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

HOTEL LASALLE, CHICAGO, ILL
December 2-3-4, 1931
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36th Annual Meeting
United States
Live Stock
Sanitary Association
Hotel La Salle Chicago
November 30, December 1-2
1932
PROCEEDINGS OF THE

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Dr. W. J. Butler, Helena, Mont.         Dr. C. E. Cotton, St. Paul, Minn.
WEDNESDAY MORNING, DECEMBER 2, 1931

The opening session of the thirty-fifth annual meeting of the United States Live Stock Sanitary Association, held at the LaSalle Hotel, Chicago, Illinois, December 2-4, 1931, convened at 10:20 a.m., Dr. J. W. Connaway, president of the Association, presiding.

PRESIDENT CONNAWAY: I am glad to see so many present at the opening session. This is especially gratifying since we are honored by the presence of a distinguished representative of agriculture who has consented to give us a few words of greeting, and of encouragement in the work we have at hand. I refer to Mr. R. W. Dunlap, an Ohio farmer, as well as Assistant Secretary of the United States Department of Agriculture. Doctor Dunlap needs no special introduction to this body, since he is known to most of you through official communications and other contacts. I think it will interest you, however, to learn something of his past which he, in his modesty, is inclined to keep under cover. I will try not to embarrass him by the facts divulged.

A few evenings ago, a banquet was given at the Saddle and Sirloin Club of this city, at which the honor guest of the occasion was Mr. Renick W. Dunlap; and the culminating incident of the evening was the unveiling of an oil portrait which bore a striking resemblance to our guest. Another happy circumstance was that this portrait had a place of honor between two other oil portraits which had graced the walls of the Club for many years. One was that of his grandfather; and the other of a great-uncle—the Renick brothers—to whom the pure-bred cattle industry of America owes a large debt for their constructive work in cattle-breeding. I learned, moreover, from one of his old neighbors that the labors of his Dunlap ancestry were of great value in the development of Thoroughbred breeding in Kentucky and other parts of the country.

I am mentioning these facts to bring out the point that the interest of our guest in the work in which we are engaged is not a casual one; but is to some extent an inheritance. Fortunately, he has not been content to wear the laurels of his worthy ancestors; but, as the record shows, he has made for himself, by his own industry, and learning, and discriminating judgment, a worthy place in the affairs of his local community, state and nation. Listen to some of the things that were said of him by those who have known him from his boyhood days: It was related that in his younger days, by diligent attention to books, lectures, laboratories, and field projects, such as husking corn, feeding hogs, and spreading the aroma of horse and cow dung over the fields of the home farm, he won a Bachelor of Science degree from his State University. Moreover, that he proved his faith in his scientific training by several years of intense practical application of his "book-larnin'" on the farm. It is further told of him that after a good ripening period of combining science and farm practice his services were sought and given as a lecturer before Farmers'
Institutes. He became in fact one of the fore-runners of the present-day "farm extension specialists"—but with the difference that his repertoire included a wider range of subjects; all of which, I dare say, were handled in a most satisfactory manner. It is evident at least that a considerable number of Ohio farmers and other business people thought so; since they elected him to the State Senate to try his skill in the formulation and enactment of laws for the benefit not only of agricultural people, but for the citizens in general. He thus became the author of the Ohio law relating to commercial feedstuffs, and a strong factor in the enforcement of the pure-food laws. His position at another time as Dairy and Food Commissioner, and for a time as Secretary of Agriculture of his state, gave him opportunities for large and valuable service which those who know say he faithfully performed.

I have referred to Mr. Dunlap as Doctor Dunlap, which is an easy slip to make in this assemblage. The title was not applied in a facetious manner; but even though he may shy at such a title, I am sure that all of you will agree that a man who has to his credit the record I have mentioned is fully worthy of the highest academic degree—a doctorate honoris causa. It is therefore with the greatest pleasure that I present Mr. Renick William Dunlap, college graduate, farmer, public lecturer on agricultural subjects, legislator, and an executive of large experience in state and national affairs. I hope, Mr. Dunlap, that what I have divulged to this group of your friends, and coöperators in the work of live stock sanitation, will not increase the natural embarrassment which you experienced a few evenings ago at the Saddle and Sirloin Club. We shall be glad to have your message. (Applause)

OPENING ADDRESS

By Renick William Dunlap, Washington, D. C.

Assistant Secretary, United States Department of Agriculture

Mr. President, Ladies and Gentlemen:

I hope you will forget this "Doctor" business as connected with me. If I were a doctor, of course, you would expect me on this occasion to make a scientific speech. I haven't any such thing in my system; in fact, I haven't any speech. I am pretty much like the fellow who, years ago, before we had good roads back in Ohio, went to the village and got a load of brick. He started home, but he hadn't gone far until he got stuck. He unloaded some of the brick; he went a little farther, and got stuck again. He unloaded a few more brick, and a third time he got stuck. His neighbor came along and said "Well, Brother Jones, what seems to be the trouble?" "Well," he said, "Here I am stuck in the mud with nothing to unload." (Laughter.)

I am a little bit different from that this morning. I really have too much to unload. It is a question of what you can stand, just what I should unload on you folks.

One of the penalties I find in holding public office such as I do, is that you are expected to make a speech on any and all occasions. I didn't know until just—well, I believe the Doctor did say something to me a day or two ago about coming over
here this morning and saying, "How-do-you-do?" But I forgot all about it until this morning. I have had other things on my mind since I have been in Chicago, as the Doctor will verify, and a few others whom I see in this audience, one thing in particular that would worry almost any human being, anyone who is human, at least.

I do want to say, however, that I deem it quite a privilege to come before this body of men and bring you greetings from the great Department of Agriculture. I want to say further that I can sympathize with you in the splendid work you are doing in your respective states. I, too, was in a similar position to that which many of you hold, when I was a state official in my own state, enforcing sanitary measures, sanitary laws. I know that many times it is not a pleasant duty. But I also know that it is a duty which, if well performed (and I am certain it is well performed in most circumstances) is of much value to the live stock industry of this country.

At the present time some folks are saying that because of the low value of live stock, we can get along with less work in looking after health measures; that because of the fact that cattle and hogs and sheep and poultry are of less value than they were a few years ago, we can lessen our effort. My notion is that we should accelerate rather than retard, because it is more necessary than ever that the farmers and live stock men of this country preserve the health of their animals.

I am indeed glad to note that you are discussing, as the first thing on your program, that terrible disease—contagious abortion. Your President has said that I am a practical farmer and live stock man. That is true. I have been in the live stock business all of my life, and I have had experience. I have experienced losses that are quite considerable, from live stock diseases, and contagious abortion was one of them. I believe I am correct in saying that there is more loss from contagious abortion today than from all other live stock diseases combined, and that is very considerable, as you know.

I recall in my rather early life the sad experience I had with hog cholera. While a student at the Ohio State University, I had some veterinary work under old Dr. Detmers. Perhaps some of you knew that grand old man. I recall at that time he was doing experimental work on hog cholera. I was in his class. I told him that we were losing hogs on our farm; in fact, that year we lost several hundred valuable hogs. He said, "I have a hog
here on which I am experimenting. I would like for you to send it down to your farm and turn it in with those sick hogs and the hogs that have died. "If the hog lives, it is your hog."

I wasn't taking much of a chance, so I agreed to do that. We sent it down. The hog lived. I got something like thirty dollars for it. I remember that very well, because thirty dollars in those days was really more than thirty dollars in these days.

It occurred to me then that if something could be discovered whereby we could prevent the tremendous loss that was taking place from hog cholera, what a wonderful thing it would be. Today, of course, we all know that if a farmer will inoculate against hog cholera, he can save his hogs.

I might go on here at great length and discuss many of the things that are of interest to me, but I know you have a long program and you have men here who are eminently qualified to discuss these various topics.

I can just say, before sitting down, that we of the Department of Agriculture appreciate the splendid cooperation which you men have given us throughout the past. Of course, I haven't been with the Department long, compared to the time many of those in the audience have been with it, but I do not recall a time (at least it has not come to my attention) when we have not gotten along harmoniously with all of you who are doing cooperative work with us. Certainly this cooperative work is much better, I believe (I am speaking broadly), than where we are going at it alone. I sincerely hope that we will continue this cooperation because, as I say, it is of the utmost value.

I wish for you a most successful session, and that you will go home with renewed encouragement. (Applause)

President Conaway: The Assistant Secretary can rest assured that this group of live stock sanitarians as a body, and as individuals, will give his Department the fullest measure of cooperation in controlling and eradicating the animal scourges of this country.

We are thankful, Mr. Dunlap, for your instructive and cheering words. I am sure that the research men present will not forget how near you missed being a Doctor—a scientific doctor. It was indeed interesting to me to learn that in your college days you had veterinary instruction from one of the most unique and efficient of the old-time teachers of veterinary medicine—Dr. Detmers. Moreover, that you were a "de facto" research assistant, and proved in a very satisfactory and convincing way the "immunity against cholera" of a pig which your old preceptor had been experimenting with. But this is dangerous ground to tread, since all the "scientific doctors" are still at sea on one important fact relating to hog cholera. No one yet knows the cause of hog cholera. This is an intriguing field worthy of tireless investigation, since out of it may come results which will revolutionize our very useful yet very crude methods of handling this disease. I am sure that Mr. Dunlap's
interest in the research phases related to disease control has not abated since his early experiences in that field; and that in every proper way he will give it his heartiest support.

Mr. Dunlap has told me that he has another engagement this morning. It would be our pleasure to have him remain throughout all our sessions; but under the circumstances, we will excuse him when it is necessary for him to go.

The next in order on the program is an address by Dr. H. Gideon Wells, Professor of Pathology in the University of Chicago. We must, however, forego the pleasure and profit of this address this morning, since word has come that a conflicting professional engagement detains the speaker. We hope to have this address at some time during the meeting. I sincerely regret that it cannot come at this particular time; since I know from having heard Dr. Wells that his address would be far more instructive and inspiring than the talk which is to follow; and which it is my duty, according to custom, to give as president of the Association.

President Connaway delivered his address.

**THE ADDRESS OF THE PRESIDENT**

*By J. W. CONNAWAY, Columbia, Mo.*

*Professor of Comparative Medicine, College of Agriculture and Experiment Station, University of Missouri*

As president of this Association, my most important duty, as I regard the matter, is not that of delivering a formal address which would attempt, even in a summarized form, to cover the numerous aspects of live stock sanitation as they exist in various parts of the large territory comprised in our own and neighboring countries, to say nothing of the live stock health conditions of the over-seas countries with which we have trade relations. Such a task would be too large for anyone to accomplish in the brief time that should be allotted to an address by the presiding officer of an association of this character. Moreover, I believe in the division of labor. And, when I was elected to this position, it was my judgment that the best service I could render would be to divide my labors and responsibilities as much as possible with the other officers and members of the Association; and especially to place upon the various committees the duty of incorporating in their reports nearly everything that the President might feel inclined to give in an address.

I felt that my most important work was to give careful thought to the appointment of the several committees; so as to ensure for each committee a personnel of zealous workers imbued with the spirit of cooperation. Having performed that duty conscientiously, and having no misgivings concerning the results of their well performed labors, I would be happy indeed to let it go at that, and end my address at this point. I would thus avoid the risk of filching material from the committee reports. But I
shall try not to sin too greatly in this respect; besides there are perhaps some things outside the special work of the committees that may be of timely interest, and appropriate for me to say.

Most of you know that I am the oldest active member of this Association, in point of years of service; being a charter member, and the only one of the original membership who has been a regular attendant during the past several years. It may not be amiss, therefore, for me to say a few words about the origin of this Association and its original purposes. It began in a very small way; and with a very small membership. It is now beginning its thirty-fifth year, with a membership of more than five hundred; and with representatives from every state in the Union; as well as representatives from our adjacent countries, Canada and Mexico. It would certainly gladden the hearts of that small pioneer group of earnest live stock sanitarians who gathered around a cattle-dipping vat in Fort Worth, Texas, on September 28 and 29, 1897, if they could look in upon this meeting today, and learn of the great progress that has been made since the day they laid the corner-stone in the word "coöperation."

TEXAS FEVER THE REASON

This Association was organized to meet an emergency, to meet a great emergency, for the control of an infectious disease which was proving very serious in many of our states, the disease called Texas fever.

At the time I refer to, fourteen states or parts of states were under quarantine for Texas fever; and the presence of this infection was causing damage not only to the infected states, from restriction of trade, and danger to adjacent states, but also to states more remote from the shipment of tick-infested cattle in avoidance of quarantine regulations. The states of Virginia, North Carolina, South Carolina, Georgia and Florida, bordering the Atlantic; Tennessee, Alabama, Mississippi, Louisiana, Arkansas, a small section of Missouri, Oklahoma, Texas and California were under quarantine. Besides, isolated outbreaks were reported from Kentucky, Illinois, Missouri, Kansas and Minnesota.

The live stock sanitary authorities of a few of the states north of the quarantine line, and which had suffered losses from shipped-in, tick-infested cattle, namely, Illinois, Missouri and Kansas, arranged for a joint meeting with federal officials to consider the situation and by coöperative action prevent further evasion of
the Texas fever quarantine. The management of the Fort Worth stockyards, on learning of the proposed conference, invited the live stock sanitary officials of the states mentioned to meet at Fort Worth to witness the experimental dipping work that was being conducted there in cooperation with the federal Bureau of Animal Industry. In addition to Illinois, Missouri and Kansas, the following states also sent representatives: Minnesota, Colorado, Oklahoma and Texas.

It was brought out in the conference that outbreaks of Texas fever had occurred in Illinois from cattle that had been shipped in from Tennessee; and that other outbreaks have occurred in Kansas and Illinois from ticky cattle shipped from southern Missouri stockyards; but which the Missouri live stock sanitary officials claimed were cattle that had been driven to these shipping points in Missouri from tick-infested territory in Arkansas north of the quarantine line. The two northern rows of counties in Arkansas at this time were in "free territory"; but as shown by the investigations of the cattle inspectors of Missouri and the federal Bureau of Animal Industry, the quarantine was being ignored by cattle-raisers and traders. In fact the Secretary of the Arkansas Board of Agriculture or Commissioner (as came out at subsequent meetings) had very little faith in the "tick theory" of the transmission of Texas fever; and consequently had little enthusiasm for supplying competent cattle inspectors to cooperate with the federal inspectors in preventing the spread of the disease north of the quarantine line.

**Quarantine Line Changed**

In Tennessee, also, several counties were outside the quarantined area; but this free territory within the State was not adequately guarded by the state authorities, according to the investigations of the federal inspectors. These matters and others relating to the Texas fever problem were quite fully discussed at the conference. And a resolution was passed requesting the Secretary of the United States Department of Agriculture to relocate the Texas fever quarantine line upon the state lines between Missouri and Arkansas, and between Kentucky and Tennessee. These recommendations were later put into effect. The arguments in favor of this change were that, under the conditions, more effective cooperation could be carried out between the federal inspectors and state inspectors of states seriously interested in preventing the spread of the disease.
This action looked like a backward step in sanitary work; but under the circumstances, it was one of the best things that could have happened; because it called strong attention to the importance of rules and regulations for governing infectious diseases and the enforcement of those measures, as well as more effective educational work. It stirred up the stock-raisers to the importance of getting rid of the "fever ticks."

That first meeting of this Association was the beginning point of the practical progress which has been going on and on, year after year, until now only a narrow fringe of cattle-fever-tick-infected territory borders on the Gulf; and this fringe will soon be wiped out. Not a year has passed since tick-eradication work was actively initiated that the good results have not more than paid the expense. I wish to call your attention particularly to the report of this year's Committee on Tick Eradication. This report, which shows the original area by states in square miles under quarantine, and the present area, will be a heartening lesson to those who are inclined to become a bit pessimistic on the proposition of the eradication of tuberculosis or any other infectious disease that, in its very nature, is eradicable by the application of proper measures.

**Tuberculosis Control Suggested**

I wish to call attention to the fact that the question of the control of tuberculosis by the coöperative efforts of the states and federal government was presented as an important project at the first meeting of this organization. Dr. Charles Gresswell, state veterinarian of Colorado, talked briefly on this subject. No definite action, however, was taken.

The "key-note" of that first meeting was "coöperation"; and it has grown in volume from that day to this, even though we have many times had differences of opinion as to the ways and means of doing the work; or disagreed as to the timeliness of putting into force measures which all, or at least the great majority, believed to be in essence right measures.

I was glad indeed, Mr. Secretary, that in your address you gave emphasis to the importance of coöperation between the live stock sanitary department of the various states and federal government and other organizations which have a legitimate part in live stock sanitation. I am sure that everyone here will agree with you that better results will be gained by coöperation than by going at it alone.
In our work in this Association, we must keep uppermost in mind its *original* aim: that of urging and supporting proper field activities in the practical control and eradication of infectious diseases. We should not allow collateral issues, no matter how important in themselves, to divert attention from the original fundamental purposes, and thus hinder practical progress.

There has been, at times in the past, too much of a tendency to present papers of a too technical nature, having but little practical bearing on the real problems of "infective disease" control. Such papers, when followed by time-consuming technical discussions, are irritating to some, and perhaps a goodly number, of the field sanitarians who come to these meetings for information concerning the practical experiences of their colleagues, and to get the boiled-down conclusions and usable results of scientific research, which can be applied in the daily program of official and semi-official disease control.

**A WELL-DEFINED FIELD**

We should not allow our meetings to usurp the field and functions of the American Veterinary Medical Association; nor of the Association of Research Workers in Animal Diseases; nor of the American Association of Animal Production; although some overlapping of activities may be unavoidable, and even desirable. The point I wish to stress is that this Association has its own tolerably well defined field to which it should devote its main energies. It is not a veterinary practitioners' organization. Their problems in general have no place in the deliberations of this organization. Every practitioner, however, should be a live stock sanitarian, since it is within his power to render in that capacity a valuable public service. And in that capacity his membership and participation in the meetings of this Association should always be welcome.

I wish to emphasize, quite as strongly, that this Association, in its primary aims, was not meant to be a research organization; although its own legitimate activities would be futile, except for the patient labors of research workers in the field of transmissible animal diseases. It is the function of the research workers to search diligently to discover the full nature of the transmissible infections, and to find ways and means of defense and attack against them. Moreover, it is their duty to present to this Association the results of that research, in a well-digested, practical, usable form. They should keep in mind that this body is made
up largely of sanitary officers whose duties are of a regulatory nature rather than scientific. In my opinion it is indefensible for any of our research associates to present before this body a half-baked, or, in more polite phrase, an incomplete, preliminary research. Such a paper may be very important, even in its unripe state; but its proper forum is not here, but before a strictly scientific group, where it can be judiciously criticised and whipped into acceptable shape and content before it reaches this Association. Otherwise, as past experience has shown, the discussions on this floor are liable to be more confusing than instructive and helpfully constructive. In this connection I should like to make the suggestion to our members of the research group, that, before presenting a research paper before this body, they subject it to the gauntlet of criticism of the Association of Federal and State Research Workers in Animal Diseases. This organization meets annually on the day prior to the opening of the Live Stock Sanitary Association meeting; and most of its members belong to the latter association. There is no good reason, therefore, why it should not serve, in a still more effective way than it now does, as a filtering and refining agency for scientific information that will be of practical service to the larger number of the members of our Live Stock Sanitary Association whose duties lie mainly in the regulatory field.

**Original Function Should Not Be Forgotten**

I would not wish this Association to become too exclusive, and limit its programs strictly to subjects dealing with the control and eradication of transportable infectious diseases. It is, however, my very sincere hope that its original, and still most important, functions and activities shall not be weakened by the novel diversions of new collateral fields. In this connection it is pertinent to say that the United States Live Stock Sanitary Association, as an organization, is not primarily concerned with live stock nutritional problems, except in the differential diagnosis of transportable infectious diseases. A sister organization, the American Association of Animal Production, a new and vigorous group, is giving special attention to the problems of animal nutrition; and not neglecting expert veterinary aid where malnutrition and pathological questions are involved.

This comparatively new organization held a meeting here in Chicago, last week. I am a member of that Association, and attend its interesting annual sessions to participate in the dis-
cussion of physiological and pathological questions related to nutrition and reproduction. It will interest many of you to learn that at the recent meeting of the Association mentioned the subject of Bang's disease occupied the full time of the opening general session. This subject is of great interest to the animal production group. The *Bacterium abortus* Bang is a far more serious obstacle to success in animal production than imbalance of rations, or genetic weaknesses that may lower resistance to disease. The president of that Association this year, Dr. C. W. McCampbell, a graduate veterinarian, as well as head of the Animal Husbandry Department of the Kansas State College, evidently realized the need of exposing the animal production group to a larger dose of veterinary information than they had previously received. He accordingly borrowed from our live stock sanitary group three veterinary veterans, Doctors Van Es, Birch and Hadley, who discussed different aspects of the abortion question in a thoroughly practical way. These talks were well received; and I am sure that seeds of friendly and useful cooperation were planted in soil that will yield, in due time, abundant aid in accomplishing the special tasks our Live Stock Sanitary Association has laid upon itself, namely, to devise and promote practical measures for effective control, and ultimate eradication of transmissible animal diseases.

