor to prohibit the moving of cholera infected or exposed hogs for any purpose whatsoever.

Dr. H. A. Seidell: This report has been approved by the Executive Committee and I move its adoption.

The motion was regularly seconded, put to a vote and carried.

President Records: Next is the report of the Committee on Legislation, Dr. D. E. Westmorland, Chairman.

Dr. Westmorland read the report.
REPORT OF COMMITTEE ON LEGISLATION

Dr. D. E. Westmorland, Chairman, Frankfort, Ky.

Dr. Chas. E. Cotton, Saint Paul, Minn.
Dr. Wm. Moore, Raleigh, N. C.

Dr. R. W. Smith, Concord, N. H.
Dr. L. M. Hurt, Los Angeles, Calif.

During the past year, the activities of this Committee have been limited. Through the efforts of some of the active members of this Association a successful effort was made to prevent the passage of legislation by the past Congress to divert part of the funds made available by the Jones-Connally Cattle Bill for the elimination of Bang's Disease. This legislation was introduced in the interest of the patent medicine industry. Its purpose was to sell the government millions of pounds of a worthless patent abortion remedy, to be paid for from the above-mentioned funds.

Several states have enacted laws for the benefit of livestock disease control. One of special interest is the act passed by the Ohio Legislature at a recent session regulating the movement of livestock through local sales yards. Like legislation is needed in several states which, we think, will materially assist in the control of hog cholera, sheep scabies and other communicable diseases of livestock. The operation of this law will be observed with interest by states which have marketing conditions similar to those existing in Ohio before the passage of this act.

We recommend that a cooperative effort be made by the various agencies of this Association to prepare uniform laws and quarantine regulations governing livestock disease control work.

DR. WESTMORLAND: This report has been approved by the Executive Committee. I therefore move its adoption.

The motion was regularly seconded, put to a vote and carried.

PRESIDENT RECORDS: Next is the report of the Committee on Policy, Dr. J. R. Mohler, Chairman. No report has been received and unless one is presented here, there will be none.

Next is the report of the Committee on Resolutions, Dr. M. Jacob, Chairman.

REPORT OF COMMITTEE ON RESOLUTIONS

Dr. Jacob: Gentlemen, the resolutions I have to offer have the full approval of the committee members here at this meeting, Dr. H. E. Curry, Dr. D. M. Campbell, Dr. W. A. Sullivan and myself. The resolutions were submitted to the Executive Committee, and they are recommended by the Committee for adoption.

RESOLUTION 1

WHEREAS, Dr. O. E. Dyson, who for so many years has served as Secretary-Treasurer of this Association, has recently tendered his resignation, and

WHEREAS, In his official capacity he has rendered a most efficient and constructive service, not only to this Association but also to the livestock industry and for the public welfare in general, therefore, be it

Resolved, That the United States Live Stock Sanitary Association go on record in expressing to Dr. O. E. Dyson the appreciation of its membership by a rising vote, and be it further

Resolved, As an indication of our esteem and appreciation, that Dr. O. E. Dyson be elected as Honorary Secretary of this Association, and that the newly-elected Secretary be instructed to forward to Dr. O. E. Dyson a copy of this Resolution.

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RESOLUTIONS

Dr. Jacob: Mr. Chairman, I move its adoption.

... The motion was regularly seconded, and carried unanimously by rising vote.

... Dr. Jacob read resolution 2...

Resolution 2

Whereas, There appears to be in this country a growing tendency toward establishing of community, private and other forms of live stock buying and selling agencies, and

Whereas, Many of these agencies are not operating under immediate official live stock sanitary supervision, and

Whereas, Such more or less unrestricted interchange of live stock has become a means of spreading transmissible live stock diseases, and a potential menace to the industry, therefore, be it

Resolved, That this Association recommend to all state live stock sanitary departments the adoption and enforcement of suitable live stock sanitary regulations to provide the necessary protection against the spread of disease from such widespread dangerous sources.

Dr. Jacob: I move the adoption of this resolution.

... The motion was regularly seconded and carried.

... Dr. Jacob then read resolution 3...

Resolution 3

Whereas, The American Veterinary Medical Association, through a special committee, has initiated a project to collect, assemble and publish statistics on animal diseases, therefore, be it

Resolved, That this Association endorse this project of the American Veterinary Medical Association, and that our members be urged to cooperate and assist in every way possible in the work of this important committee.

Dr. Jacob: I move the adoption of this resolution.

... The motion was regularly seconded and carried.

... Dr. Jacob then read resolution 4...