**Cooperation is Reciprocal**

The sister organization, in seeking specific information relative to abortion disease, has no desire, I am sure, to assume any of the functions and special responsibilities of our live stock sanitary organization. And by the same token, we should seek from them, on appropriate occasions, such information from their special legitimate fields as may have a definitely helpful bearing upon work. On the other hand, I think that members of our own Association, who are working in the related fields mentioned, should resist the temptation to offer papers to the live stock sanitary group that do not fit in definitely with the original practical purposes of this Association. Other and more appropriate forums are available which would give responsive hearing to good papers which would be time-killers with us, because of their minor value in carrying out the specific aims of this Association.

I fear from what I have said that some of my friends may think that I would almost favor striking from our agenda practi-
cally everything except that which relates to formulating and promoting the enforcement of veterinary sanitary police measures. Such a procedure would of course be the height of folly; although I must confess that, in my opinion, the subject of the effective enforcement of proper, uniform, state and interstate, quarantine regulations should be the chief concern of this Association. This specific subject belongs to no other organization.

We should not overlook the fact that the Executive Committee of this Association consists of representatives of the live stock sanitary control departments of all the states of the Union and of the federal Bureau of Animal Industry, and of the neighboring countries, Canada and Mexico. Moreover, it should be taken for granted that when they come together in these annual conferences the dominant idea should continue to be, as it was in the early days, how to coöperate to best advantage to prevent the transportation of animals infected with dangerous transmissible diseases from one section of the country to another; and at the same time promote trade in disease-free animals.

**QUARANTINES HAVE EDUCATIONAL VALUE**

It is self-evident that competent inspection and effective quarantine regulations are prime essentials in any successful plan of control. Without these the success thus far attained in this country in dealing with contagious pleuro-pneumonia, foot-and-mouth disease, Texas fever, tuberculosis, dourine and glanders would have been impossible. Nor should we deceive ourselves into believing that without strong reliance upon these same indispensable control measures satisfactory progress can be made in preventing the spread of the Bang abortion disease, hog cholera, Johne's disease, anaplasmosis, avian tuberculosis, and other infectious and parasitic diseases. The coöperative projects with herd-owners in the establishment of disease-free herds is doing a vast amount of good; but, without proper quarantine and proper disposal of the infected animals from such herds, a vast amount of harm will be done. Live stock sanitary boards should not shy at imposing quarantine regulations; and this Association should urge the more general and more stringent application of such measures in control of the major infectious diseases which are such a menace to the live stock industry. The educational value of a properly enforced quarantine regulation in teaching the
public the true nature of an infectious disease can scarcely be estimated.

In presenting as strongly as I have what I regard as the chief lines of duty in live stock sanitary matters which this Association should promote, I would not have anyone think that I do not fully appreciate the need and importance of research as an essential basis for support of practical procedures in disease control. Indeed, at the first meeting of this Association, it was my happy privilege, by invitation, to present the results of the coöperative experimental work which had been carried on by Dr. Mark Francis, of the Texas Agricultural Experiment Station, and myself, at the Missouri Experiment Station, on practical phases of Texas fever.

You will bear with me for reverting again to the early history of Texas fever to include a bit of the scientific background upon which this Association was founded. This will serve well to illustrate the importance of research in supplying the rational bases for effective practical control measures.

**Epochal Discoveries**

Prior to the first meeting of this Association, the classic research of Dr. Theobald Smith, with discovery of the *Pirosoma bigeminum* as the micro-parasite of the blood responsible for Texas fever, was a matter of record. Dr. F. L. Kilbourne had demonstrated that the southern cattle tick (*Boophilus bovis*) was the transmitter of Texas fever. Dr. Cooper Curtice had worked out the life history of the Texas fever tick, and had given the name, *Boophilus bovis*, to this ecto-parasite. Mr. Robert J. Kleberg had shown the value, as a ranch practice, of intermittent dipping of his cattle herds to limit tick infestation on the King ranch in Texas. Dr. Francis had constructed and used the first experimental dipping-vat for testing the value of dips on tick-infested cattle destined for shipment into tick-free territory. Dr. Victor Norgaard, of the Pathological Division of the U. S. Bureau of Animal Industry, had also carried out tests of a number of cattle dips at the King ranch. Prior to this also our good friend, Dr. Nelson S. Mayo, while Professor of Veterinary Science at the Kansas State Agricultural College, removed from his own mind every doubt he may have entertained concerning the validity of the "tick theory" of the transmission of Texas fever, by infesting his own family cow with larval ticks, the progeny of mature specimens of the *Boophilus bovis* sent to him.
from Texas by Dr. Mark Francis. I, too, but at state expense, and in collaboration with Dr. Francis, had also confirmed the "tick theory" in a much larger way, and under conditions which also precluded the possibility of infection by other means.

Other research work which I had done, and which was of scientific and practical interest at the time, was the demonstration that the fever ticks lose their infective properties for susceptible cattle when grown upon the horse, although they may become dangerous again when grown again on infected cattle. Dr. C. A. Cary, at the Alabama Polytechnic Institute, also had shown that the Alabama mule has the power to destroy the Texas fever infection in the southern cattle ticks, in tick-infested territory. I confirmed the results of his research by infesting susceptible Missouri cattle with the progeny of ticks which he had grown on mules.

I am mentioning these early researches relating to Texas fever, not because I happened to have an active part in them but to illustrate the close relationship of research to the practical control of animal diseases; and to urge that portion of our membership, which is interested chiefly in the enforcement of control measures, to maintain a sympathetic attitude toward research. And on the other hand, I would again urge our research members to keep in mind that this Association was never intended as a forum for the discussion of the details and technicalities of scientific research; although it has from the very beginning greatly appreciated the well ripened fruits of scientific investigation, when such were appropriate for its practical needs, and were presented in a reasonably non-technical form.

EARLY WORK ON IMMUNIZATION AGAINST TEXAS FEVER

Before laying aside questions of historical interest, I must mention another phase of research relating to Texas fever which culminated in considerable temporary benefit to a number of cattle-breeders in the North and South. It is well known to older members of this Association that Dr. Francis and I carried on some very successful work in immunizing cattle against Texas fever. And as a result of that work many thousands of cattle have been "vaccinated" and saved from that disease. Both of us realized, however, that vaccination was but a makeshift emergency measure, and would not solve in an adequate way the Texas fever problem; and that the only true solution was the extermination of the fever ticks.
These lessons from Texas fever lead me to say that the propaganda for vaccinating against tuberculosis by means of the BCG living tubercle virus, or any other so-called "avirulent" tubercle germ, should not be allowed to gain headway in this country and hinder progress in the work of eradicating this disease from the herds and flocks of the North American continent. In this connection it is a very hopeful sign that cattle-breeders and veterinarians are turning more and more to methods of eradicating the Bang abortion disease; and relying less and less on vaccination to afford relief from the economic losses due to that disease.

In the history of the American live stock sanitary service, both before and following the organization of this Association, the word "eradication" has been used so often in connection with the successful handling of several of the major infectious diseases as to make the farming public and the veterinary profession of this country increasingly "eradication-minded" and less "vaccination-minded" with respect to all the infectious animal diseases.

**WHY NOT ERADICATE HOG CHOLERA?**

You all know the high value which that enthusiastic and efficient sanitaryian, Dr. I. K. Atherton, placed upon proper sanitary measures, in contrast to the unrestricted serum-virus immunization method, for control of hog cholera. He has shown that in spite of the value of vaccination in saving a large percentage of the healthy exposed hogs, no progress at all has been made in preventing the constant recurrence and spread of the disease in the great swine-raising territory of the Middle West where serum-virus vaccination has been carried on for twenty years or more. The question arises: Why should not proper efforts be made to eradicate hog cholera? And why should not this be one of the goals of this Association? The answers to these questions are plain. Hog cholera should be eradicated; and this Association should use its influence toward the accomplishment of that purpose. Hog cholera losses and the cost of immunization impose an enormous burden on the swine industry which eradication of the disease would relieve. There is no valid reason why so expensive a disease as hog cholera should be placed, by live stock sanitarians, in a different category from Texas fever or tuberculosis as far as its ultimate fate is concerned. We all realize, however, that on account of the general economic conditions the public revenues are not adequate to allow a proper
increase in the official sanitary forces of the federal and state live stock sanitary departments to handle all the projects now in force, and take on new lines of sanitary work; although there can be no doubt that the annual losses from hog cholera are much greater than would be the expense of an additional properly trained force of veterinary sanitarians to organize and carry out this special work. It is evident that educational work relating to stock-farm sanitation would have to be conjoined with the necessary sanitary police measures in carrying out this project.

It has been suggested that the eradication of hog cholera would rob the veterinary practitioners of an important source of revenue. But I am sure that no self-respecting veterinarian feels that the maintenance of any infectious animal disease, which should be eradicated, is essential to his fullest success. Besides, he would necessarily have an active part in the hog cholera eradication work. Moreover, I can see no better opportunity and means to develop a new and badly needed veterinary service for the live stock industry, namely, a larger and more complete veterinary sanitary inspection service for all classes of farm stock, and of dairies. I believe that through a successful hog cholera eradication project a readjustment of veterinary service could be effected that would be more satisfactory to the live stock raisers, and more profitable to the veterinary practitioners.

EARLY COMPLETION OF TEXAS-FEVER PROJECT IN SIGHT

I began my talk with the subject of Texas fever because the control and eradication of that disease was the first big project promoted by this Association; and in closing I want to urge each member to look upon this as an important national project in which he is personally concerned, and that he will support to his utmost the early completion of this work upon which Dr. Williams, of Texas; Dr. Bux, of Arkansas; Dr. Flower, of Louisiana, and Dr. Knapp, of Florida, with the splendid coöperation of the federal Bureau of Animal Industry, are engaged, and can soon complete, unless halted by economic hindrances.

I know that all of you concur in the words of Secretary Dunlap that we should not slow up in any of these important live stock sanitary projects, but should go forward with the fullest energy possible. This is particularly true of the Texas fever project, since the early completion of this would release a well trained body of federal inspectors for coöperative service in other states and on other projects. I know that Dr. Mohler approves of this
go-forward policy; and I am sure that if his predecessors, Dr. D. E. Salmon and Dr. A. D. Melvin, could look down upon this gathering today, they would rejoice in the splendid progress that has been made by the cooperative efforts of the state and federal departments in the direction of eradicating animal plagues from the North American continent. And I am sure, too, that Doctors Rutherford and Torrance, of the Canadian service, would join with them, and with Dr. Hilton, in the urge to “GO FORWARD.” (Applause)

PRESIDENT CONNWAY: We have a real treat for you this morning in presenting a representative from the Republic of Mexico, who is going to talk to us on the problems of the live stock industry situation in his country. It is a pleasure to introduce Dr. Francisco Moguel, attaché to the Mexican Embassy, in Washington, who represents the Bureau of Live Stock Industry of Mexico. He is a veterinarian. (Applause)

DR. MOGUEL: Mr. President and Gentlemen: It certainly is a great honor and great opportunity for me to appear before this Association, and I feel my responsibility, because this is the first time that Mexico has been on the program.

Dr. Moguel then read his paper, “The Live Stock Industry in Mexico and Its Sanitary Problems.”

THE LIVE STOCK INDUSTRY IN MEXICO AND ITS SANITARY PROBLEMS

By Francisco Moguel M., Washington, D. C.

Attaché to the Mexican Embassy

Mexico's geographical situation, its climatic conditions, water-supply, territorial extension, scant population and natural wealth make of it a country specially suitable for the development of the live stock industry, this being one of its principal sources of wealth. For this reason our government, as far as it has been able to do so, has been giving it major attention in order to accomplish this development. In recent years it has achieved much, as it has enjoyed the enthusiastic support of our ex-President, General Plutarco Elías Calles, who is an ardent live stock breeder, and the forceful support of the recent Secretary of Agriculture, Gral. Manuel Pérez Treviño, and without doubt will receive from Mr. Francisco Elías, present Secretary, fresh stimulus, because he also has a profound knowledge, through personal experience, of the needs of the industry, as he is one of the principal and most progressive live stock men of the state of Sonora.

The live stock industry is of importance in the Republic because in many zones its exploitation is one of the principal
activities; in others at present it is the only one. Some send their live stock to our principal consuming centers and the others export them as well as their products to this country, which is the natural market; and with the products of that exportation we are in a position to consume the articles elaborated by the various North American industries, thus contributing to the expansion of the latter.

Mexico has two great chains of mountains which run from north to south, parallel with the coasts of the Pacific and the Gulf of Mexico, but which unite in the state of Oaxaca, continuing as one through the state of Chiapas. The country, therefore, is divided into three principal parts, one along each coast and the third in the central plateau. The Pacific region has a steep slope to the ocean but on the gulf side the slope is very gradual. The country is situated between parallels 14° and 32°, so that there is a wide diversity of climate, from extreme cold in the high mountains to tropical on the coasts and in the southern states. On the high central plateau there is a delightfully temperate climate.

**Topography and Climate**

The northern states have extensive plains, some of them warm and dry in summer, as in Texas and Arizona, and others cool and humid, as in California. In the north central states there are districts that are cold and dry but they also have other better districts where there is a temperate climate. In other states further south it can be said that there is a very desirable climate.

The territorial extent is approximately two million square kilometers and our population is scarcely fifteen millions. Formerly agricultural properties were very poorly distributed. There were individuals or companies that owned tremendous zones, only a small part of which was devoted to agriculture, the remainder being dedicated to the grazing of live stock, which were largely left to take care of themselves, the proprietor taking notice of their existence only when it became necessary to sell them. Many owners had no idea of the number that they possessed.

The agrarian policy of our government in no way affected the live stock industry because in the districts where agricultural property has been divided, the exploitation of that industry is today intensive in place of extensive. Nevertheless, there are yet ranches where it is not rare to find forty or fifty thousand head
of large stock or seventy or eighty thousand of small stock. So
the industry is yet far from having reached its maximum develop-
ment.

The republic has extensive zones covered with natural grasses
of good qualities, the growth of which in some regions is so
exuberant that it is higher than the animals. There are zones
in which three crops of corn can be raised each year, which,
because of a lack of roads, is not sent to the consuming centers
but can be used in the raising and fattening of swine.

The principal cattle-producing states are Sonora, Chihuahua,
Coahuila, Jalisco, Michoacán, etc.; of sheep and goats, Querétaro,
Guanajuato, Aguascalientes, Zacatecas, etc.; and of horses and
mules, Jalisco, Guanajuato, Zacatecas, etc. The principal milk-
producing area is that surrounding the city of Mexico and the
secondary centers of population.

QUALITY OF LIVE STOCK IMPROVED

During our political upheavals the live stock industry passed
through a critical period, as it is one of the chief sufferers in such
cases for the reason that it furnishes immediately available
provisions. But far from causing us irreparable damage it
served as a sort of cleansing, in that it brought about the riddance
of native cattle, so that now the animals with long horns have
almost disappeared. In their place we find a better class because
our breeders periodically import the best breeding stock of the
recognized breeds such as Hereford, Shorthorn, Aberdeen-Angus,
Holstein and Swiss and it is therefore easy to understand that
Canada and Mexico are the principal purchasers in the United
States of Hereford foundation stock, as was stated in the Ameri-
can Hereford Journal, and that North American breeders and
those of Central American republics buy in Mexico Swiss breed-
ing stock of high quality.

Following these general statements I wish to explain briefly
the organization of the office whose duty it is to watch over the
development of this industry and the work that it has undertaken.

The Bureau of Live Stock Industry is divided into three main
branches, called departments, one of which deals exclusively
with the improvement of live stock; another with combating
the diseases which appear in the country and with preventing
the introduction of others, and the third with the preparation
of biological products and with investigation and experimenta-
tion. Each of these departments is divided into various sections.
The Department of Animal Husbandry is in direct contact with the public through the Bureau's veterinarians who are in charge of the sixteen zones into which the republic is divided. These officials are carrying forward a broad educational program to stimulate the application of all such methods as will bring progress in the industry. They study the best means of repopulating their zones with live stock; they promote the use of better breeding stock, proper feeding, the formation of live stock associations, boys' and girls' clubs, the organization of expositions and regional fairs, etc. In cooperation with the Department of Medicine they are charged with the application of measures to prevent and combat epizootics. In addition, the public may apply to them for advice in all matters relating to their profession. The Bureau furnishes them with all materials necessary in carrying on their work, such as bulletins, posters and motion-picture films.

National Breeding Stations Established

As an educational measure and in order that small owners may have available good breeding animals for the improvement of their live stock, there have been established national breeding stations in eight central agricultural schools situated in various parts of the republic and in the National School of Agriculture near Mexico City, it being the intention to establish the largest number possible, located specially in the live stock centers. All possible facilities are provided for the importation of registered breeding stock, the importation of animals of poor quality being impeded.

With the object of forming registry books of national live stock there is a section in which they record all animals imported into the republic which are registered in associations in the various countries and which are recognized by the Bureau of Live Stock Industry. The calves of these animals born in the republic are scrupulously registered, the registration being furnished free to the interested parties. In this manner we are able to furnish data concerning places in the country where breeders of pure-bred live stock may be found as well as genealogical data, as we have registry books of all the principal foreign associations.

As a stimulating and educational measure there has been organized an annual National Live Stock Exposition in accordance with a presidential decree. This is held from the first Sunday to the second Sunday of November and during the past
year there were constructed a number of well conditioned show barns which can be said to be the best in Latin America. At this exposition there are assembled the best live stock of the republic as well as animals specially imported from the United States, Canada and other countries, and it is not rare to find animals that have taken first place in the expositions of these countries. In order to obtain the best representation and results, the government has extended all possible facilities, as for example, free transportation of all animals exhibited as well as those purchased at the Exposition for breeding purposes. This presents a fine opportunity for acquiring animals of high quality at a low price. In addition to the National Exposition other regional expositions are held in various cities at different times of the year. For all of these the same facilities are provided as for the National.

Milk tests are held during the expositions, for richness in butter fat and purity of the same. There are also held contests in egg-laying and ton litters of pigs. For the former there have been constructed in San Jacinto, in the Federal District, suitable premises and there is official registration of the laying.

**Dairy Industry Developed**

As the dairy industry has been constantly acquiring greater importance, there have been created several sections that give courses in the theory and practice of the handling, pasteurization and transportation of milk; the preparation of all kinds of cheese and butter; the installation of pasteurizing plants, creameries, cheese factory equipment and refrigeration plants.

In addition there are other sections that are engaged in stimulating the development and improvement of the various species of live stock, poultry, rabbits, etc.; and other sections are occupied with the best utilization of skins, wool, meats, by-products in general, etc.

As I have previously stated, the Department of Medicine and Animal Health is charged with the control of diseases whether epizoötic of sporadic, which appear in the country, as well as with preventing the introduction of foreign infections such as foot-and-mouth disease, rinderpest, contagious pleuro-pneumonia, European fowl-pest and others, which fortunately do not exist in the republic. The Bureau has ample authority under existing laws and regulations for taking radical measures in this respect. This authority is federal and therefore applicable to the
whole country, which we consider to be advantageous, because it gives us uniform procedure and quick results.

To prevent the development of diseases within the country we depend on the Veterinary Sanitary Policy Regulations, signed by the President on November 24, 1929. These confer on the Secretary of Agriculture and Fomento the necessary authority for their application, through the Bureau of Live Stock Industry. They mention also among many other things the species of animals to which they are applicable, these being specially the domestic species and those that may be the medium for the propagation of epizootics. The regulations specify the diseases covered by them and which of these it is compulsory to declare, such as anthrax, blackleg, tuberculosis, variola, rabies, contagious abortion, foot-and-mouth disease, rinderpest, contagious pleuropneumonia, glanders and hog cholera. In general it is compulsory to give information to the authorities when they have knowledge of the appearance of any of these, but there are specially enumerated those individuals, companies and institutions that, through their activities, are intimately associated with these subjects.

The provisions of the second chapter of the regulations, relating to isolation and quarantine, specify the requirements with respect to area, the manner in which traffic in animals and products of the same may be carried on within the area, and the duration of quarantine, according to the disease.

**Preventive Vaccination Compulsory**

In the article referring to prophylaxis, it is indicated that when there is an outbreak of a disease by the regulations, preventive vaccination of susceptible species in the region is compulsory, provided we are not dealing with those in which immediate slaughter is required. In order to facilitate immunization, the Bureau distributes to the live stock growers, at reduced cost, the necessary biological products which are prepared in its laboratories, as for example, Pasteur vaccine against anthrax at five cents per dose (about two cents, American money). In cases where there is inability to pay, these products are furnished free. The vaccines are administered by veterinary officials without cost, but it may be done by private practitioners under the supervision of the former.

The movement of animals and raw products of the same from one county to another is controlled by the personnel of the Bureau, it being a sanitation requirement that shippers must provide
themselves with a certificate in which are stated the number and species of animals or class and quantity of product, the name and address of the owner or shipper, as well as the consignee, the route and means of transportation, the purpose of the movement and specially that the animals do not proceed from a zone that is under quarantine. A copy of this document is sent to the Bureau representative at destination in order that, on arrival of the animals, he may determine the accuracy of the certificate, as the original is delivered to the shipper who must present it to the inspector. Carriers can not accept the animals for transportation without this certificate.

Article 106 of the regulations provides that all railway cars, steamships or other vehicles that have been used in the transportation of animals must be cleaned, washed and disinfected immediately after unloading and before they are again used for any purpose. These services are paid for by the interested parties, are carried out in accordance with the provisions of the regulations and are supervised by the Bureau. The work is done very economically, because it is conducted by companies whose volume of business makes it possible to do it at reduced prices.

In addition to the general provision there are prescribed the procedures to be followed in visiting farms, in the recognition and the official declaration of the existence of infectious diseases, slaughter, cremation or burial of animals affected, disinfection of the premises, and the disinfection or destruction of products of animal origin.

**Official Regulations For Disease Control**

The second chapter of the regulations specifies clearly the measures to be taken in case of an outbreak of any of the different diseases; for instance, taking an easy example, in case of the appearance of anthrax all animals of susceptible species in the zone must be immunized. None of the products of animals dead from the disease may be utilized in any form and the products of the apparently healthy animals in the region may be utilized only within the same region and after inspection by official veterinarians.

In the case of blackleg, cattle less than three years old must be immunized and susceptible animals may be moved into an infected zone only after they have been vaccinated. With the exception of hides, no parts of the carcasses of animals dead from
blackleg may be used and those only after disinfection by immersion in a 1:1000 bichlorid of mercury solution for two hours.

In the case of glanders, a disease which fortunately is not widespread but is found most often among army horses, immediate slaughter of the sick is required. All equines, whether healthy or suspected of exposure, must be tested with ophthalmic mallein and all that react must be slaughtered. This procedure is repeated in fifteen days. From suspects of the second test, blood samples are taken for conducting complement-fixation tests. All objects used in the handling of the sick animals that can not be thoroughly disinfected must be burned. The premises and all equipment that has been in contact with the sick animals must be disinfected or burned under the supervision of official veterinarians.

As I have already stated, there does not exist in Mexico any foot-and-mouth disease, rinderpest, contagious pleuro-pneumonia, etc., but when any of these appear in the republic the regulations require the immediate slaughter and burning of all affected or exposed animals as well as all that have been in contact with them. The area to be quarantined in such cases must be fixed in accordance with special conditions in the region, such as the number of animals, the number of sick, topography, means of communication, etc., the chief concern being to assure the health of the remainder of the live stock in the country, even though such quarantine measures may cause serious interference with business activities and with communications.

EXPERIMENTS WITH LIVE VIRUS PROHIBITED

The restriction of movements is extended to persons, raw vegetable products, vehicles and all equipment that it is deemed necessary to include. A declaration of freedom from the disease is made a year after the last case is found, following the placing of test animals on the premises for a period. In no case is it permitted to experiment with the virus or immunizing products of such infections, that are based on live virus.

As in the case of diseases mentioned above, the regulations specify the measures to be applied in white diarrhea of calves, strangles, equine influenza, swine erysipelas, rabies, trypanosomiasis, etc.

In this connection I do not refer to the provisions governing contagious abortion, piroplasmosis, tuberculosis or white diarrhea of chicks, because I will later describe the special work carried on
by the Bureau in the campaigns against each of these diseases. There are in addition provisions covering the humane handling of live stock in transit, which prescribe the number of consecutive hours that they may be kept in cars without rest, the conditions that must be maintained in loading-yards and, their feeding during the journey.

The preparation, storage, importation and sale of serums, viruses, vaccines, bacterins, antitoxins and other biological and pharmaceutical products used in the control of animal diseases also are regulated; there being required among other things an authorization from the Bureau which is issued only when these products fulfill the purposes for which they are prepared; otherwise they must be destroyed.

SECTION ON CONSULTATION AND HYGIENE

The Bureau has not only studied laws and regulations and put them in effect; on the contrary its principal work has been carrying out of a broad educational program for the improvement of the situation of live stock growers as far as possible, before the application of the laws was begun. For this purpose there have been printed innumerable bulletins which are distributed free, describing each of the various diseases and curative or preventive methods. Bureau veterinarians hold meetings, illustrating with moving-picture films the different methods of vaccination, disinfection and elementary measures of treatment and simple surgery. In addition there are organized sanitary brigades for combating epizootics. The Section on Consultation and Hygiene gives advice verbally or in writing, explaining elementary procedures in treatment or simple surgery and proper feeding as well as rules to be observed in maintaining premises where the animals are kept. In short they employ all the propaganda possible to augment the education of the live stock growers.

The Institute of Veterinary Medicine has a Section of Diagnosis, in which there are made, without cost, examinations of pathological products sent by growers, in accordance with instructions relating thereto. The results are communicated to the interested parties by telegraph, giving them instructions regarding combating the epizootic and when necessary sending Bureau veterinarians.

In the same Institute there are prepared vaccines against anthrax, by the Sobernhein and Pasteur methods; bacterins against fowl cholera and hemorrhagic septicemia; mixed bac-
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terins against fowl cholera, fowl typhoid, white diarrhea, etc.;
natural and artificial aggressins against blackleg; tuberculin,
mallein and antigens for the diagnosis of contagious abortion;
and other biological products.

All the immunizing products before mentioned are furnished
at very low prices or without cost for educational use or when
inability to pay is demonstrated by those who acquire them.

In the Institute there are Sections on Biologic Chemistry
and Zoölogy and in addition there have been assigned to it the
study of the experimentation with the various diseases, the cause
of which, as in “Derriengue,” is unknown, as well as the treat-
ment of them. This work has already been begun.

It is indisputable that one of the principal sanitary problems
in our republic is bovine piroplasmosis, as we unfortunately have
extensive zones infested with the tick which transmits that
disease. These zones, in a general way, are along our coasts and
in the southern states. The Bureau has inaugurated the most
energetic campaign for employing all its forces to the end that
this parasite may be eradicated. In consideration of prevailing
conditions, economical, educational, etc., before dictating the
requirements necessary to carry on eradication work, there was
inaugurated some years ago a broad educational program for the
purpose of impressing upon our live stock growers the dangers
and disadvantages occasioned by the ticks and the necessity for
combating them. For this purpose there have been distributed
innumerable bulletins, posters, leaflets, etc., describing the
use of arsenical solutions and methods of preparing the same,
the construction of vats, and suggestions for selecting appropriate
locations for them.

**Extension Work**

The veterinarians and other personnel engaged on this work
hold meetings, illustrating the discussion with motion-picture
films. In expositions there are exhibits demonstrating all of
the foregoing. All this propaganda has been distributed not
only in the infested zones, but also in the regions where ticks
do not exist, in order to make plain the damages caused by the
dissemination of this parasite. At the same time that the
propaganda has been carried on, work has gone forward to define
the free and infested zones, drawing up first a preliminary map
of these, the limits of which have been carefully fixed. One of
the principal concerns of the Bureau has been, first of all, to
protect the free zones from infestation, by controlling the movement of live stock in accordance with the natural routes that have developed out of the needs of the consuming centers.

One of the reasons is that in some regions the principal activity is the exportation of live stock and in order not to interfere with this there were, in the beginning, adequate requirements, as for example, preventing the movement of live stock from the southern part of Sonora, which is infested with ticks, to the northern region which is free. To this end there was issued a presidential decree fixing a quarantine line beginning at Puerto Carretas on the eastern boundary of Sonora, and going southwesterly to the coast of the Gulf of California. The state of Sonora, therefore, is divided into two zones, and it is required that live stock going from the South to the North be dipped twice at intervals of seven to twelve days in an arsenical solution of 0.22 per cent strength. For this purpose there have been constructed the necessary dipping vats and corresponding equipment which are under the care of the Bureau veterinarians who furnish certificates permitting their movement when it is determined that the animals are free of ticks. Without this certificate the railroad companies can not accept the live stock for transportation. The state of Chihuahua being free of ticks, the entry of live stock from the infested zones is not permitted until they have been subjected to the same treatment. The same is true in the case of zones in the states of Durango and Coahuila. There are very severe penalties for the violations of any of these provisions.

**Biology of Ticks Studied**

Coincident with the establishment of infested zones there has been accomplished the identification of the various ticks existing in the republic and additional studies relating to their biology.

This preparatory work in a short time produced good results, as large numbers of growers of various regions of the country commenced to urge the Bureau to adopt measures designed to combat the tick.

Some states, at the suggestion of the Bureau, have dictated local decrees making campaigns against the tick compulsory, and defining the systems for carrying them forward. Among these may be cited Tabasco, which was the first, and Zacatecas and Puebla. There are included in the Veterinary Sanitary Police Regulations, general provisions covering the campaign against the tick throughout the country. Among the principal articles
of interest to be mentioned especially, is the obligation on the part of all live stock owners in the infested zones to construct vats for dipping their live stock in accordance with plans furnished and the preparation of the tick-destroying solution, which must contain 0.22 per cent of arsenic. The dipping must be carried on every twelve to fifteen days and will be supervised by the veterinarians and the personnel assigned to that work. If the dipping is not carried out by the owners, it will be performed by the personnel of the Bureau for the account of the interested parties.

It is strictly prohibited to move live stock from the infested to the free zones without their having been freed of ticks. It is also prohibited to move animals from a free to an infested zone and if this occurs the animals in question are considered as being infested. The movement of live stock is under the supervision of veterinarians and the railroad companies are not permitted to receive the live stock for shipment unless they have a certificate in which is stated the manner in which they may be moved. Animals from infested zones may not be unloaded in the free zones except into yards that fulfill the requirements specified clearly in the regulations. The same is true of cattle proceeding from the free zones which have to be unloaded in the infested zones.

Forage, manure and straw from the infested zones are also subject to certain requirements. In the free zones, manure and bedding originating in the infested zones must be destroyed or used only under specific permit. In this regulation the terms live stock or animals include, in addition to cattle, horses, mules and asses if they are tick-infested.

CATTLE-DIPPING WIDELY PRACTICED

At present it can be said that the campaign against the tick is going on in all the republic, with large numbers of vats already constructed. In the state of Tabasco, for instance, almost all the ranches have vats and are dipping the cattle at regular intervals. In many zones infestation has been greatly reduced and in many districts it will not be long until the ticks will be eliminated. Such districts will be declared free zones as soon as the requirements of the regulations have been fulfilled.

The Bureau does not require that the arsencial dip method of destroying ticks be used exclusively, but recognizes also the method of starving them through excluding hosts from the pastures. This is a very practical method in many districts,
because of the great area of many ranches and the abundance of grasses. It is a method also that fits well the economic conditions of the country. To further tick eradication the Bureau's laboratories prepare concentrated arsenical dip which is furnished at extremely low prices. Enormous quantities have been prepared and the demand is such that we see the possibility of being unable to supply all that is requested. We therefore assist in the acquisition of similar solutions, in order to further the work. There are also sold at low prices all articles of equipment needed in the use of the arsenical dip. In general it may be stated that this work is becoming universal. Large numbers of growers contribute to the Bureau's educational work. Many of these who are truly interested and are known to be reliable are named honorary agents in tick eradication work.

Other campaigns that have been vigorously inaugurated are those against infectious abortion and white diarrhea of chicks, drastic measures being taken to prevent their dissemination. Diagnosis of the former is effected by the different agglutination tests. At this point I wish to take the opportunity to express our high appreciation of the magnificent cooperation that the Bureau of Animal Industry of the U. S. Department of Agriculture has extended us. They have furnished us sufficient quantities of antigen for the diagnosis of pullorum disease. To other offices also I express our appreciation, having in mind especially the Motion Picture Office of the Department mentioned.

Foot-and-Mouth Disease Appears

In the Spring of 1926, foot-and-mouth disease unfortunately appeared in the state of Tabasco, for the first time in the history of Mexico, extending also into Campeche and Yucatán. Its progress was clearly marked along the lines of communication. Through the measures taken by the Bureau it was completely eradicated and up to this time it has fortunately not reappeared.

It was not possible to determine from where and in what manner the infection was brought to the country. One reason for that was when the first information regarding the disease reached us, there had already passed a long period since its first appearance. Stockmen failed to recognize it and attached no importance to it, having no idea of the damages that it causes. They were not alarmed until they noted the rapidity of its spread, when they communicated with the Bureau's regional veterinarian, who advised the Bureau of his suspicions that it was foot-and-
mouth disease. Veterinarians were immediately sent to the region and they had the cooperation of Drs. Truman W. Cole and Severin O. Fladness, assigned by the U. S. Bureau of Animal Industry, who, after much work, confirmed the diagnosis at Frontera (now Alvaro Obregón), Tabasco.

As at that time the present regulations were not in effect, there was issued a presidential decree, declaring the existence of the disease in the three states above named and parts of Chiapas and Veracruz, placing them under quarantine. That decree contained all the provisions I have already mentioned, which were strictly enforced. The federal government assigned the largest number of veterinarians and defrayed all necessary expenses. With the moral support of the local governments and the stockmen in the affected regions, the campaign was carried on with such success that a few months later the disease was eradicated. In November, 1927, that is to say, a year after the appearance of the last case, the quarantine was lifted.

Two years later, stockmen of Villa Hermosa, Tabasco, remembering the previous experience, sent urgent notices of the appearance of a similar ailment. In the emergency, veterinarians were immediately sent by airplane, in spite of bad weather conditions, to make the necessary investigations. At the request of my government, the Bureau of Animal Industry sent from Washington, also by airplane, laboratory animals for use in making differential diagnosis. The disease proved to be simply mycotic stomatitis.

Quarantine Inspection Service Established

As our international commerce is growing day by day, there was established several years ago a veterinary inspection service at frontier and ocean ports. Major attention is given to that service with a view to preventing the importation of animals or products that may be the carriers of the infections of communicable diseases, chiefly those, of course, that do not exist in the republic. The importation of animals that are zootechnically defective is also prevented, because the government is anxious that our live stock shall be well rated. Equal scrupulousness is exercised in the inspection of animals and products that are exported, in order that the purchasing countries may be assured of their healthfulness.

In connection with imports, the regulations contain appropriate requirements. It is provided that animals or products may be
imported only through certain specified ports of entry on the
coasts and the borders where there are quarantine stations, and
Bureau veterinarians are stationed for the purpose of making
inspections. In order that this work may be conducted in the
most efficient manner, there has been promulgated a standard of
construction for sanitary stations which fulfill all the require-
ments.

For the importation of animals from any country except the
United States, Canada and the Central American republics, it
is necessary to secure prior permission from the Secretary of
Agriculture, which may be requested directly or through Mexican
consuls. These permits are given only when the sanitary con-
ditions of the region of origin are satisfactory and must indicate
exactly the place of origin, number and species of animals, route
by which shipped and the port of entry. Shippers must in addi-
tion secure a certificate from a competent authority, in which it
must be stated that the animals or products are in good sanitary
condition and that during the previous six months there has not
existed in the district any communicable disease. This document
must be vised by the Mexican consul in the district of origin.
From countries in which foot-and-mouth disease, rinderpest or
contagious pleuro-pneumonia exists, the importation of meats,
hides, bones, bristles and other raw products of animals is pro-
hibited. We are kept informed of sanitary conditions in other
countries by the personnel of the consular service, who render
monthly reports thereon and consular regulations contain pro-
visions governing the viséing of sanitary certificates and similar
documents.

**Importations From United States**

In the case of the United States the only requirement is a
certificate executed by a veterinarian of the Bureau of Animal
Industry, or by a local sanitary authority, if it is endorsed by
the Bureau of Animal Industry.

If the documents mentioned are lacking, the imports offered
are rejected or are placed in quarantine for such period as is
deemed necessary. In case animals offered for importation are
found to be affected with a communicable disease, they are
destroyed or refused entry, or curative treatment is applied, as
the case may be, according to the particular disease; or products
offered may be destroyed if necessary. All this is clearly set
forth in the regulations.
If the veterinarian in charge finds the certificates in proper order and the animals to be in a healthful condition he issues a certificate to that effect. Until that has been done the customs authorities cannot begin to clear the shipment, much less pass it for entry.

Importations for temporary periods are subject to the same requirements as those entered definitely and live stock in transit through the United States for Mexico, or through Mexico for the United States, must always be inspected at the place of entry into the republic of Mexico.

The regulations outline the procedure to be followed in the inspection of vessels in which live stock are transported, their arrivals, quarantine, disembarcations, provisions furnished their crews, cleanliness, disinfection, etc.

The foregoing are some of the general requirements. I will now explain briefly some of the special procedures in the case of each species.

All horses, mules and asses are mallein-tested by the ophthalmic method and all that give a positive reaction are slaughtered. Suspects are retested in 15 days and if there are suspects to that test, blood samples are taken for serological tests. There are in addition special requirements applicable in the case of parasitic disease such as scabies and trypanosomiasis, the animals being subjected to dipping or slaughtered, as the case may be.

**OPHTHALMIC AND INTRADERMIC TUBERCULIN TESTS USED**

Cattle for dairy purposes are tuberculin-tested by the ophthalmic and intradermic methods and all that react are exported. The same is true of reactors to the serologic test for Bang abortion disease. A careful examination is made also of the mammary glands. Cattle proceeding from zones infested with fever ticks are dipped twice in arsenical solution at intervals of 7 to 12 days.

Sheep and goats are inspected for parasitic disease and if necessary are subjected to dipping in lime and sulfur in the manner prescribed in the corresponding regulation. In the case of goats, examination for Malta fever is extremely important.

In the case of canines, in addition to a clinical examination to determine if they are suffering from any communicable disease, those from Europe that are intended for stock-herding purposes are examined for the presence of *Tenia coenurus*. Poultry are also subject to special requirements, as are raw products of animal origin such as milk, hides, meat, bristles, wool and bones,
and manufactured products, such as cheese, butter, cream, etc. Inspection is also required in the case of fish and shell-fish. Packing materials proceeding from countries where foot-and-mouth disease, rinderpest and other diseases exist are subject to restrictions, being destroyed or carefully disinfected.

As I have already explained, we do not desire to be unduly severe in the measures taken in relation to animals and products offered for importation; we apply the same measures when animals or products are exported, because we realize the immense value of "sanitary credit" and appreciate the great work done in other countries which, like our own, consider healthfulness to be the first interest of all. And we offer as a guarantee the experience which long practice has given our personnel and their scientific honor.

**INTERNATIONAL TREATY**

There exists in addition an international treaty between the governments of the United States and the United Mexican States which has for its object major cooperation in the most effective measures for the protection of the interests of stockmen in both countries, in preventing the introduction of communicable diseases of live stock. Under this treaty it is undertaken to maintain an efficient veterinary sanitary police service in the maritime and frontier ports specified for the entry of animals and their products. Veterinarians may make the inspections and examinations that are required on either side of the border as may be more convenient and effective. Well equipped quarantine stations are provided for. The treaty also fixes the requirements as to permits, certificates or other documents which shippers must present as proof that the animals or products are in proper condition for entry and as to the manner and means of transporting the same.

The two countries obligate themselves to organize and maintain sanitary police services for combating communicable diseases and the authorities must indicate the zones in their respective countries in which such diseases exist or are suspected to exist. This is especially provided for in case of the appearance of foot-and-mouth disease, rinderpest, contagious pleuro-pneumonia or other disease that has not recently existed in these countries, in which event the information must be transmitted promptly by the most rapid means.

From places where foot-and-mouth disease, rinderpest or contagious pleuro-pneumonia exists, the importation of ruminants
and swine is prohibited until sixty days after the appearance of the last case. The remainder of such country is considered as suspicious until non-existence has been proven. When these diseases appear near the boundary of any country, the nearby region of the neighboring country will be considered as suspicious until there is proof of non-existence.