Resolution 4

Whereas, There is pending before the Congress of the United States a measure to provide trade agreements with a South American country, and

Whereas, That country harbors within its borders infectious diseases of live stock, especially foot-and-mouth disease, which do not now exist in the United States, and

Whereas, Said agreement provides for a repeal of a section of our present federal law governing the importation of live stock and live stock products into the United States, and

Whereas, the importation of live stock or live stock products from such infected countries may seriously jeopardize the welfare of our live stock industry, therefore, be it

Resolved, That this Association go on record as vigorously opposing any modification of existing federal laws governing the movement of live stock or live stock products from any foreign country harboring foot-and-mouth disease or any other transmissible disease of live stock which does not now exist in the United States, and be it further

Resolved, That a copy of these resolutions be forwarded immediately to the chairman of the Foreign Relations Committee of the United States Senate.

Dr. Jacob: I move the adoption of this resolution.

Dr. W. J. Butler: I will second the motion. There is just one thing I want to say. That is a wonderful resolution. If it is not
asking too much, I would appreciate a copy of that resolution being forwarded to every state veterinarian, or every officer in charge of live stock in the United States, with a request that it be given as much publicity in the papers as possible.

I do not know how you men feel in the eastern section, but I know how we feel in the West. We know foot-and-mouth disease exists in the South American countries, and perhaps it is not such a serious problem with them, but we know that if foot-and-mouth disease ever gets in the cattle of Montana, we are through.

You just could not visualize foot-and-mouth disease being in a herd of cattle in the winter, and that herd of cattle coming through until spring. It isn't possible.

There is no more important resolution being presented to this particular organization than the one that has just been read. I do hope that each individual veterinarian in the United States will get a copy, or become cognizant of this resolution and do everything possible to bring to the attention of his colleagues these important facts.

We know from years past that some of the banks in New York, particularly, are interested in opening up trade channels with the Argentine and other South American countries. They do not realize what effect it would have upon this country if foot-and-mouth disease came to us. We appeal to you to give this as much publicity as possible, and I so move.

PRESIDENT RECORDS: Dr. Jacob, is that amplification of the resolution accepted?

Dr. Jacob: Yes.

PRESIDENT RECORDS: As the motion is being voted on, it carries that instruction to the Secretary, to see that at least each state veterinarian gets a copy of this resolution, and that it be given as much publicity through the proper channels as possible.

Dr. H. D. Fort: In addition, I should like to add to that that each member of the Senate Committee be supplied with a copy of the resolution.

PRESIDENT RECORDS: Is that agreeable to the maker and seconder of the motion?

Dr. Jacob: Yes.

Dr. Butler: Just so they realize the danger. Ten years ago, this particular proposition came up. We talked here about it, and I remember I went to Washington and saw the late Senator Walsh about it. He got in touch with Senator Kendrick. I had been to South America. I knew a diplomatic free lance who had engineered many a trade deal between the United States and the South American countries, and he told me that at the time it was all cut and dried and he could not stop it, that the bankers of the United States simply had to make good on an agreement of this kind which is contemplated.

I tell you there is no greater danger to the live stock industry of the United States today than this proposed agreement between the United States and these South American countries, not only from a financial standpoint, a strictly economic standpoint of dollars and cents, but the after-effects that may come from the importation of these South American cattle. To have some one else pass upon whether or not these cattle should come into the United States is absurd from a sanitary standpoint. It is dangerous and it is dynamite, and I hope by giving this enough publicity, we will be able to do our share in preventing this agreement.

Dr. R. M. Sardes: In giving publicity to that resolution, contact the United Press and the Associated Press, and you will have international publicity on the resolution tomorrow morning.

The question was called for.
ELECTION OF OFFICERS

The motion is a little complicated now, so we will proceed to vote on it. Those in favor kindly signify by saying "aye"; those opposed, "no." It is so ordered.

The next order of business appears to be the election of officers for the ensuing year. We will hear the report of the Nominating Committee, given by Dr. H. D. Port.

ELECTION OF OFFICERS

Dr. Port: Dr. Crossman, chairman of the Committee, has been called away, and he asked me to make the report of the Nominating Committee.

For President, Dr. Walter Wisnicky, Madison, Wisconsin. For First Vice-President, Dr. R. W. Smith, Concord, New Hampshire. For Second Vice-President, Dr. D. E. Westmorland, Frankfort, Kentucky. For Third Vice-President, Dr. J. L. Axby, Indianapolis, Indiana.

Mr. President, I move the adoption of this report.

The motion was regularly seconded.

President Records: It has been moved and seconded that this report of the Nominating Committee be adopted. Are there any questions. Under the heading of questions, independent nominations are permissible. There are none, and the question has been called for. Those in favor of the report of the Nominating Committee vote "aye"; those opposed, "no." There is no opposition.

The report of the Committee provides that the new officers be: President, Dr. Walter Wisnicky; First Vice-President, Dr. R. W. Smith; Second Vice-President, Dr. D. E. Westmorland, and Third Vice-President, Dr. J. L. Axby. If the officers are here, we should like to have them brought forward.