Article 11 of the treaty provides for the exchange of regulations, official publications, periodicals or whatever other matter relating to these subjects may be issued, and for transmitting information with respect to changes in methods of preventing, controlling and treating diseases. It provides also for the exchange of students and experts, or visits by representatives of the respective governments for the purpose of observing methods of control and eradication of diseases that may appear in the two countries.

The treaty provides for the issuance of special regulations for the movement of live stock between the two republics, which have already been made effective in both the United States and Mexico. The certificates of inspection and diagnostic tests executed by the official veterinarians of either country will be honored by the other.

Sanitary Conditions Generally Satisfactory

By the description I have given of the various measures to prevent the development and spread of diseases of live stock, it might be thought that we are fighting desperately against them, but the contrary is true. Sanitary conditions in the country are in fact very satisfactory. Our most common troubles are with anthrax, blackleg, hog cholera, and fowl cholera, but the number affected as shown in the monthly bulletin of epizootics, official organ of the Bureau of Live stock Industry, is small in proportion to the number of live stock in the country. With respect to bovine tuberculosis it can be said that it is not a major problem because it is confined to the milk-producing area around the city of Mexico and the situation of and conditions in that district are not friendly to its rapid development. As regards infectious abortion and pullorum disease of poultry, these have developed only recently and are being controlled by the new methods that science has placed in our hands. Probably bovine piroplasmosis constitutes our major sanitary problem. However, we are giving it preferential attention and while it is known that it will take many years to eliminate it, we have been able to diminish greatly the damages caused by it through control over the move-
ment of livestock to the free zones and the work carried on in the infested zones.

DR. MOQUEL: I thank you for your attention. I hope we will have the privilege to be with our neighbors, the United States and Canada, from now on. (Applause)

PRESIDENT CONNAWAY: We certainly thank Dr. Moguel for giving us this view of the livestock industry of his country and the methods that are employed in controlling these diseases.

I am sure that most of us feel safer now, after hearing from Dr. Moguel, as to the safety on this side of the line. These diseases are not respecters of county lines or district lines or state lines or international lines. So we must cooperate on this great American continent in the control of these diseases.

The session adjourned at 11:55 a.m.

WEDNESDAY AFTERNOON, DECEMBER 2, 1931

The second session convened at 1:25 p.m., President Conaway presiding.

PRESIDENT CONNAWAY: As the Chairman of the Committee on Bang’s Disease is absent, we will hear a report from Dr. C. P. Fitch. (Applause)

DR. FITCH: Mr. President and Members of the Association: The Secretary, Dr. Dyson, was kind enough to print copies of this part of the report of the Committee on Bang’s Disease. There are a few minor typographical errors in the printed copy which I will point out after I have finished reading the report.

Dr. Fitch then read the report of the Subcommittee, “Recommendations for a Uniform Technic for Conducting the Tube Agglutination Test for Bang’s Disease.”

REPORTS OF COMMITTEE ON BANG’S DISEASE

DR. P. MALCOLM, Chairman, Des Moines, Iowa

Dr. M. F. Barnes, Harrisburg, Pa. Dr. W. K. Lewis, Columbia, S. C.
Dr. C. P. Fitch, Saint Paul, Minn. Dr. F. H. Brown, Indianapolis, Ind.
Dr. J. M. Buck, Bethesda, Md. Dr. W. Wisnicky, Madison, Wis.
Dr. E. T. Hallman, East Lansing, Mich. Dr. Jacob Traum, Berkeley, Calif.

Part I

Recommendations for a Uniform Technic for Conducting the Tube Agglutination Test for Bang’s Disease

Much more satisfactory results will be obtained by the test for Bang’s disease if more nearly uniform methods are adopted by all laboratories conducting this test. There are certain procedures in conducting the tube test for Bang’s disease concerning which a varied technic makes no appreciable differences in the results obtained. In laboratory work, as in other procedures, individuality must prevail. For that reason we are not specifying definite procedures when several will give the same results.

1. Blood should be collected from the jugular vein by means of a hypodermic needle. Containers should be clean, dry and sterile. A convenient receptacle for collecting blood is a 1/2” x 4” test-tube. The size of the hypodermic needle is a matter of individual preference. It should be of sufficient size to permit an ample flow of blood, not smaller than 16 gauge. Preferably a separate needle is employed for each animal or the needle may be thoroughly washed in an antiseptic solution before the bleeding of each animal. Some laboratories have special boxes for sending out the containers for collecting blood samples. The boxes can be sterilized. It is advisable not to fill the tube more than one-half to two-thirds full of blood, and allow it to remain quiet on its side at an angle of approximately 30 degrees until it has become well coagulated. The sample must not be allowed to freeze. If the blood is to be sent to a laboratory, when 3 to 4 days will elapse before it is tested, it is advis-
able to pour off the serum. Under usual circumstances, however, the serum can best be sent on the clot in the original container. It is highly important, however, that the blood serum shall be as free of hemoglobin as possible.

2. The tubes must be properly labeled. It is satisfactory to number the tubes consecutively (1, 2, 3, etc.) and on a clean sheet of paper identify each tube with the individual animal by tag number, registry number or further descriptions. It is necessary to take the greatest care to see that each specimen of blood is properly identified. It is highly desirable to have special sheets prepared for the identification of the animals. These sheets may be made up in a way suitable for the individual state or other organization.

3. The antigen should be prepared from cultures of typical strains of Bac. abortus Bang that show no tendency to spontaneous agglutination and manifest normal agglutinability. Strains selected should be cultivated and studied under usual laboratory conditions to determine that they do not contain dissociated forms. Either a monovalent or polyvalent antigen may be employed. The culture medium selected shall be such that the strains will grow well on it. There is very little preference of the medium ordinarily employed, namely, nutrient agar containing glycerin, serum-infusion agar, liver-infusion agar, or potato-agar. The cultures should be incubated only until maximum growth is obtained, which is usually from 48 to 72 hours, at 37.5° C. The bacteria may be grown either in the atmosphere or in a modified atmosphere containing 10 per cent CO₂. Glass test-tubes, Blake or Erlenmeyer flasks, or flat bottles may be used as containers for the culture medium on which the bacteria are grown. It is necessary that the purity of the culture be definitely determined. Contaminated cultures have been the source of much difficulty in the agglutination test.

4. Bacteria should be removed from the culture medium with a phenolized saline solution containing 0.85 per cent C. P. sodium chlorid and 0.5 per cent C. P. phenol crystals. Bacteria may be loosened from the medium with a blunt instrument or soaked loose by permitting the phenolized saline to stand on the culture for two to three hours. Suspensions of bacteria should be carefully filtered through paper, cotton, or cotton, spun glass and gauze, to remove any particles of agar. Unheated antigens are entirely satisfactory and are recommended. Heating of the antigens at 65 to 100° C. for two hours does not seem to alter sensitivity. If the antigens are heated, however, extreme care must be exercised to exclude all agar from the suspension, to guard against the so-called "agar thermo agglutination" of the bacteria. The antigen may be diluted to the desired concentration immediately after the bacteria are washed from the medium or stored in concentrated suspension and diluted with carbolized saline solution as needed. Antigen should not be unduly exposed to the sunlight. For use, the concentrated antigen is diluted with phenolized saline solution until its density is 0.04 per cent bacteria by centrifuge-tube method. This density compares with tube 1 of the McFarland nephelometer, 200 parts silica standard, or approximately 7 centimeters on the Gates apparatus. Antigen so diluted which has satisfactory agglutinating properties retains them, at refrigerator or room temperatures, for at least one year. If a different concentration than this is employed it should be so stated when the results of the test are reported. Each lot of antigen should be tested out carefully with sera of known titres, high, medium and negative. It should give clear-cut reactions with all three, otherwise it should be discarded.

It is not usually necessary to alter the pH concentration of the antigen. Sensitivity of antigens having a comparatively broad zone in pH concentration are not appreciably altered (a pH from approximately 4.7 to 8.9).

5. Either the multiple dilution method or the decimal system of dilutions may be employed. The dilutions shall be 1:50, 1:100 and 1:200, or 1:250 and higher if desirable.

6. The tests should be held at approximately 37.5° C. for at least 42 hours before reading. Tests of sera containing amounts of hemoglobin, which are appreciable to the unaided eye, should be held at room temperature. Tests of such hemolyzed sera which do not show complete agglutination in all dilutions used in testing (at least up to and including 1:200) should be considered not satisfactory, and no diagnosis made. Water-bath or hot-air incubator at
temperatures up to 55° C. are acceptable, providing the temperature does not at any time exceed this level. Unstoppered test-tubes are entirely satisfactory for conducting the test.

7. All tests incubated at 37.5 to 55° C. must be held until the second day (approximately 40 to 47 hours) before final observation, at which time the tests may be read. Maximum titres of a few low- to medium-agglutinin-content sera are not obtained until the third day. Tests held at room temperature must remain 68 to 72 hours before final observation.

8. Tests should be observed both in racks and held in the hands and shaken. The agglutination results in individual serum-antigen mixtures should be recorded as complete agglutination by a + sign, incomplete agglutination by 1, and no agglutination by -. Very slight traces of agglutination should be ignored. The reading of tests should be carried on only by individuals who have had wide experience in this work. Extreme care should be exercised in the observation of tests to minimize the discrepancies resulting from improper or careless observation.

9. It is always advisable to supplement the agglutination titres with a complete knowledge of the history of the animal, and the clinical aspects of the disease in a herd before making diagnosis. This is of especial importance in suspicious cases in advising retests. Table I gives the interpretations of reactions recommended.

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All suspicious animals should be retested within a period of 10 to 30 days. It is impossible to determine on a single test, whether the titre is on the up grade or whether it is more or less constant. Retests will answer this question in most cases.

It is impossible to give a definite method of procedure in respect to the interpretation of all phases of the agglutination test. If it were possible to do this, the work could be reduced to machine accuracy. This cannot be done. It requires the knowledge and experience of individuals trained in this line of work. The interpretation and consequent diagnosis of agglutination titres should be intrusted only to persons who are familiar with Bang's disease in all of its aspects.

DR. FITCH: I would suggest, Mr. Chairman, that we act on this portion of the report at the present time. In order to bring it before the Association, I move its adoption.

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

PRESIDENT CONNAWAY: The report is before you for discussion.

MEMBER: Mr. President, may I ask Dr. Fitch to dilate on the reason why he begins his dilutions at 1:50 rather than 1:25. Some of us feel that in testing cattle, very valuable animals, 1:25 is an injustice to the cow, to the owner and to the veterinarian, because we have to go through the explanation that it has no value, afterwards. I would like to have it brought before the meeting to see if we can't get uniform customs, eliminate the 1:25 dilution, and be guided by that so that we, who wish to do it this way, may quote this Association as an authority.
DR. FITCH: Mr. Chairman, there is nothing in this report that prevents any laboratory from using a 1:25 dilution if it is desired. This Committee does not desire to make any such recommendation. Personally I do not believe that a 1:25 dilution has any particular significance in the control of Bang's disease, and I believe that it is usually of more detriment that it is of value.

On the other hand, I am in full sympathy with those individuals who take into consideration the fact that a 1:25 reaction may indicate a rising titre and a consequently infected animal. If any individual wishes to set that as a dilution, I have no quarrel with him. We do not use that dilution in our laboratory at Minnesota.

DR. CECIL ELDER: In the last paragraph of No. 4, in the testing out, you refer to high, medium and negative titres. What do you mean by medium?

DR. PITCH: A dilution around 50 to 100. That is, a reaction in that dilution, Dr. Elder.

DR. W. J. BUTLER: One hates to get up and talk about this particular subject, but I do believe that 1:25 should be included in that report. What are you going to do with range cattle, with semi-range cattle? You can't get to see them every hour or every day. You have to blood-test them. If you don't have a 1:25 dilution, the chances are you have a reactor in there with a rising titre, as Dr. Fitch said. If you let that animal go, by the time you retest that animal again, you may have a spreader in that particular herd, and all your work may have gone for nothing.

I agree that probably Dr. Fitch is right, under farm conditions, but I cannot agree that he is right under range conditions. As I understand it, this Association is to work for the good of all of us.

DR. FITCH: I desire to point out that in this last paragraph that exact thing is implied. You cannot make regulations that will fit every condition. Conditions on the range in Dr. Butler's state may require that thing. I would say to Dr. Butler that more animals, by at least eighty-five per cent, will be taken out on a 1:25 dilution that are perfectly safe animals to leave in the herd.

We have been carrying on an experiment at University Farm for two years and are continuing it until we have more data on this group of so-called suspicious animals. We yet have to get an animal that is dangerous, that gives a constant reaction at that dilution, but if any laboratory desires that dilution they are at perfect liberty to put it in.

DR. LEO F. RETTGER: I wonder if Dr. Fitch would be willing to tell us if the majority of the Committee is in favor of the 1:25 or 1:50 dilution. I think he spoke here particularly from his own personal standpoint.

DR. FITCH: As far as I know, the majority of them are in favor of the 1:50 dilution and not in favor of the 1:25.

PRESIDENT CONNAWAY: If there is no further discussion on this point, we will call for the next paper, by Dr. Wisnicky.

DR. W. WISNICKY: A subcommittee was appointed to gather together some material in relation to control phases of this disease. We have made a report and have submitted this report to the Committee on Bang's Disease, and it has been approved by the Committee as a whole.

Dr. Wisnicky then read the report, "Control Measures Proposed."

Part II

Control Measures Proposed on Bang's Disease

Increased interest as well as increased activity in relation to the control of Bang's disease in this country has been noted during the past year. The educational progress in Bang's disease has been general throughout the United States. The request for this knowledge has been so much in demand by the live stock owners that various agencies have interested themselves in disseminating such information as is available concerning the disease. Such mediums as bulletins originating in state and federal institutions, agricultural press publications, daily newspapers and bulletins originating from bankers associations, have been chiefly active in disseminating this information. Some states have created extension projects and provided veterinarians well versed
in this disease to advise farmer groups, in connection with the county agents and farm advisers, pertaining to all phases of Bang's disease; in such states as have an intensive cattle industry, information on Bang's disease is sought more frequently than information concerning any other disease of cattle.

In order to secure reliable information as to the prevalence and other phases of this disease, a questionnaire was sent to the chief live stock sanitary official of each state in the Union. All states but two replied to this questionnaire and supplied such information as they had available on the subject. On the basis of the data and estimates furnished by the various live stock sanitary officials in the United States, approximately 10,000,000 of the 56,000,000 cattle in the country are affected with Bang's disease. In round numbers this makes about 18 per cent of the total cattle population which is thought to be affected with Bang's disease. Between 50 and 60 per cent of the herds are thought to be harboring infection in some degree. The information further indicates that all breeds of cattle are equally susceptible to the disease. However, the systems of management in various sections of the country have some bearing as to the degree of infection.

Beef cattle in the northern parts of the country, where some form of protection is necessary during the severe winter months, are thought to be as heavily infected as dairy cattle. Beef cattle in the lower latitudes, where the climatic conditions are not severe and where they spend practically their entire period of life on the range, are thought to carry only a very small degree of infection.

Thirty-eight states reply that they have a definite plan of control against Bang's disease. The exact procedures which are followed by the different states vary somewhat. In some cases the states assume definite responsibility in relation to encouraging and directing the abortion control program, while in other states definite procedure is planned and advice pertaining to this procedure is given whenever requested. The general plan which is followed by these thirty-eight states is similar. It is based on the detection of infected animals by means of the agglutination test and then handling the reactors in accordance with the best possible procedure, which can be outlined under the existing conditions of the various farms. The most desirable procedure is the complete segregation of the reacting and non-reacting animals. If this cannot be followed, then it is conformed with as nearly as possible.

The fact seems quite generally established that the proper application of the results based on the blood test and a reasonable sanitary program are adequate in most instances to reduce gradually and eradicate Bang's disease from the herd eventually.

Ten states report that no biological agents are being used, and seventeen states have regulations which definitely control the use of abortion biologics.

Thirty states have interstate regulations which prohibit the introduction of cattle unless they meet with the regulations pertaining to Bang's disease. Twenty-three states definitely prohibit the introduction of cattle unless they have passed a negative test to Bang's disease prior to shipment. Seven states will not accept cattle which are known reactors to a test for Bang's disease, except by special permit or for immediate slaughter.

The interstate regulations promulgated by the various states have the same object in view, and in a general way the provisions are somewhat similar. There are, nevertheless, variations concerning certain features pertaining to the kind of test to be used, the age of the animals which must be tested, the number of days within which the test must be conducted prior to shipment, etc. The differences in the regulations pertaining to this disease are not sufficient to be of serious consequence to cattle-owners moving animals from one state to another. In fact, similar differences exist pertaining to the regulations concerning the tuberculin test. Some states still will not accept the single intradermic test, while most of the states recognize it. The interstate regulations which the thirty states have promulgated serve as a large factor in compelling the herd-owners' attention to the disease. They likewise offer a certain measure of protection, although to obtain the full value indicated by these regulations, considerable educational work must go along with them.

The purchase of a negative animal from an infected herd does not grant the security which the owner may be led to believe. He should be appraised that this negative animal should not be put into an infected herd. He should
further be advised that it should not enter a clean herd until it has served a period in quarantine and been retested and found to be negative.

The increased interest in and better understanding of Bang's disease by the farmers and herd-owners has been responsible in a large degree for the decreased use of abortion remedies. The answers in the questionnaire thoroughly indicated that the use of abortion remedies is decidedly on the decline. Some states have passed laws prohibiting the use of abortion cures. Live stock sanitary officials in some of the states have waged a relentless war against these fake remedies.

Veterinarians throughout the country have in a large measure discontinued the use of abortion biologics. The use of abortion bacterins has decreased to a minimum. Live-culture vaccines are still being employed in treating Bang's disease to some extent. In some of the states the use of live-culture vaccine is not permitted in a particular herd until the degree of infection is known and then this product is used only when it is deemed feasible.

During the past year some of the states have passed regulations providing that only cattle negative to the abortion tests can be exhibited at state fairs. Some of the big national exhibitions of cattle have likewise adopted the rule that only cattle negative to the abortion test can be shown. Following the example of the states and national fairs, regional and county fairs have likewise passed similar regulations. Such regulations compel the owner of pure-live stock to make an early endeavor to rid his herd of this disease in the event that it is present.

Live stock owners seem to possess a keen appreciation of the devastating effects of this disease. Their interest is aroused to the point where they possess the desire to undertake a clean-out program. They appreciate at this stage that a pure-bred animal in the future will have little value unless it can be ascertained to be free of Bang's disease.

The question of relationship of this disease to public health has held a prominent position. Considerable national publicity at one time indicated that Bang's disease was an important factor in public health. Careful research work has gone a far way in changing the original opinions of the seriousness of Bang's disease to human health. At the present time there is sufficient information to indicate that Bang organisms in milk are rarely responsible for producing undulant fever in the human. The exact extent to which this disease in cattle is responsible for infecting human beings is not definitely determined and final decision on this particular point must await further reliable finding. It is apparent that the live stock sanitary officials minimize the effects that the bovine type of this disease has on the human family while the health officials tend to regard the bovine infection with more concern.

Some cities have passed or contemplate passing ordinances prohibiting the use of milk coming from infected cattle. Some ordinances tend to be more drastic than necessary, and as a result create an unwarranted burden on the herd-owners.

Movements have been started in some states to provide funds for the purpose of not only eradicating this disease but also for providing indemnity where reacting animals are condemned and disposed of. Herd-owners are inclined to support such a movement. Live stock sanitary officials at this time are definitely opposed to taxation for paying indemnity on abortion reactors. The amount of infection is so high, when compared to the amount of existing tuberculosis at its peak, that if operating costs and indemnity were paid, commensurate with that for tuberculosis eradication, appropriations to cover such costs and indemnity would have to be stupendous. In the eradication of Bang's disease from the herd the owner must assume considerable responsibility relative to the execution of the sanitary program. A non-cooperative attitude would tend to stop progress against the disease in any herd. It is true that some animals which react to tests for Bang's disease may possess considerable economic value, and it would be contrary to policy to dispose of such animal for slaughter.

The question of the efficient detection of Bang's disease in cattle has received a great deal of attention. The agglutination tests (both the tube and the plate method) are regarded as being sufficiently accurate to be of great economic value. Comparative tests of many laboratories confirm that the plate method
corresponds favorably with the tube method. Antigens used for the agglutination test may vary considerably. It is possible to produce a highly sensitive antigen or an antigen which can be regarded as lacking in sensibility. The standard which is being used in most cases at the present time is the one which has been developed through experience in conducting a large number of tests and correlating the results of these tests with past and future histories of the cattle on which said tests were made. It is believed that different states employ somewhat different standards in relation to antigens used.

Experience has clearly indicated that the success which is achieved in eradicating this disease from a herd is dependent as much if not more upon the effectiveness of the sanitary procedure as it is upon the agglutination test. The results of an accurate agglutination test have little value if the application of these results through the sanitary program are not effective; since such is the case, it is important that a trained sanitarian, such as the practicing veterinarian, undertake the direction of the sanitary program. The practicing veterinarian should take an important part in the execution of the sanitary program and other phases of this disease.

In Wisconsin, practicing veterinarians, who are trained and approved for abortion control work, conduct the blood tests as well as direct the sanitary procedure; the work is checked from time to time and kept under close supervision. Only antigens, of which advance samples are approved by the state control laboratory, are permitted to be used, and all agglutination tests are compelled to be reported.

Research work has been in progress during the past year at the various experiment stations and the federal Bureau of Animal Industry in relation to the various phases of this disease. This Committee earnestly recommends that research projects pertaining to this disease be continued, and, if possible, be given more support. Research in connection with chemotherapy, biologics, improvement of antigens and the transmission and behavior of this disease under natural conditions, are particularly indicated.

**Part III**

**Interstate Movement of Dairy and Breeding Cattle**

There is every indication that Bang's disease is a serious menace to the cattle-breeding industry. Our knowledge concerning some of the phases of this disease is still incomplete, although the subject has been carefully and consistently studied by the most highly trained and skillful scientists in many countries. It is known, with the knowledge now available, that cattle-owners can control the spread of this disease and materially reduce their loss by strict attention to sanitation in connection with the proper use of the agglutination test. When the benefits from these measures become more generally understood, a demand will follow for more progressive measures and, with the support and cooperation of the cattle-owners, it will be possible to eliminate the disease.

Your Committee suggests the following uniform regulations for the interstate movement of dairy and breeding cattle:

1. No dairy or breeding cattle shall be shipped, driven on foot, or otherwise transported interstate except upon the following conditions:
1. That such cattle are moved interstate to public live stock markets where federal inspection of live stock is maintained.

2. That such cattle come from a herd which has been officially certified as a Bang disease-free herd by the state in which that cattle originated.

3. Unless such cattle have been tested within 30 days prior to date of movement, by the agglutination test for Bang's disease, and shown to be free from such disease, such test not to be applied within 15 days from date of calving.

II. The rapid plate or tube agglutination test will be accepted providing it has been applied by a regularly employed state or federal veterinarian, or an accredited veterinarian who has had special instruction in applying the agglutination test by federal or state laboratory instructor, and approved by state live stock sanitary official.

III. Certificates of test charts must be made in triplicate form, one copy to be attached to waybill for the shipment or otherwise movement of cattle. The two other copies must be forwarded by the veterinarian issuing same to the state veterinarian or sanitary official of the state where animals originate, for his approval and distribution. One copy is to be retained by him, one copy is to be forwarded to the live stock sanitary official in the state of destination.

IV. Each animal negative to the test shall be ear-tagged or otherwise permanently marked or identified by registration name and number.

Your Committee suggests that the Committee next year formulate a uniform set of requirements for certification of Bang disease-free herds.

Dr. R. R. Birch: Does that regulation permit the interstate shipment of animals which do not come from state-certified, clean herds?

Dr. Malcolm: It takes care of that. They are either to be tested or to be from state-certified, accredited herds.

Dr. Birch: There are several points with respect to these regulations which are very important and which should receive our most careful consideration. Placing importations on the basis of the clean herd is essential if we are to progress. As far as individual states are concerned, steers and cattle for immediate slaughter may be admitted without test. Pure-bred bulls, young unbred heifers and cattle from clean herds under satisfactory supervision in other states may be admitted on individual test with reasonable safety. I believe that mature breeding females from herds of unknown status or from those known to contain reactors should be admitted only under special permit. These points I conceive to be the basis of regulations which really will be effective but some latitude will be found necessary if each state meets its own individual problem.

I am sure the weak spot in most regulations in force today is that they admit all individuals that test clean regardless of whether they come from clean herds. Bulls and unbred heifers may be accepted on this basis with a degree of safety because they do not break down rapidly and become spreaders but the reverse is true of mature breeding females. Those of us who have been engaged in cleaning up herds and keeping them clean know perfectly well that we cannot, without great danger, move into our clean herds mature breeding females from infected herds or from herds of unknown status even though the transferred animals test clean. Yet, the regulations in most of our states place the official stamp of approval on this practice, which naturally leads purchasers to believe it is a safe procedure.

I hope when our Committee gets to work it will, as Doctor Connaway has suggested, build its recommendations on these known facts. We are misleading our breeders and causing them heavy and unnecessary losses until we abandon the test of the individual (with the exceptions mentioned) as a basis for interherd and interstate transfer.

Dr. Malcolm: Mr. Chairman, I think the first part of Regulation I takes care of the proposition where cattle are shipped to central markets where federal inspection is maintained, so that animals that are not tested can go to those markets. But if these regulations were adopted, they couldn't move out of those markets into our states, if all the states had the same regulation.
DR. A. T. KINSLEY: If I understand the remarks of Dr. Birch and Dr. Malcolm, there soon would be no animals passing through public markets for breeding purposes. I am wondering how that is all going to work out. If I understood Dr. Wisnicky, there are fifty to sixty per cent of the herds now infected. Is that right?

DR. WISNICKY: To some degree.

DR. KINSLEY: That is estimated. There are perhaps eighteen per cent of the breeding and dairy cattle in the country that are affected.

Regarding Dr. Malcolm's suggestion of testing in public markets through which many breeding cows are shipped at the present time, I would like to ask the Doctor how he determines on a springer cow just fifteen or sixteen days before calving.

DR. MALCOLM: After calving.

DR. KINSLEY: That would not be so difficult, but these cattle come up for test, and they are supposed to go out in two or three days' time, and it is not always possible to determine just the length of time, particularly before calving. It is more easily determined afterwards.

Second, those who do testing in the public yards find that a certain percentage of those animals react positively. We have no regulations as to what can be done with those reactors. For the benefit of the speakers who have preceded me, I can assure them that some positive reactors are switched over into the feeding class and shipped to their states. How is that to be prevented? It is a difficult problem.

Then following on out, I am wondering, in these twenty-three states (I believe that is correct) that require negative-reacting animals shipped in for breeding and dairy purposes, how many of the regulatory officers, when they receive the certificate of inspection, write those parties and tell them that these are negative animals and should not be commingled with herds in which there is Bang's disease. I know personally of instances where cattle were shipped out and went into herds that were positive, in states that have these regulations now. Gentlemen, I ask you, what value is that test at the man who takes only the negative-reacting animals and places them in infected herds?

DR. H. MARSH: I would suggest the elimination of one clause in those regulations, which would simplify them and make them more practical. The clause is in the regulations of a number of states, but I believe it is unnecessary. That is with regard to rejecting a test fifteen days before and fifteen days after calving. That just complicates it. Of course, there may be some chance that you would miss a positive cow that would come in. There is also the chance that on the test as outlined by the Committee, you might get a positive cow on a negative reaction. You stand just as much chance, I believe, of getting that kind of a cow earlier in pregnancy. Some cows, at least, will not react and in thirty days abort.

To simplify the regulation, I would suggest that that particular clause be eliminated.

DR. C. H. CASE: I would like to ask one question of Dr. Malcolm. He said that a shipment of cattle should have a test within thirty days. What are you going to do with a man who has a show herd? One client entered eleven state fairs, starting the latter part of August and ending up at Thanksgiving time. Does he have to test those cows every thirty days going into different states? That is a serious complication. They are held up on the line. They want to know what they can do. I would like some information.

DR. MALCOLM: The idea of thirty days before shipment is that you have any time within the thirty days to ship. You can test them the day before you ship them.

The point he brings up is that they are moving from one show circuit to another. That would be governed by the regulations of the fair association.

DR. CASE: They are held up at the line.

DR. MALCOLM: For instance, you have a show circuit moving from your state to Iowa. We do not require an agglutination test at the State Fair in
Iowa. They haven't gone that far with it yet. Your particular point there would be that you would have to conform with the regulation of the State Fair and not with this regulation.

DR. CASE: The states are making the trouble and not the fairs. It is the state line that has held these fellows up.

DR. MALCOM: I don't know of anything being held up in coming into Iowa.

DR. CASE: Some of the other states have done it.

DR. MALCOM: Our thought is to have something uniform for the interstate movement of dairy and breeding cattle, because I notice that in a great many of the regulations they accept this and they accept the other. We attempt to bring out a standard that all states would accept.

With regard to Dr. Kinsley's remarks, I think the regulation takes care of the shipment into there. Then if you have this regulation of shipping out of the market into the state, that clears your central market, and you will have to let the state, into which the cattle go, take care of its own problem.

Another gentleman here said something about applying the test fifteen days before date of calving. There is nothing in this regulation that says any specified time ahead of shipment, but it does require that the test not be made sooner than fifteen days after calving.

PRESIDENT CONNAWAY: It is best to bring up every possible obstacle, because we can't overcome them or get around them without knowing what they are.

MEMBER: I am not clear as to whether or not this is a Committee report to be adopted and to be enacted, going out as the official recommendations of the Association. If it is simply a recommendation for further study and adjustment of the problems we are discussing, I am in favor of it, but, if not, surely it is in no condition to adopt now and to put in as a uniform regulation.

DR. MALCOM: This Committee report is merely a suggestion that these uniform regulations be adopted. It is up to the Association. We are not asking the Association to approve it.

DR. C. A. CARY: We haven't heard the details and don't know the regulations. I think we ought to have some means by which we can get at definite things. We should have this printed, as the other Committee did. A lot of us in the back of the room, even sitting where I am, could not get the exact facts of these regulations. I think we are going into this thing blindly. I think we need to see what we are doing or know what we are doing. Either get a blackboard and have these written down, or else have them printed.

DR. M. JACOB: Mr. Chairman, I want to discuss this question, not from the standpoint of a regulatory officer, because I am not a regulatory officer, but it is my opinion, speaking from the standpoint of a veterinarian and also from the standpoint of a livestock enthusiast, that this regulation as it is now submitted is entirely premature. (Applause) I believe that if a uniform regulation such as this were to go into effect at this time, it would react to the detriment of the veterinary profession. I think it would be a hindrance to the development of the livestock industry, because, as Dr. Kinsley brought out a moment ago, these apparently clean herds (and we will assume they are clean cattle) will go into another man's herd that is infected and, in reality, start up a new storm of the disease.

In view of these facts, Mr. Chairman, I move that this report be referred back to the Committee for another year's study and, in addition to that, that a copy of the report be submitted to the various regulatory officials for study before they come to this meeting.

The motion was seconded by several and duly carried.

PRESIDENT CONNAWAY: The next on the program is Dr. W. K. Lewis on "Experiences and Results of State Quarantine Against Abortion Disease." (Applause)
EXPERIENCES AND RESULTS OF STATE QUARANTINE AGAINST ABORTION DISEASE

By W. K. LEWIS, Columbia, S. C.

State Veterinarian

Back in the year 1923, at the solicitation of Colonel B. W. Hunt, of Eton, Georgia, a few live stock sanitary officials and live stock owners in the southeastern states were asked to meet with him in Macon, Georgia, to talk over this condition of Bang's disease, at that time referred to as contagious abortion.

Col. Hunt and Dr. Connaway being personal friends, Dr. Connaway came down and met with us, also Dr. W. E. Cotton, of the U. S. Bureau of Animal Industry. Well do I remember that day spent in Macon when this subject was discussed very thoroughly, taking into consideration the information we had of the condition at that time.

As a result of that conference, the state veterinarians present, Dr. Peter Bahnsen and myself, and probably Dr. Knapp, of Florida (I have forgotten if Dr. Knapp was present or not), agreed that we would formulate regulations pertaining to Bang's disease and refer them to the regulatory officials of the southern states for their consideration, and to meet at a later date and agree upon a uniform regulation.

In the main, we were unsuccessful in getting the other regulatory officials to meet with us. My good old friend Dr. Cary even went back on us. In fact, he wrote me a letter and intimated that Bahnsen and I were crazy. Probably we were, because we didn't know what we were talking about. Anyway, Dr. Cary has since fallen in line.

However, before the regulations could be submitted to all the regulatory officials and meet with their approval, our old friend Peter Bahnsen, in his enthusiasm, promulgated and adopted his regulation, effective September 1, 1923. In fact, I think Peter wanted to be the first to get on the bandwagon.

In June, 1924, the state of South Carolina adopted a regulation that we thought was very workable at that time. I will admit it was not perfect in every respect. However, it has worked very nicely. We immediately sent copies of our regulations to all the regulatory officials of the various states, and we obtained replies from some, but very few. However, we felt that this condition had to be met face to face sooner or later, and we were not afraid to face the issue. We notified the transportation com-
panies. I want to say that we have received practically 100 per cent cooperation on the part of the transportation companies in bringing cattle into the state of South Carolina with a certificate showing that they have not only passed the tuberculin test but the blood test for Bang's disease as well. There have been few exceptions, but very few.

At this point I would like to refer to Dr. Case's point. We permit exhibitors to ship cattle into South Carolina for exhibition purposes with the understanding that if any of the cattle sold remain within the State, they must pass the blood test. We didn't care to throw a wrench into the machinery of the fair officials and prevent these herds coming in, because we want our people down there to see good cattle. We have had very few cattle, but at this time we have some mighty nice herds.

We do, however, have some trouble with trucks, I might say, over which we have very little control, because cattle are brought into the State not only from adjoining states but other states, and it is practically impossible for us to keep up with these men as they cross the state line, because a great many of them are brought in under cover of night, and we have no way of tracing them. However, we have done so only in a few instances.

Following the step taken by Georgia and South Carolina, I believe Arkansas was the next state to fall in line. The thought that we had, that originated at that little meeting in Macon, Georgia, since that time has gradually spread until at this time, as stated by Dr. Wisnicky, there are thirty states that have similar regulations. Seven states will not permit the shipment of reactors, old reactors, except for immediate slaughter.

We feel that the action that we took at Macon, Georgia, in July, 1923, has been of inestimable value to the live stock industry of our Union. As stated by Dr. Wisnicky, the interest that was created in the testing of herds in our state, by virtue of the fact that the quarantine was placed into effect, has been wonderful. I doubt very seriously if the people in the state of South Carolina or any of the other states where we have similar regulations would take the same amount of interest in the testing of their herds, if you did not have the quarantine regulation. We have found that true in other lines of work.

As to the quarantine, we handle the situation in this way: We are only testing herds by reports. We have it thoroughly understood with the owner beforehand that any of the cattle that react to the test will be placed under quarantine and must
be kept isolated from the remainder of the herd, or he might dispose of them for immediate slaughter.

As stated a few minutes ago, of course we have a larger number of grade cattle in our state than pure-breds. That isn't such a factor, because the majority of the cattle-owners are willing to dispose of these cattle for immediate slaughter. They desire to get them off their premises as soon as possible. So we have practically no violations of our state quarantines in that respect.

As a result of the interest manifested in our state regarding the testing of cattle (I am referring to blood testing, of course), as far as I could ascertain, the South Carolina Guernsey Breeders Association was the first association in the United States to refuse to allow animals to be placed in the sale unless they were negative to the test for Bang's disease. The action taken by the Guernsey Breeders Association was also taken by the Jersey Breeders Association.

Mr. Chairman, as I stated in the beginning, the points regarding this condition have been so thoroughly covered, especially in Dr. Wisnicky's report, there is little for me to say except that, in the main, we have had no complaint from any of the cattle-owners in our state, no opposition regarding the quarantine that we have and the manner, I might say the practical manner, in which we are handling the reactors, assisting them to free their herds of infection. As far as we can ascertain by retesting, we have cleaned several badly infected herds in the State along practical lines that were originally laid down by Dr. Connaway.

(Applause)

DISCUSSION

DR. C. E. COTTON: I would like to ask Dr. Lewis if he tags reacting cattle and if his regulations provide that Bang's disease is a quarantinable disease.

DR. LEWIS: Yes. We tag the animals with a serial number tag, and the owner is served with a quarantine notice.

We do this, however, Dr. Cotton: We have an understanding with the herd-owner, before the test is applied, as to what he may expect in case any reactors are found.

DR. COTTON: What disposition is made of your reacting cattle when they are shipped for slaughter? Is there a permit issued so they will be slaughtered only, or can they be resold for other purposes?

DR. LEWIS: Slaughtered only.

DR. BIRCH: How many breeding cattle do you import a year?

DR. LEWIS: In the past year we have imported probably 2,000 head of breeding cattle. There is quite a bit of interest in dairying down in that section, and quite a number of cattle have been shipped in from the various states, as far north as Wisconsin, Tennessee, and other states surrounding.

DR. COTTON: You quarantine them and you tag them. You give a permit, when they are shipped for slaughter, and release them from quarantine.

DR. LEWIS: We do not give a permit to be shipped out of the state. They must be sold in the state of South Carolina.
THE EFFECT OF PASTEURIZATION UPON BRUCELLA MELITENSI VAR. SUIS

By CHAS. MURRAY, S. H. McNUFFT and PAUL PURWIN

Department of Veterinary Investigation
Iowa State College, Ames, Iowa

Conflicting data regarding the effect of pasteurizing temperature upon Brucella melitensis, var. suis, in market milk have led to uncertainty of public health officials concerning the health hazard of milk carrying this organism. Numerous investigators have reported the porcine variety showing greater heat resistance than the bovine. Boak and Carpenter report experiments of Park which showed that a mixed culture of Brucella abortus isolated from cattle and swine was killed by exposure to 140° F. for 10 minutes, 142° F. for 7 minutes, and 145° F. for 5 minutes.

These same authors report the results of thermal death-point studies of several strains of Br. abortus of bovine, porcine and human origin grown in milk. The exposure of the cultures was in Sternberg bulbs submerged for varying intervals in an electrically controlled water-bath. Human and bovine cultures were destroyed in 15 minutes at 140° F. No cultures were viable after 20 minutes when tested by injection into guinea pigs and by inoculation on suitable media. They also state that the cul-
tures most virulent for guinea pigs showed the higher thermal death point and that the porcine strain was most resistant. Other investigators have reported similar results but none in America, as far as indicated by available literature, have made the tests using the type of pasteurizer in common use by the dairy industry.

Proescholdt\(^3\) has shown that \textit{B. abortus} (Bang) is killed by heating for one-half hour at 60°-65° C. (140°-149° F.). Zeller and Wedemann\(^4\) have conducted experiments to test the effect of continuous pasteurization upon milk inoculated with \textit{Br. abortus} (bovine). Five experiments were carried out, using an

\begin{table}
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\hline
\textbf{Sample} & \textbf{TEMPERATURE (°C.)} & \textbf{CULTURES} & \textbf{GUINEA PIGS} & \textbf{GUINEA PIGS} \\
& & & \textbf{TI TRE (9-23)} & \textbf{LESIONS (9-23)} & \textbf{CULTURES} \\
& & & \textbf{PIG 1} & \textbf{PIG 2} & \textbf{PIG 1} & \textbf{PIG 2} & \textbf{PIG 1} & \textbf{PIG 2} \\
\hline
Uninoculated & 12 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
Inoculated & 12 & + & Died & 400 & + & + & + & + \\
After 0 min. & 60 & + & + & 400 & + & + & + & + \\
After 1 min. & 61.7 & Mold & Died & 400 & 0 & + & 0 & + \\
After 2 mins. & 62 & Mold & 0 & 400 & 0 & 0 & 0 & + \\
After 3 mins. & 62.5 & Mold & 0 & 400 & 0 & + & 0 & + \\
After 4 mins. & 62 & Mold & 400 & 400 & + & + & + & + \\
After 5 mins. & 62 & Mold & 0 & 0 & 0 & 0 & 0 & 0 \\
Outlet after & 30 minutes & Mold & 400 & 400 & + & + & + & + \\
Foam after & 30 minutes & Mold & 200 & 400 & 0 & 0 & 0 & + \\
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Ahlborn pasteurizer of two types, one with a preheater and the other without. This Ahlborn-type pasteurizer is very similar to the machines in common use in creameries and pasteurizing plants in America. It consists of a wood vat, metal-lined and equipped with a tubular rotating stirrer, through which water heated by steam is continually flowing to maintain the desired temperature of the milk batch. It is equipped with a recording thermometer to register the milk temperature throughout the process. The type equipped with preheater differs from the other only in that a separate container is installed to retain the milk while it is being brought to the desired temperature. As
soon as this temperature is reached, the milk is conducted into
the pasteurizer proper, where the temperature is maintained
under constant agitation.