INSTALLATION OF OFFICERS

Dr. Port: Dr. Smith has been called away. We present the remaining officers. (Applause.)

President Records: The incoming president is compelled to make a speech.

President-Elect Wisnicky: Mr. President and Fellow Members: I believe this is one of the moments that Dr. Axby talked about last evening. I did not really anticipate this, neither did I suspect it was going to happen. I had a feeling I was near the top, being First Vice-President last year, but when I reviewed the history of the past, I noticed that the First Vice-President did not necessarily step up, and I did not have any anticipations.

I did, however, have a little pre-warning of this during the lunch hour today. Someone made a remark about that famous city of Milwaukee, and he indicated that the President would come from the state in which that city is located, but I immediately told him that the famous industry of Milwaukee was merely incidental to the great barley-growing industry of our state, and that was a small industry, but the biggest industry in our state was the great dairy industry, composed of 3,250,000 cattle.

I do want to tell you, since I have been elected to the presidency, that I deeply appreciate it, and I certainly want to keep that confidence which you have bestowed upon me in electing me to the presidency. I feel, however, a little inadequate at the present time. I know of the famous presidents who have preceded me, and the splendid work that Dr. Records has done here during the past year, and I do not know whether I can measure up to that high standard or not. I do wish to assure you in my rather humble and sincere way, that I will try to do all I can to carry out the functions of this office, and see that the Association goes ahead with its program of achievement, but I likewise appreciate that I can not do that unless I have the good
and fullest coöperation of every member, so when I call upon you, through the committee chairmen or otherwise, during the next year, to work with us, I know without any further saying that you will work with me as you have with the past officials of this Association. Again I want to say that I thank you. (Applause.)

President Records: I extend my personal congratulations, and I will now turn the gavel over to you. I hope you have better luck keeping track of it than I have had this year. (Laughter and applause.)

President Wisnicky: I accept this gavel as the symbol which transfers responsibility.

Since I hold the chair now, I will call upon the Second Vice-President, Dr. Westmorland.

Second Vice-President Westmorland: I wish to thank the organization for the honor conferred upon me. Dr. Axby, who is one of the orators of this Association, wants plenty of time, so I will now yield to him. (Laughter and applause.)

Third Vice-President Axby: Mr. President, those of you who heard what I said last night, certainly did recognize that I stated one of the verities of life, because to me, this is just another thrill, coming, as I said to you last night, when least expected. I had no idea at all that this was going to happen.

I want to say to you also that I fully recognize the fact that I am Third Vice-President, and that vice-presidents should be seen, under most circumstances, and not heard. I will, however, take advantage of this opportunity to say to you, and attract your attention to the wonderful and grand old Hoosier State about which it has been said:

"The winds of Heaven never fanned,
The circling sunset never spanned,
A better or a fairer land,
Than dear old Indiana."

From that state there have come in the past, statesmen and poets, and famous politicians, and characteristic of those men I want to run true to form, and I say to you now, I appreciate this honor, and I will give my entire coöperation if it is desired or indicated or needed. I shall first back up the President, the new President, whom I know just as you folks know, and I am frank to say that in his selection, I know no mistake was made; and secondly, where it is indicated or desired, I shall back up proudly this Association, always. (Applause.)

President Wisnicky: Is there any further business to come before this Association?

Dr. Jacob: I believe there is one other thing that should be done in the form of a resolution, expressing our appreciation to the outgoing officers for the fine service they have rendered during the year. I offer that as a motion.

The motion was severally seconded, put to a vote and carried.

Dr. Jacob: I also move that we express our appreciation to the management of the La Salle Hotel for the courteous and efficient way they have served us and handled the meeting.

The motion was regularly seconded, put to a vote and carried.

President Wisnicky: Is there any further business? If not, a motion for adjournment is in order.

Dr. Port: I move we adjourn.

The motion was regularly seconded and carried, and the meeting adjourned at 2:50 p. m.

Adjournment
Appendix

Report of the Committee on Pullorum Disease, as recommended at a conference held at the La Salle Hotel, Chicago, Ill., December 6, 1934, as modified by a special committee appointed by the U. S. Live Stock Sanitary Association. (See pp. 388-389 of the report of the 38th annual meeting.)

The following paragraphs are to be added to the original report.

**PULLORUM ERADICATION**

1. Matters relating to disease shall be under the direction of the live stock sanitary authorities of the respective states in cooperation with the United States Bureau of Animal Industry.

2. In the control of pullorum disease (formerly known as bacillary white diarrhea) on any farm or poultry plant, all chickens over four months of age must be tested for pullorum disease by means of some officially approved method and reactors must be removed from the premises upon completion of the test and the premises must be immediately carefully cleaned and disinfected under official supervision.
40th Annual Meeting
United States Live Stock Sanitary Association
Hotel La Salle, Chicago
December 2-3-4
1936
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