Thirty different bovine Bang strains, some freshly isolated,
others cultured in the laboratory for a long time, were used. In
each experiment the washings of growth from 18 to 30 Kölle
dishes, incubated 2 to 10 days, were filtered through a single
paper filter and added to 250 to 550 litres of milk. Varying
degrees of heat were used for different times, and cultures were
made in bouillon and upon common and Drigalski agar. Guinea
pigs were inoculated in different ways with the pasteurized
samples. After two months, the pigs were autopsied and cultured.

**Experiment II**—Culture: Bovine 20. Milk: Fifteen gallons pasteurized, not
clarified; temperature 9° C.; placed in vat and raised to 62° C. in 9½ minutes.
Machine operated with open lid. (December 12, 1930.)

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<tr>
<th>Sample</th>
<th>Temperature (°C.)</th>
<th>Cultures</th>
<th>Titre (1-9-31)</th>
<th>Lesions (1-9-31)</th>
<th>Cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninoculated</td>
<td>9</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inoculated</td>
<td>9</td>
<td>None</td>
<td>400</td>
<td>400</td>
<td>+</td>
</tr>
<tr>
<td>After 1 min</td>
<td>62</td>
<td>None</td>
<td>40</td>
<td>10</td>
<td>+</td>
</tr>
<tr>
<td>After 3 mins.</td>
<td>61.5</td>
<td>None</td>
<td>400</td>
<td>25</td>
<td>+</td>
</tr>
<tr>
<td>After 4 mins.</td>
<td>61.7</td>
<td>None</td>
<td>400</td>
<td>400</td>
<td>+</td>
</tr>
<tr>
<td>After 5 mins.</td>
<td>62.2</td>
<td>None</td>
<td>25</td>
<td>200</td>
<td>+</td>
</tr>
<tr>
<td>After 30 mins.</td>
<td>62.5</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Outlet</td>
<td>None</td>
<td>400</td>
<td>400</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Foam</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

In most of the tests run the bacteria were all killed in the milk
after it had passed the preheater (to bring it to 60° C. before
placing it in the pasteurizer proper). In a few cases the organ-
isms were still viable after passing the preheater, but when the
60° C. temperature was maintained for 10 minutes, all were
destroyed. The conclusion, stated by the investigator, is that
continuous pasteurization at 60°-63° C. (140°-145° F.) for one-
half hour is sufficient to destroy all Bang abortion (bovine)
organisms contained in milk.

Our experiments to determine the effect of commercial pas-
teurization upon the porcine type of Brucella were conducted
using a machine which was a 100-gallon size pasteurizer kindly
loaned us by the Dairy Industry Department. It was set up in
a room of the laboratory where water, steam and electric connections were possible. The machine is a coil machine known by the manufacturer as Class A-1. It was equipped with a recording thermometer. In the first 5 runs made, the temperature as indicated on the chart of the recording thermometer never showed below 60°C (140°F) and never above 62.2°C (144°F). The results of the first 5 runs were irregular and unsatisfactory. The first test showed all organisms killed in a sample removed after a 1-minute exposure at 63°C (145.4°F), while the remaining four showed viable organisms in samples removed after exposure up to 62°C for 4 minutes and in the foam and outlet after 30 minutes up to 63°C. In seeking a cause for this irregularity we enlisted the help of those familiar with commercial pasteurizing methods and learned that advice given us when the machine was being set up was erroneous. This was to the effect that the lid of the pasteurizer need not be closed and, acting upon this, contrary to our better judgment, our first 5 runs had been made with an open lid. The next 4 runs were made with a closed lid and, as indicated in the charts, were uniform and satisfactory.

The cultures used in all experiments except two are the same and consist of 3 porcine strains: No. 4, isolated in 1926; No. 44, isolated in August, 1929, and No. 51, isolated in February, 1930. All are of tested virulence for guinea pigs. The quantity of culture used was that obtained from 4 agar slants of each strain,
12 in all, grown 48 hours, washed off with milk and then filtered through glass wool. These cultures were added to 15 gallons of pasteurized milk, not clarified. Samples of milk to be tested were removed from the pasteurizer at varying intervals with a 10-cc pipette. The samples were immediately placed in the refrigerator (temperature, 10-14° C.) and allowed to stand two or more hours until the cream line formed. Intraperitoneal injections of the cream into guinea pigs and inoculations on agar were made. In most cases the latter were unsatisfactory, showing a heavy overgrowth with molds. Agglutination tests against an antigen prepared from the three porcine strains used for inoculation were conducted on the blood from all injected guinea pigs at intervals of approximately 30 days after injection.

**Experiment IV—Culture: Bovine 20. Milk: Fifteen gallons pasteurized, not clarified; temperature 9° C.; placed in vat and raised to 61° C. in 9 minutes. Lid closed and outlet plugged. (January 7, 1931.)**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Temperature (°C.)</th>
<th>Cultures</th>
<th>Guinea Pigs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pig 1</td>
</tr>
<tr>
<td>Uninoculated</td>
<td>9</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Inoculated</td>
<td>9</td>
<td>None</td>
<td>400</td>
</tr>
<tr>
<td>After 5 mins.</td>
<td>62.5</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>After 10 mins.</td>
<td>61.5</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>After 15 mins.</td>
<td>62.5</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>After 20 mins.</td>
<td>62</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>After 25 mins.</td>
<td>62</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>After 30 mins.</td>
<td>62.5</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Foam</td>
<td>62.5</td>
<td>None</td>
<td>0</td>
</tr>
</tbody>
</table>

The results of pasteurization in one experiment with open lid indicate that all organisms were destroyed after the temperature of 63° C. (145.4° F.) was maintained for one minute, not only in samples removed from the vat of the pasteurizer but also in those from the outlet and from the foam. In the four other tests with open lid, results were variable. In no case was the temperature range (60-63° C. for 30 minutes) sufficient to kill the organisms from the foam or outlet samples. The outlet consists of a 1-inch faucet with the cut-off at the lower end. Later models use a flush gate-valve, a matter of great importance as shown later. The milk contained in this was not agitated by the stirrer and consequently probably never reached even the minimum temperature of the milk in the vat. Certain it is that
the organisms contained were still viable, as evidenced by the infection set up in 9 of the 10 guinea pigs inoculated. In experiment 2, which is a check test, substituting a bovine strain for the porcine strains used in the first five, results differed only in that living organisms were not obtained from the foam. This suggests that the porcine strains used may be slightly more heat-resistant than the bovine. In any case, pasteurization with open lid for 30 minutes is not effective in destroying either the porcine or bovine variety of Brucella.

In the last three experiments slight changes in technic were made. The lid was kept closed, except while sampling, and the outlet of the machine was closed with a rubber stopper on the inside, thus giving an effect similar to the use of the flush gate-valve. Temperature readings were made from a standardized thermometer inserted through a rubber stopper in the recording thermometer opening into the vat. To check these readings a second thermometer was inserted through an opening in the lid to a point just above the surface of the milk, to determine the effect of opening and closing the lid for sampling at the intervals indicated. While the lid was kept closed the difference between the temperature of the milk and that of the air above was not over 2° C. When the lid was opened to obtain samples the temperature of the air fell as much as 8° C. but was restored in one minute to at least 61° C.

In these three tests pasteurization was effective in 3 minutes at 62° C. (143.6° F.) as far as milk tests show and in 30 minutes as indicated by tests of the foam. It is more than probable it was effective for the foam in less than 30 minutes but animal inoculations were not made with foam before this time. It was not demonstrated that pasteurization with the lid closed would be effective for the milk in the outlet but from the results of the first 6 experiments it would not appear probable, since the milk contained in the faucet would not be more agitated with a closed lid than with an open one and the milk in this dead space would probably never reach the temperature necessary for effective pasteurization.

**Summary**

Pasteurization tests, using a standard pasteurizing outfit, show that a temperature of 62-63° C. (143.6-145.4° F.), applied three minutes, is sufficient to destroy Brucella organisms, both the bovine and porcine varieties. This indicates that the usual
pasteurization temperature of 62-63° C. for 30 minutes gives an ample factor of safety, providing the pasteurizer is operated in the proper manner. With the lid of the pasteurizer open, a much longer time exposure to this temperature is required and the results obtained are irregular and uncertain, in that viable organisms were recovered from the foam even after pasteurization for 30 minutes. The absolute necessity of a flush gate-valve is also indicated, for in those experiments in which an ordinary faucet outlet was used, viable organisms were obtained from the outlet after pasteurization for 30 minutes, whereas with the outlet closed by a stopper on the inside, no living organisms remained after exposure for three minutes. The experiments emphasize the importance of carefully conducted operations in pasteurization if successful results are to be obtained.

REFERENCES


DISCUSSION

PRESIDENT CONNAWAY: This research paper has a very practical application and is very pertinent to a session of this kind. It helps to close up the little gaps whereby infection may be spread. Are there any questions?

DR. J. TRAUM: Dr. Murray, did you make any observations earlier than three minutes?

DR. MURRAY: One and two minutes. They were both positive.

PRESIDENT CONNAWAY: Are there any further questions? If not, we will pass to the next paper, "Further Researches on Bang's Disease," by Drs. W. E. Cotton and J. M. Buck, U. S. Bureau of Animal Industry. Dr. Buck will read the paper. (Applause)

. . . Dr. Buck read the paper. . . .

FURTHER RESEARCHES ON BANG'S DISEASE

By W. E. COTTON, Superintendent, and J. M. BUCK, Assistant Superintendent, Experiment Station, Bureau of Animal Industry, U. S. Department of Agriculture, Bethesda, Maryland

At the 1930 meeting of this Association we presented a paper briefly discussing the Bureau's work on Bang's disease that had been accomplished since the presentation of a paper by the late Dr. E. C. Schroeder, nine years previously, which reviewed the earlier work done by the Bureau on this subject and gave an account of studies then recently completed or in progress.

It is the purpose of the present paper to supplement that of a year ago; giving results of work then unfinished but now completed and some that has been undertaken since.
The paper of a year ago, among other things, directed attention to results that had then been obtained from experiments on the transmission of the disease to cattle through the conjunctiva, as well as through the intact and slightly abraded skin; and to other studies made to gain more light on the relation that may exist between cattle and swine abortion. Considerable attention was given to vaccination as a prophylactic measure, in an effort to secure more definite information as to the value of this method of combating the disease and, if possible, so improve methods of vaccination as to free them from objectional features. It was possible, a year ago, to discuss some of the experiments in immunization that had been completed but others had not progressed to a point where results could be predicted with certainty. Abortion disease experiments with cattle, especially those which concern immunity, are far too time-consuming to expect that many facts will be discovered or radical changes in ideas regarding the problem brought about within a twelve-month period. However, the Experiment Station's work on Bang's disease has progressed during the year, and it is possible to present at this time a limited amount of additional data, either in connection with the unfinished experiments of last year, some of which have now been completed and the data presented for publication, or with work inaugurated within the year.

**Modes of Transmission**

Opportunities have presented themselves during the past year to make further studies of the conjunctival method of exposure in connection with cattle. We reported a year ago that, out of 17 attempts to transmit the disease through this channel, 16 had been successful. We are now able to state that of 26 pregnant cows or heifers that have been used, either as controls in vaccine experiments or employed exclusively for the securing of information on this method of transmission, 25 have acquired the disease and 22 of these have aborted. We have experienced some little difficulty, especially in our vaccine experiments, in avoiding over-exposure or under-exposure when making use of this method. However, it seems possible, either by adjusting the dose or the proper selection of the *Br. abortus* strains, largely to overcome this feature.

Endeavors have been made to secure further information regarding the intact skin as a portal of entry for the infection, by subjecting three pregnant heifers and one pregnant cow to this mode of exposure.
It was previously reported that four out of seven animals, where suspensions of *Br. abortus* had been deposited upon the skin, had acquired the disease. Of the four animals which have been more recently used to shed further light on this matter, one acquired the disease and aborted, another produced a vigorous calf and, as far as could be determined, failed to acquire the malady. A sufficient length of time has not yet elapsed to show what will be the outcome of the gestation periods of the two remaining animals, since they were but recent additions to the experiment.

While it remains purely a matter of conjecture as to whether either of these portals of entry for the infection are frequently or rarely employed by the microorganism, it seems by no means improbable that they may be involved with greater frequency than we have been accustomed to suspect.

**Relation of Cattle and Swine Abortion**

On the question of the intercommunicability of cattle and swine abortion, we stated in our report of a year ago that swine strains had given evidence of being less pathogenic for cattle than strains of the bovine type. We experienced considerable difficulty in causing pregnant heifers to abort, even following conjunctival exposure to heavy *Br. abortus* (*suis*) suspensions prepared from the sixth transfer of a typical swine strain. Our more recent results have tended to confirm those which our previous experiments yielded. Three additional pregnant cattle have now been exposed via the eye to a swine strain and one pregnant cow has been subjected to swine strain exposure via the skin. Two of the animals have been subjected to eye exposure on three different dates; another has been exposed by this method but once. The fourth animal has received two skin applications of suspensions prepared from swine strains. The gestation periods of none of the group have yet been completed. However, judging from the agglutination results which have been obtained in all cases, it seems extremely doubtful if the infection has become established in any of the animals.

**Brucella Abortus in the Blood of Swine**

To gain more information on the nature of abortion disease in swine, 2 mature boars and 12 pregnant sows, negative to the agglutination test, were each exposed via the conjunctiva to a virulent strain of *Br. abortus* of the swine type. Blood was repeatedly drawn by tail-bleeding, under conditions as nearly
aseptic as possible, and used to inject guinea pigs which were killed and autopsied about two months later. (An article giving the results of this experiment in detail is now in the hands of the publisher.) All but one (a sow) of the 14 hogs became infected as indicated by the agglutination test; and, though three of them aborted, \textit{Br. abortus} was recovered from the products of abortion of but two. \textit{Br. abortus} was recovered from the blood of all but one of the animals (a sow) that became infected. It appeared in the blood-stream as early as the 10th, 11th or 12th day after exposure in five of the animals; on the 17th or 18th day in three of them; on the 24th day in another; and on the 38th, 40th and 45th days, respectively, in the remaining three. It was recovered from the blood of five of the animals but once; from three, twice; and from four, three times. The time between first and last recovery of the organism from the blood of any of the animals was 22 days but there was some evidence to indicate that this period of time may sometimes be longer. The invasions of the blood-stream appeared to have no relation to time of parturition, \textit{Br. abortus} being recovered from 1 to 35 days before parturition in the case of six of the sows, and from 4 to 34 days after in the case of four.

The agglutination titre of the blood, when it was found to be infected, varied from 1:50 to 1:1000. Nearly half of the infected samples reacted in a titre of but 1:100.

These studies indicate that when both boars and pregnant sows are exposed to \textit{Br. abortus} infection \textit{via} the conjunctiva, this organism appears in the blood-stream shortly after but that it does not appear to persist there, except possibly in rare instances, for more than a month. In the animals used, there was no indication of recurrence of invasion, except possibly in one case.

The experiment also indicates that \textit{Br. abortus} of the swine type does not cause abortions in swine with nearly the regularity as does the bovine type in cattle. The course of the disease in the two species of animals seems to be different. There appears to be a greater tendency in swine for agglutinins to disappear and for the occurrence of rapid and complete recovery.

In order to determine whether a similar condition obtains in infected cattle, blood has been drawn repeatedly from nine controls in one of our vaccine experiments following \textit{Br. abortus} exposure and injected into guinea pigs. Results of blood collections on three different dates two weeks apart are at the present
time available. Though the blood titre of these cattle ranged from 1:500 to 1:1000 when the blood samples, for inoculation purposes, were procured, evidence of the presence of Br. abortus in their blood has not been obtained.

Relation of Agglutination Titre to Udder Infection

As opportunities have presented themselves, we have made agglutination tests of milk and blood sera and guinea-pig inoculations of the former to determine the relation of agglutinins in milk and blood to udder infection. The results of these tests, in general, have confirmed those of earlier work which were to the effect that no Br. abortus infection was found in the milk of cows reacting in a titre of 1:100 or less, but that this organism was present in the milk of about 86 per cent of those cows having blood titres of 1:200 or above. Recent work has shown that the chances of infection being present in the udder increase with the blood titre and that a blood titre of 1:1000 nearly always indicates udder infection, whereas one of 1:200, as the test is made at the Station, indicates that somewhere near 50 per cent of the animals so reacting have infected udders. Br. abortus has been recovered from a few cows reacting in a titre of 1:100, but the indications are that cows reacting in a titre no higher than this, which have infected udders, are rare, unless they have been recently infected and have not reached their maximum titre.

An effort was made to ascertain whether udder infection can be determined by testing the milk from individual quarters of the udder for agglutinins. The milk of 30 selected cows having blood titres of different degrees has been studied. Four of these had a blood titre of 1:100; seven, 1:200; five, 1:500; and fourteen titres of from 1:1000 to 1:4000.

Of the four cows having blood titres of 1:100, two gave milk titres of 1:50 in all four quarters of the udder and all quarters proved to be infected with Br. abortus. Another cow gave milk negative to the agglutination test from all four quarters of her udder but that from two of the quarters proved to be infected. The milk from two quarters of the remaining cow had titres of 1:50 and 1:100, respectively, and that from the other two quarters failed to react. Br. abortus was not found to be present in milk from any quarters of her udder.

Of the seven cows having a blood titre of 1:200, two of these gave milk reacting to titres from negative to 1:50 in different quarters of their udders and no infection was found to be present.
On the other hand, another, giving negative milk reactions from three quarters and one of a titre of only 1:25 from the other, was found to be eliminating *Br. abortus* from three quarters of her udder. Four other cows of the group, giving milk reactions from negative to 1:50 from different quarters of their udders, were proved to be eliminating *Br. abortus* from one or more quarters.

Of the five cows having a blood titre of 1:500, one gave milk from three quarters of her udder which had a titre of 1:50 and that from the other, 1:100, but no infection was proved to be present in her milk. Another cow gave milk reacting from 1:25 to 1:50 from different quarters of her udder which proved to be infected. The milk from two cows reacted in titres of 1:25 and 1:200 and that of another in titres of 1:200 and 1:500. The milk of all three cows proved to be infected.

Of the fourteen cows having a blood titre of from 1:1000 to 1:4000, the milk reacted in widely different titres, ranging from 1:50 to 1:1000. The milk from all but one of these cows proved to be infected. One of the cows which had a blood titre of 1:2000 had a milk titre of only 1:50 from each quarter of her udder and yet *Br. abortus* was found to be present in each.

It is likely that repeated tests would have proved more quarters of the udders of the 30 cows to be infected. It will be observed, however, that agglutination tests of the milk in several cases of the infected quarters of udders, failed to detect infection.

There does not appear to be a definite relation between titre of blood reaction and numbers of quarters of udders infected. Cows having a blood titre of 1:200 have been found to be eliminating *Br. abortus* from each quarter of the udder, whereas some of those with titres of 1:1000 or 1:2000 were doing so from only one, two or three quarters, as far as could be determined.

Our experience leads to the belief that the blood test, when titres of 1:200 and above, as the test is made at the Experiment Station, are considered as denoting udder infection and those of 1:100 or less as denoting freedom from infection, gives more reliable information regarding udder infection than testing of the milk from individual quarters for agglutinins.

**STUDIES IN VACCINATION**

The vaccination of animals as a means of imparting immunity is a subject that continues to engage the attention of the Bureau. An endeavor has been made to determine the nature of results
that may reasonably be expected from the use of vaccines prepared from *Br. abortus* strains possessing different degrees of virulence and whether the results derived from the vaccination of pregnant animals with avirulent strains is comparable with the results derived from the use of vaccines in connection with virgin heifers or open cows.

Six different vaccine experiments have been inaugurated during recent years, which we will designate as follows:

1. A calfhood vaccination experiment.
2. Vaccination during pregnancy with an avirulent *Br. abortus* strain.
3. Vaccination of unbred animals with *Br. abortus* strains representing three different degrees of virulence.
4. Comparative studies of two avirulent *Br. abortus* strains for the vaccination of pregnant cattle.
5. Comparative studies of two avirulent strains and two strains of medium virulence when used separately in connection with unbred cattle.
6. A second calfhood vaccination experiment.

The results of the first calfhood vaccination experiment, which were briefly discussed a year ago, have now been published. They were regarded as indicating that vaccines, when prepared from *Br. abortus* strains of different degrees of virulence, impart to calves a substantial degree of immunity that is demonstrable during their first gestations and that probably confers protection against the disease for a number of years.

The use of vaccine during calfhood has some advantages over its use in connection with older animals, one of these being that it eliminates the possibility of vaccinating pregnant animals by mistake and thus defeating its object by establishing the infection in them. It also reduces danger of the vaccine infection becoming implanted in the udder.

The results of experiment 2 (vaccination during pregnancy with an avirulent *Br. abortus* strain) were likewise called to your attention last year. Use was made of 10 principals and 9 controls in this experiment. Seven of the principals received a single vaccine injection and 3 received two injections.

The degree of immunity derived from the avirulent strain used for vaccination during pregnancy did not appear to be marked. But 40 per cent of the vaccinated animals completely resisted a degree of *Br. abortus* exposure that was resisted by 11.1 per cent of the controls. Failure of the avirulent strain to
protect more uniformly in this experiment was considered as possibly due to the tendency for strains to lose their immunizing properties as they sustain losses in virulence. The intervals between vaccination and Br. abortus exposures in this experiment, as in all those concerning pregnant animals, were, however, necessarily brief, a feature that may have had a pronounced bearing upon results.

Experiment 3 (vaccination of unbred animals with three Br. abortus strains representing three different degrees of virulence) was also briefly discussed a year ago, although the experiment at the time was incomplete. Vaccine experiments 2 and 3 have since been completed and the results submitted for publication. Vaccine experiment 3 plainly revealed that recently isolated strains of Br. abortus are objectionable for vaccine preparation because of their tendency to become established in the udders of the vaccinated animals. Strains possessing but a slight degree of virulence for guinea pigs seemed nearly as effective as immunizing agents as more virulent strains, and when subcutaneously injected did not localize in the udder.

The results of this experiment, in which the gestation periods of 31 animals were studied, were regarded as encouraging, for, whereas 21 of the 23 cows and heifers which had been vaccinated previous to conception produced vigorous calves, 7 of the 8 controls which were employed in the experiment aborted. The matter of localization of the vaccine infection in the udder could seem to be quite definitely controlled by the selection of Br. abortus strains of proper virulence.

The aim in vaccine experiment 4 was to determine the comparative merits of two avirulent strains from the standpoint of immunity production when used in connection with bred animals. In our experience, the use of vaccines in connection with bred cattle has offered only slight encouragement. In this particular experiment the results were of the same character. Neither of the two avirulent strains of which use was made produced anything resembling a substantial immunity. The results likewise failed to suggest there was any appreciable difference in the immunizing properties of the two strains employed. While a small proportion of the vaccinated animals produced living calves, the presence of Br. abortus infection could be demonstrated both in the colostrum and uterine exudates of nearly all of the 12 principals, as well as in the controls at times of calving or aborting. While it is possible that the degree of Br. abortus exposure to
which the animals in this experiment were subjected exceeded that which would be encountered in infected herds, the results failed to suggest that much encouragement could be derived from the use of the two avirulent strains employed during pregnancy.

In vaccine experiment 5, it was hoped to gain a better understanding as to the immunizing value of avirulent strains as compared with strains of low virulence when used in connection with unbred cattle. Use was made of two avirulent strains designated 801 and 901, respectively, and two strains of much reduced virulence (11 and 19) on which considerable experiment data were available. That the degree of *Br. abortus* exposure to which the cattle in this experiment were subjected after they became pregnant was severe is evidenced by the fact that all eight controls aborted, the presence of *Br. abortus* being demonstrated in their colostrum and uterine exudates. Of the group of six animals which received vaccine prepared from strain 19, four produced vigorous calves. The presence of *Br. abortus* in the colostrum or uterine material at time of calving could not be demonstrated. Two animals aborted; however, only one abortion could be attributed to *Br. abortus* infection. Of the group of three animals which were vaccinated with strain 11, all produced vigorous calves although the colostrum of one animal contained *Br. abortus* and both the colostrum and uterine exudate of a second animal contained the infection. Of the four animals which were vaccinated with the avirulent strain 801, three produced vigorous calves and one aborted. Two of the four animals had *Br. abortus* colostrum infection and a third both colostrum and uterine infection. Of the four animals which were vaccinated with avirulent strain 901, three produced vigorous calves and one aborted. The aborter and one other principal were proved to have both *Br. abortus* infection of the colostrum and uterine exudate. While the experiment thus seemed to indicate that the degree of immunity engendered in unbred stock by vaccination is dependent to a considerable degree upon the virulence of the *Br. abortus* strain employed, it also suggested that in unbred cattle a considerable degree of immunity can be conferred by avirulent strains.

Vaccine experiment 6, pertaining to calfhood immunization, does not differ materially from the original calfhood immunization experiment, except for the fact that the calves were vaccinated in all cases when about four months of age (slightly younger than in the original experiment). Only strains of somewhat
reduced virulence entered into the preparation of the vaccine used in the present experiment. Although a large proportion of the 35 animals that were entered in this experiment have now been bred and subjected to *Br. abortus* exposure, their gestation periods, except in two instances, have not terminated.

While the results of our immunization experiments have thus far failed to indicate that artificial immunization affords anything resembling a perfect method for combating Bang's disease, or as satisfactory in dealing with many infected herds as testing and elimination programs, we are led to suspect strongly that, by selecting *Br. abortus* strains of proper virulence for vaccine preparation and by confining the use of vaccine largely to unbred animals, possibly calves or virgin heifers at near breeding age, immunization may be perfected to the point where in many herds it may be found to serve a useful purpose in reducing abortion losses and assisting herd-owners gradually to eliminate the disease without at the same time being a menace to human health.

**Summary**

The data presented give further evidence to show that the conjunctival method of exposure transmits the disease to pregnant cattle and swine with remarkable regularity and strengthens the results of our earlier experiments, which indicated that the infection may pass through the unbroken skin, and also suggests the possibility that these routes may be of importance in nature. The data also throw additional light on the value of *Br. abortus* agglutinins in blood and milk as indicators of udder infection, and on the relation of the virulence of *Br. abortus* used for vaccine to the degree of immunity induced by it. Additional evidence is given to show that while the latter is in general directly proportional to the former, yet a strain of such moderate virulence that it will rarely become localized in the udders of vaccinated cattle still retains, in a large measure, its immunity-producing properties. It is pointed out also that additional data support results of earlier experiments which indicate that cattle possess a marked resistance to infection with the swine type of *Br. abortus* through natural means of infection.

The finding that *Br. abortus* invades the blood-stream of boars and pregnant sows shortly following infection, but apparently does not remain there for long, is at least of considerable interest and may prove to be of importance. It is possible that infectious
abortion of swine may more nearly resemble undulant fever than it does infectious abortion of cattle.

DISCUSSION

PRESIDENT CONNAWAY: I knew that we have men here who have done research work along this line that we would like to have recorded in our notes. The Michigan people, New York people, and other stations doubtless have done some work along these lines. Dr. Gilman, have you anything to give us on any phase of this work?

DR. H. L. GILMAN: I think not. While I have done considerable work on this question of the relation of the blood titre and the milk titre to the presence of the organism in the milk, I think our results agree quite closely with those of Dr. Buck. There may be some differences, but I would agree with the paper first, before making any comments.

DR. W. WISNICKY: Dr. Buck, are there any data on whether a live-culture vaccine may change in virulence?

DR. BUCK: The organism does not become established in the animal, there is no way of finding out. With an avirulent strain, following intradermic injection, we were able to implant the strain, but following subcutaneous injection it takes a real virulent strain to become established in umbred animals, in calves and virgin heifers.

DR. C. E. COTTON: If an animal that has been treated with an avirulent strain is later to be shipped interstate to one of the twenty-three states that require that the animal pass a complete negative test, could we expect that animal to react or not?

DR. BUCK: Of course, the avirulent strains do not produce reactions that persist as long as the strains of high virulence, but still in our experience we never yet have introduced an avirulent strain into animals, that I recall, where we did not get reactions following its introduction, for a time. But the less virulent the strain is, the shorter the period of time that the reaction lasts. I think that holds true in a general way. With the avirulent strains, the reactions have nearly disappeared, but I do not say that they entirely disappear. They come down to 1:50 and 1:25. Not in all cases do they entirely disappear, especially with the strains of medium virulence.

DR. COTTON: How long would you conclude it would be before that animal would fail to react if moved interstate?

DR. BUCK: More depends on the animal than the type of culture, in our experience. With some animals you may not get a reaction. You may get only a low titre at the start. Another animal might go 1:2,000. It seems to depend largely on the animal. Considering all strains together in a general way, it takes a pretty good long time before reactions entirely disappear. I would say somewhere between six months and a year. Some of them might disappear before. But for several months I would really expect a reaction, a slight reaction, to persist. It might go to 1:2,000, perhaps down to 1:100, 1:50 to 1:25 in five or six months.

DR. COTTON: From the whole standpoint, this looks like a very serious problem. In Minnesota, in order to discourage the use of the living organisms that have been used for the past eight or ten years, regulations were adopted that before persons would be allowed to use living organisms, they must have a permit. We will look on vaccinated animals in the future the same as reacting animals, because this proposition was defeating our efforts in undertaking to establish clean herds.

We have twenty-three states that will not admit cattle unless they have passed a satisfactory negative test for Bang's disease. It seems to me that we are working at cross purposes. We are encouraging the use of avirulent or some other strains to control and save some of these actual aborters. It seems to me that we are treading on very dangerous ground, if we hope to build up cattle that are free of this disease and herds that are free from it. What in the world are the states going to do that are demanding a satisfactory negative test when other states and our federal government are encouraging the use of avirulent or some other strains that are known to produce reacting cattle? It seems to me that we are defeating our purpose.
Dr. Adolph Eichhorn: I think that Dr. Cotton is under a misapprehension here. I believe from previous reports of Drs. Buck and Cotton that this is purely a scientific experiment and nothing whatsoever as a control measure. I understand that the project is simply a study as to immunization but not with any connection whatsoever as to controlling abortion.

With regard to the paper, I was interested in one particular point, and that is that cows or animals giving a reaction of 1:100 are not harboring, or only exceptionally, the organisms in the udder, or eliminating them in the milk. This has a great bearing on control measures. If this statement is correct, and of course only time will prove it, then naturally our control measures must be changed to conform with such findings, because if we have a large proportion of the animals under 1:100, and they are not spreaders, they might be interpreted as being in another class than those which are actually eliminating the organisms in the milk. This is, I think, a very important factor and requires further study, not along the line of control measures at this time, but for the future.

Dr. Wisnicky: Mr. Chairman, if the purpose of the experiments that the Bureau is conducting with vaccines on cattle is as Dr. Eichhorn has stated, I think that is perfectly proper and in order, but is such the case? About a month ago, a very descriptive and elaborate article was published in the farm press outlining these experiments that the Bureau is conducting, and giving great promise of future accomplishments. In our opinion we believe that is a serious set-back to the control efforts which the various states are at the present time undertaking.

In Wisconsin, during the last legislature, we had the first appropriation given us to be used in our efforts to control Bang's disease. That particular article, released by one of the Bureau officials, had a whole lot to do with deterring our efforts in that respect.

Dr. Cotton: Dr. Eichhorn said I had a misapprehension. I am glad to know that I have a misapprehension, but the fact remains that this comes before the control board and we are all trying to build up clean herds in our state. As Dr. Wisnicky says, if we are met with the farm press and the breeder, with the idea that the latter can go on and vaccinate and save some of his actual abortions, it is defeating our control work.

Dr. D. H. Udall: From the standpoint of a clean herd, Dr. Cotton, I assume you mean a herd that stays clean.

Dr. Cotton: Yes.

Dr. Udall: I think Dr. Case will bear me out in the theory of maintaining a clean herd, that a measure of cleanliness and health is a subject as applied to individual cows and refers to the length of time of productivity in the herd. I would like to ask Dr. Buck if he has any data on the length of time that this immunity remains, or any data upon the breeding performance of vaccinated animals as measured by subsequent periods. It refers not merely to the act of aborting but to various other abnormal manifestations that develop in the genital organs of cows.

Several years ago, I was so impressed by the avirulent strains that I vaccinated something like 40 heifers anywhere from one to six times. I have never made any report on that, but I would like to know whether his evidence shows that this immunity is carried through more than one lactation period, or if there is any evidence upon these animals with respect to their breeding performance in subsequent years, or whether these animals were merely fed and remained on this ration, or whether they were under the strain of an animal in a herd kept for economic purposes.

Dr. Buck: In our original calfhood immunization experiment, we carried the group through three pregnancies. We figured the second and third pregnancies were not worth so very much. The data could not be depended upon to bring out just what Dr. Udall asked, because we had the matter of exposure added to the vaccination. But they were mingled with aborting cows nearly all the time that they were in the experiment, which ran through some three years. Other cows were in there that weren't exposed artificially, and several of them contracted the disease. But the principals in that experiment continued to produce normal calves and showed no evidence of sterility, I mean in a general way. I felt that if they had been operated for farm purposes the
results would have been good. Whether the results would be repeated under farm conditions, I am not certain.

On the other question, we do not have data on the production. Our work has been principally confined to experiment stock. We would not be able to give much information on that side of it.

Dr. C. A. Mitchell: Is there any direct relationship between the agglutination titre and the protection upon the animal?

Dr. Buck: In a vaccination experiment we reported several years ago, practically all the animals became negative to the test, and there appeared to be a pronounced immunity, because, in the experiment I speak of, there were eight controls. I believe seven of the eight controls aborted. I think one or two of the twelve or thirteen principals acquired the disease following exposure. But those that produced normal calves, where we were unable to associate them with abortion infection at all, appeared to have a marked immunity, and still their reaction was negative. They all went at least as high as 1:100, some I am certain went to 2,000, following the administration of the vaccine, and the titres gradually disappeared or gradually became less.

Dr. Wisnicky: Dr. Buck, how do you measure the immunity when the cow ceases to react to the agglutination test?

Dr. Buck: We judge the immunity by her performance after we expose her.

Dr. C. H. Case: Several years ago, I used an avirulent culture on several herds. Some of those cows continue to react today, after five years. Over seventy-five per cent of them have gone back to negative. But this last year, through a sale, some of those cows were transferred to a positive herd that was vaccinated five years ago and went back to negative, and three out of the five aborted this year when they were exposed. For the practitioner who wants to have his clients get along and wants to have a free herd, don't use any vaccine. I have used that in the past and I am very sorry today. (Applause)

Dr. F. H. Brown: Several years ago when the vaccine was first put on the market by various commercial houses, we were led to believe that a certain medium must be used in order to add to the life of the organism; otherwise, when it was used, it would be a bacterin. I gather from your paper that organisms of high virulence are to be feared in use in the field by practitioners on account of after-results.

Just where are we going to tell the commercial houses they can go in the preparation of this vaccine so that it will be avirulent and not be so virulent as to cause all this trouble that we are talking about? That question may be out of order, but I would like to know to just where we are going to draw the line.

Dr. Buck: I am not certain they could be told, with the knowledge we have at the present time. But we are trying to determine if the virulence of strains remains reasonably constant so that as the experiments are carried on from year to year the results are reasonably uniform. Of course, there is no way that we know definitely that measures the virulence of organisms. We have been judging our virulence by guinea-pig inoculation. We inoculate a great many every time we use a strain for the preparation of vaccine. We always try to inject the guinea pigs with the same dose, the same amount of suspension, and we always kill them the same length of time after they have been inoculated. We may find that it is possible to judge the virulence of the strain with some degree of accuracy, at least, by that method.

I never have heard that the particular type of medium that the organism grows on is necessary. We use potato-agar for growing our organisms used in experimental work. The idea seems to have been created that we are advocating vaccination. We have said in the paper that we feel it may have possibilities but we are not advocating vaccination at the present time. We are trying to study vaccination, merely trying to learn something about it. We have not gone further than that, that I am aware of.

Dr. Gilman: I would like to get one question clear in my mind. Did you not say that cattle, with a blood reaction of 1:100 or lower, failed to show the organism in the milk, and those with a blood reaction of 1:200 usually showed it in the milk?
Dr. Buck: I quoted that as previous work. I think Dr. Schroeder and Dr. Cotton in previous years presented the statement that, with the work they had done in one large herd, their results terminated that way. They did not determine any particular titre, but they grouped them. They failed to find the presence of the infection in animals that reacted at 1:100 or below, but they found it in 86 per cent of the animals that reacted at 1:200 or higher. They did not state whether 75 per cent or 100 per cent were in the 1:1,000 or the 1:500 class.

Dr. Gilman: Did you not make the statement that the blood titre would therefore be a better indicator of udder infection?

Dr. Buck: We feel from our experience since then that if we went by that guide, if we considered a 1:100 or a 1:150 titre as the absence of infection, and 1:200 and above as the presence of infection, it would be better than testing the milk.

Dr. Wisnicky: Mr. Chairman, I am rather inquisitive about this subject of vaccines because it is an important one with us. The thought occurs to me that there is some published work on adverse effects on milk-production when the cows react to the agglutination test. I haven't it clear in my mind as to just what the results are, but I think the Oregon Station put out a bulletin on that, and if I am not mistaken the Storrs Station did also. If that is a fact, I believe that any results which are released on live-culture vaccines or any other kind of vaccines, that are responsible for producing agglutination titre of any degree, ought to be correlated with milk-production because in Wisconsin, being chiefly a dairy state, it would be a most important factor with us.

President Connaway: If there is no further discussion we will proceed to the next order of business. Before we do, I want to call attention to this spirit which I would like to see permeate this whole group, and that is the spirit of open-mindedness. None of you men has fought harder against vaccination than I have. None of you has been more in favor of eradication of Bang's disease and all these other eradicable diseases than I have. But at the same time, we must keep an open-mindedness toward problems of research, even though those researches may be misused by people who want to make misuse of them. Some of the papers and some of the breeders, who do not want to join in with your campaigns of eradication, use these statements and hopes of the Bureau and experiment stations. Our commercial serum and vaccine companies utilize those things sometimes to the hurt of the people who are doing that research. But those are things we cannot avoid.

I want the Bureau to go forward with its work and, if possible, work our way eventually of vaccinating successfully against abortion disease. I think all you men would like to see the same thing done. I know the dairymen of the country would like to see it done. Even if they fail, they will convince themselves that it is a failure and will admit it just as freely as anybody else. So let us keep an open mind toward research problems.

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

THURSDAY MORNING, DECEMBER 3, 1931

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

President Connaway: Our first number on the program this morning is a paper by Dr. L. P. Doyle, on "Anemia in Young Pigs." (Applause)

Dr. Doyle: Mr. Chairman, the experiments which we are going to report represent an effort to determine what are the factors, you might say, which are normally in the environment of pigs, which in turn tend to prevent anemia.

You may know that in the early part of our work, we noticed that anemia was much more likely to occur in pigs which were kept inside than in those which were kept outside, even though the pigs were in pens that had concrete floors. So, in the experiments I am reporting here, we have made a rather practical, perhaps crude, effort to determine some of the factors in the environment of pigs under ordinary conditions which would prevent this disease.
I found from the report of Dr. Kernkamp, of the Minnesota Experiment Station, over at another meeting, that he has been carrying on work along much the same lines.

Dr. Doyle then read his paper.

ANEMIA IN YOUNG PIGS

By L. P. Doyle, Lafayette, Indiana

Purdue University Agricultural Experiment Station

Department of Veterinary Science

Anemia in suckling pigs is now recognized as of sufficient importance to merit the attention of farmers, veterinarians, and nutritional investigators. It appears quite certain that this disease accounts for a large portion of the disappointing results which follow attempts to raise pigs in barns and central hog-houses. The symptoms and lesions of anemia have already been quite adequately described; consequently, these will not be discussed here.

As regards the cause of anemia, it may be said simply that the disease results from failure to supply the young pigs with what is needed for normal blood-production. If the pigs do not store up sufficient blood-building materials before they are born, they will develop anemia within two to five weeks after birth, provided they are obliged to subsist on the mother's milk alone. A way has not yet been found to supply the required blood-building materials through the sow’s milk. It is a fact that pigs are sometimes able to escape anemia even though they are kept inside on concrete floors until a month or more of age. Table I records observations on one of two litters in which this occurred.

Table I—Record of pigs from sow on blue-grass pasture until farrowing, but kept inside after farrowing

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<th>Pig</th>
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<th>2 Months of Age</th>
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Average 13.8 13.0 14.9
The sows which farrowed these pigs were two years old. They had run on blue-grass pasture during the gestation period and had been fed sparingly on yellow corn and skim milk. The ration fed to the sows after they were put in the farrowing-house was the same as has been used repeatedly in producing anemia under inside conditions. This may have been an instance in which the pigs stored up enough blood-building material in utero to enable them to escape anemia during the nursing period. All of the factors which may operate during the gestation period to prevent anemia in the pigs have not been fully determined as yet. From the practical standpoint, it may be said that ordinarily it is not possible to feed and manage the brood sow during the gestation period in such a way as to prevent anemia consistently in the young pigs which are kept indoors for three or four weeks and not fed anything but the sow's milk during the first half of the nursing period.

During the anemia studies made at Purdue, the disease has been encountered at birth in pigs farrowed by sows which had followed cattle in the feed-lot; and also in pigs farrowed by sows which had been fed very liberally on a grain ration while having access to pasture during the gestation period. It is a well established principle, of course, that supplying good pasture for the brood sow and supplementing this when necessary with an adequate ration without over-feeding during the gestation period are important steps toward insuring vigorous pigs at farrowing time.

In view of the fact that anemia which occurs during the nursing period may do lasting damage to the animals which survive, the prevention of the disease is of greatest importance. Allowing the young pigs to have access to blue-grass sod has proved to be

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<th>Table II—Sow and pigs put on blue-grass pasture two days after farrowing (grams of hemoglobin per 100 cc of blood)</th>
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an effective means of preventing anemia in animals which are normal at birth. Table II shows the results which have been typical of several experiments in which the sow and pigs were put on blue-grass pasture when the pigs were from two to five days old.

It is seen that the hemoglobin content of the blood of the pigs on pasture remained relatively high; while that of the control pigs, which were kept inside of a central hog-house, showed a continuous decline throughout the four weeks of the experiment.

Several experiments have been made in which litters of pigs less than one week of age were divided and part of the pigs were placed on blue-grass sod inside of a central hog-house for two to five hours per day, while their litter mates and the sows were kept away from sod. The results of these experiments showed that access to blue-grass sod inside of a hog-house protected the pigs against anemia while enabling them to grow at a normal rate. Table III shows the beneficial effect of allowing pigs to have access to blue-grass sod (inside), beginning as late as two weeks after birth.

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<th>TABLE III—Pigs put on blue-grass sod (inside) when two weeks old (grams of hemoglobin per 100 cc of blood)</th>
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The feeding of green rye and green alfalfa to sows and pigs inside of a central hog-house failed to protect the pigs against anemia. Table IV shows the amounts of hemoglobin found in the blood of a typical litter in this experiment.

It is seen that the pigs which were fed the green feed were not any better able to produce hemoglobin than were the control pigs which received only the basal ration.

A question naturally arises as to what might be the effect of soil which is free from sod. Table V shows a comparison between the hemoglobin content of the blood of pigs which had access to rich soil (inside) and that of their litter mates which were kept away from sod and soil. The experiment was begun when the pigs were four days of age.

The difference in the hemoglobin content of the blood of these two groups of pigs at four weeks of age is doubtless significant of
a beneficial effect of access to the soil. In experiments in which the effect of blue-grass sod was compared with the effect of soil free from sod, it was noted that the young pigs ate the sod more readily than the soil and showed a correspondingly higher hemoglobin content of the blood.

The beneficial effect of allowing young pigs to have access to blue-grass pasture while the sows were kept confined in small pens was well shown in an experiment beginning in early April and ending in the latter part of May. Eighty-one pigs and their mothers were put outside when the pigs were from three to six days old. The sows were kept in small pens provided with cinder

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The beneficial effect of giving pigs access to blue-grass pasture while the sows were confined in small pens (grams of hemoglobin per 100 cc of blood)
floors and small shelter-houses. The pigs were allowed to run over a small blue-grass pasture. As controls, ninety-one pigs and their mothers were kept inside of a central hog-house continuously during the four weeks of the experiment. Table VI shows a comparison between the hemoglobin content of the blood of the two groups of pigs at weekly intervals during the four weeks.

SUMMARY AND CONCLUSIONS

From these experiments it appears justifiable to conclude that if young pigs are given easy access to blue-grass sod, beginning within the first week after birth, they will usually be amply protected against anemia.

Access to soil alone also provides considerable protection against the disease.

There is probably no peculiar merit in blue-grass sod as compared with other sod of equal palatability.

Green feed free from soil, when fed to the sow and pigs, failed to show any preventive effect on anemia in the pigs.

PROBLEMS CONFRONTING PRACTITIONERS IN SWINE DISEASE CONTROL

By D. D. Baker, Wabash, Ind.

My subject suggests very obviously the honest confessions of a practitioner in handling infectious diseases of swine. These problems I shall confine to a technical class and not include the business problems confronting the practitioner, although they are somewhat closely related.
These technical problems are those with which most veterinary practitioners have to deal at the present time. Each problem is presented on behalf of the practitioners at large, with the hope that someone may have a happy inspiration that will relieve us, to a great degree, of these puzzling conditions.

In following such procedure the improvement of the veterinary service is foremost in mind, but I feel such confessions may brand a veterinarian as being incompetent and uninformed if publicity be given to these problems of which we ourselves never boast, nor do we willingly admit, at least where the questioning party may fail to understand the problem in its true light.

But in you gentlemen attending this meeting we recognize a personnel capable of judging the meritorious services of our profession along with the shortcomings, so that the few problems we have to face may be judged correctly. It is my opinion that this branch of veterinary science dealing with swine diseases is as efficient and well advanced as any branch of veterinary medicine. Yet, like all the others it has its problems.

We do not have a large number of infectious diseases of swine, yet they are gaining in importance with the advance of years. Some that were not considered of primary importance have grown more severe and more virulent with the development of the swine industry.

Flu, erysipelas, dysentery, necrotic enteritis and pox, as well as parasites, respond to control measures which are largely summed up in sanitation. Yet, when these are present in complications they present more of a practitioner's problem. Treatment of these single diseases usually surprises the owner with the small amount of loss. Most of them are eliminated by a strict sanitary program. So we can say that sanitation is the greatest factor in successful swine practice. Yet the suggestion of a strict sanitary program is the least satisfying to a client, of most any advice that can be offered. The practitioner must treat animals under conditions adverse to animal health on many farms with the hope that sometime in the near future his efforts will yield results due to less complications and less mixed infections which sanitation will prevent.

To most farmers a sanitary program appears too costly, and to most tenant-farmers an impossibility. Most of our farm-owners resided upon their estates when sanitation was less important, and now the tenant has very little cooperation in employing methods used in sanitary disease control. These conditions
tax the practitioner's resources in facing one of his major problems, especially when epizootics occur, requiring treatment or prevention which only healthy hogs can survive.

Since hog cholera forms our principal epizootic of swine, the major problems of the practicing veterinarian are centered around this disease and vaccination against it, in dealing with these other infectious diseases. Since immunity can be produced against hog cholera, that disease has lost its position among the fears of the swine-owner. To the veterinarian the principal problems of swine diseases are all closely allied to hog cholera, its diagnosis and treatment.

Most all veterinarians have experienced these trouble cases associated with hog cholera vaccination. It is a common saying among veterinarians that if he does much vaccinating he has trouble cases. There is but little solace in that thought but it is quite true. They do not happen frequently but the economic loss to the swine industry and to the veterinarian is of considerable importance. They do more to destroy the confidence in hog cholera vaccination than can be overcome by several years of successful treatment.

Where some chronic debilitating condition exists in the herd, the trouble is not excusable. However, cases are more numerous where some secondary infection has gained a foothold at the time of serum-virus reaction, causing severe losses. This is characteristic of hemorrhagic septicemia infection and flu. I have observed but one case of hemorrhagic septicemia with no apparent complication or contributing disease reaction. The responsibility of that diagnosis was keenly felt all during the course of the disease. My first case of swine-pox occurred as a post-vaccination intruder. The loss ran about 10 per cent, which seemed heavy in this mild disease where losses are not frequent. I learned to guard against pox as well as to insist upon good care and sanitation after vaccinating, to prevent minor diseases causing heavy loss with the serum-virus reaction.

With the present methods of hog cholera vaccination some of these losses seem unavoidable. As long as the reaction of serum and virus in the animal's body exists after administration, other disease organisms find favorable conditions to do damage.

These post-vaccination troubles are no doubt often referred to as "serum breaks." In my experience true serum breaks are not of enough importance to be classed as a practitioner's problem. However, there are cases where a small number (3 to 5
per cent) of the hogs sicken and die—thrifty animals—that would indicate a serum of low potency or an idiosyncracy of the individual animals not favorable to serum-virus reception. Of course, if that serum entered the bowel or bladder the idiosyncracy is with another individual. I have made faulty injections with a ventral hernia resulting, or bloody urine escaping, so that I know that great care should be exercised by everyone in the administration of the serum as well as in the estimate of the dosage. It takes care and close observation of the operation to vaccinate hogs successfully.

Of late years practitioners have had many cases of serum shock. They are embarrassing beyond description. That trouble has been quite ably solved, we are promised, by our new regulations on serum production.

Virus breaks do occur. They may be due to loss of immunity from baby-pig vaccination or other reasons too technical to explain, but their incidence should be lowered. To the herd-owner loss of immunity is balmmed on the product or the administration of that product. His inclination is to find someone using a product that is surely more reliable. His misfortune is over and the success that follows makes the change seem justified. These cases of loss of immunity are not frequent enough to prevail in a single herd but one case is often enough to lose a client.

Bureau regulations govern the production of serum and biologies. These regulations were formulated for the protection of the animal industry against inferiority hidden behind a common label. When those regulations shield a producer in marketing a product that gives questionable results, then those measures of protection fail in the primary object for which they were instituted. To say that producers only meet regulations is a serious accusation that is not intended. However, field trials sometimes indicate that they have forgotten all but the commercial phase of production.

These post-vaccination troubles ruin many good steady clients. They ruin them in the sense that they lose confidence in the program of vaccinating their swine as a routine treatment. When hog cholera prevails, of course, they have their herds vaccinated but other years they choose what may seem just as profitable a program, which is not to vaccinate.

The history of vaccination shows a gradual decrease following outbreaks of cholera. Each year fewer vaccinate until there exists
a large number of susceptible hogs. Then another outbreak of cholera occurs with sick herds; some fat hogs about ready for market; sows nearing the end of their gestation period; or sows with small baby pigs; unthrifty pigs needing treatment; some sows losing their immunity; farmers demanding to know how many of their sick hogs will recover; and the fear of a shortage of serum—the most unfavorable period to be forced to use serum and virus. A more uniform annual vaccinating program is to be desired.

Following vaccination many herd-owners check very carefully the cost with that of their neighbors or with lay-vaccination cost, as a result of which the fee attached to vaccination must receive careful consideration. It constitutes a real problem in swine practice. The principal competitive factor is lay vaccination and this would be found regardless of price among some individuals whose fascination for manipulating a syringe must be satisfied. Quite a few neighborhood outbreaks start this way.

When hog cholera is prevalent, I believe that the diagnosis is usually more accurate than in years when the disease is met with in only a few, scattered, subacute as well as acute types of the disease. Hog cholera as we diagnose it today presents a varying syndrome that is puzzling to the practitioner. The disease is usually diagnosed correctly and treated satisfactorily. I have seen it diagnosed as flu with horrible results—$2,000 worth of hogs dead and the loss of a home.

Probably this was due to carelessness on the part of the veterinarian but his record and reputation are among the best. Probably some complication misled him. It is easy to think that we would not make that mistake if such a case were encountered, yet capable practitioners throughout the hog-raising states do have this puzzling condition arising in connection with hog cholera control. What a satisfaction it is to find a case of hog cholera or any disease manifesting typical clinical symptoms and revealing typical postmortem lesions. If the disease must be encountered it is a satisfaction to find it in a typical form, so that a diagnosis based upon our scientific skill can be made with a fair degree of certainty. Many times the disease symptoms or lesions are not exactly typical yet show no complications. In those cases the good results that follow are a great satisfaction. But a good many cases do show complications—respiratory or digestive involvement—yet some herds respond to serum-virus treatment and others go all to pieces.
A practitioner's experience in complicated swine diseases is marked with enough fatalities that he cannot but wonder if our differential diagnosis of infectious diseases has not been sadly neglected. Then when a consultant is called in, someone who meets with several times as many of these cases, and he is very reserved about making any definite diagnosis, the problem is increased by the fact that no one has progressed to a great extent in differentiating these complicated cases. Any disease may occur with cholera and with some there are not many additional lesions. In some of these cases the serum-virus treatment fails to produce any satisfactory results in a particular herd while records show that the same serum and virus proved satisfactory in other herds without complications.

There is nothing more important to treat and control infectious diseases successfully than the ability of the practitioner to make a correct diagnosis. If that is faulty then likely the line of treatment followed will be an expensive procedure. There are means of treatment in a hazy diagnosis where treatment and protection for all the diseases suspected can be followed but the cost is of serious importance when less expensive treatment might be administered if our diagnosis were based upon more certainty than the present methods provide.

I have the greatest respect for those who have given to us the knowledge available and methods of treatment found effective in the control of all live stock diseases. But there are problems yet to be solved which puzzle the practitioner in swine diseases. The most important of these, as I have tried to emphasize, might be limited to post-vaccination troubles and the uncertainty of our diagnostic resources. The minor troubles to a large extent are based upon the human element involved, including the failure of the farmer to fulfill his rôle as well as the practitioner or producer to render proficient service.

Improvement in post-vaccination troubles requires more interest on the part of all the veterinary forces to stabilize the confidence in hog cholera immunization. We do not wish this treatment to retrogress to a status of unreliable biologics, whose use is based upon the recommendation that if they do not produce immunity they lighten the form of the disease. If our advancement in biological therapy is to be as prophesied, it should not be curtailed by inferior products nor by shattered confidence of the public.
Also, the improvement in our diagnostic resources requires the united efforts of all veterinary forces.

The magnitude of the swine industry and the dependence placed upon the veterinary profession justify a more earnest endeavor to maintain our distinction as "guardians of the animal industry."

President Connaway: That was a most excellent paper and presented by one out of the ranks that form the backbone of disease control, even if they may not be under state or federal pay.

We will now have the report of the Committee on Transmissible Diseases of Swine, by Dr. F. H. Brown.

Dr. Brown: The Committee that served you this year is largely the same as the one that served last year, with the exception of three members. I would not want to term them "new men" but "additions" to this Committee. One addition was necessary owing to the passing of Dr. I. K. Atherton. At this time before I present the Committee's report, the Committee desires to refer to our good friend, Dr. I. K. Atherton. One of his last official acts was to serve this body as a member of this Committee and contribute a very good paper on "Hog Cholera Control." We trust that the Great Reaper who saw best to take this man from us is dealing kindly and justly with his soul, and we trust that he will ever rest in peace in that land that once we journey to, we do not return.

The Committee also wants to mention at this time the change in the personnel of the Committee, inasmuch as we feel that our exhaustive report last year included about all the recommendations that we can make to this body. Our report this year is rather short, but we have made a few recommendations to this body that we believe are worth while.

Dr. Brown then read the report. (Applause)

REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

Dr. F. H. Brown, Chairman, Indianapolis, Ind.

Dr. Chas. Murray, Ames, Iowa
Dr. U. G. Houck, Washington, D. C.

Dr. J. H. Riets, Morgantown, W. Va.
Dr. R. A. Craig, Lafayette, Ind.

Dr. C. H. Hays, Lincoln, Nebr.
Dr. R. R. Birch, Ithaca, N. Y.

Dr. C. McCandless, Salem, Ohio
Dr. Mark Welsh, College Park, Md.

The scope of the Committee on Swine Diseases was restricted when, in 1929, the name of the Committee was changed to its present designation, "Committee on Transmissible Diseases of Swine." In addition to this Committee we have related committees, including the Committee on Miscellaneous Transmissible Diseases, the Committee on Parasitic Diseases, and committees on certain specific diseases. Even though the reports of these committees will naturally overlap more or less, the result will be beneficial in bringing to us the views of the different committees on the swine disease situation.

The relative importance of swine diseases is recognized more fully now than in the past by all groups interested in our swine industry, including veterinary practitioners, federal and state livestock sanitary officials, serum-producers and swine-growers. It is generally recognized that while hog cholera is no less important, other diseases are of increasing importance on account of their prevalence, their effects, and their influence upon immunization against cholera.

There has been a marked increase in hog cholera in the middle western states compared with last year, and the losses have been heavy, as many farmers were not able to finance the immunization of their herds. Iowa, Illinois, Indiana, Michigan and Ohio have suffered most, but our latest information indicates improvement in the hog cholera situation.
Your Committee invites attention to the recommendations in the report of the Committee of 1930, and in view of the prevalence of transmissible diseases of swine (hog cholera, flu and infectious abortion), desires to discuss further the recommendations made by this Committee.

This year, as in previous epizootics of hog cholera, large numbers of cholera-infected hogs were marketed. The marketing of these hogs for slaughter, and the movement of stock hogs from communities in which these early outbreaks of the disease occur to live stock centers and community sale barns, and to farms and communities that are free, or comparatively free, of cholera infection, are important factors in the dissemination of the virus of hog cholera. Failure to enforce regulations or pass laws to meet the conditions responsible for hog cholera epizootics, is responsible for a large part of the financial loss resulting from this and other diseases of swine.

The use of trucks in the transportation of swine as well as all classes of live stock should receive additional attention in the control of their operation as a common carrier of live stock.

It is evident that there are causes other than impotent anti-hog cholera serum and cholera virus which account for most of the unsatisfactory results following the use of these agents in the immunization of hogs against cholera. The administration of serum and virus to hogs exposed to and suffering from diseases other than cholera accounts for many so-called "serum breaks" and a large part of the death rate subsequent to vaccination. This has become more apparent with the increase and prevalence of swine diseases other than hog cholera, and vaccination by laymen.

Economic conditions have encouraged the administration of small vaccination-doses of anti-hog cholera serum. Under present field conditions your Committee believes that it would be advantageous to increase the minimum dose of serum recommended for field use.

The increasing number of reports of swine erysipelas in various parts of the United States merits the consideration of those interested in control measures for the prevention of diseases of live stock. Apparently well authenticated laboratory diagnosis of the disease in South Dakota and Iowa calls attention to the danger of a serious hazard to the swine industry in the Corn Belt unless proper measures are taken to suppress it.

Many of the state sanitary officials and members of the staffs of state agricultural experiment stations are cooperating with the Bureau of Animal Industry in a swine sanitation plan for growing healthy hogs and eradicating round worm infestation in pigs. The economic importance of a sanitation plan of management in swine production has been definitely proven. In order to give greater impetus to this disease-control measure, your Committee suggests individual support by the members of this Association, especially the practicing veterinarians, in their respective states and communities.

The economic importance of infectious abortion in swine production, and the relation of this disease to undulant fever in man, is appreciated by this Association. Your Committee recommends that the President appoint a special committee to study methods of control and eradication for this disease and recommend a plan for its eradication in breeding and farm herds.

In addition we desire to submit for reference a list of the various federal, state and private institutions which have published results of research work on swine diseases, together with subjects treated, for the years 1930-1931.

**UNIVERSITY OF CALIFORNIA**


**ONTARIO RESEARCH FOUNDATION**


**CORNELL UNIVERSITY**


University of Illinois

Michigan State College

Rockefeller Institute


U. S. Bureau of Animal Industry


Iowa State College
Rucks, Willy, and Murray, Chas.: Infectivity of the cells of hog cholera blood. Jour. A. V. M. A., lxvii (1931), n. s. 31 (5), pp. 691-702.


Discussion
President Conaway: This excellent report and the papers are before you for discussion. Will anyone discuss Dr. Doyle's paper? I am sure there are very important points in connection with this that might be touched on by others here.

Dr. T. H. Ferguson: I would like to ask Dr. Doyle if he has done anything in the way of experimenting with iron or copper in relation to the handling of these pigs.

Dr. Doyle: We found that the individual administration of various forms of iron, ferric chlorid and ferric oxid, enabled the pigs to maintain a relatively high hemoglobin level. But the end-results of those experiments were somewhat disappointing, in that the pigs which were given iron to prevent anemia were not, as a rule, satisfactory pigs at three to five months of age.

To put it another way: In our experience there was just as high a proportion of runts in the pigs that were given iron at from three to five months of age, as there was in the control pigs. We think that the use of the sod, at least under our conditions, either inside or outside, is a more practical way of preventing the disease and that the end-results are more satisfactory.

Dr. Ferguson: To what medicinal property in the sod do you attribute the good results?

Dr. Doyle: Of course, we have not made any determination of that. You understand that if a pig can be brought to eat a good ration, that pig will be protected against anemia to quite an extent. Of course the impractical thing there is to get a pig to eat the ration the first week or ten days after it is born.

Dr. E. M. Nightingale: How do you administer it?
Dr. Doyle: By means of a small dose-syringe.

Dr. Brown: I might explain the Committee's desire in having Dr. Doyle's paper before this body. Where the practitioner is constantly dealing with post-vaccination trouble, I think this anemia contributes to that situation. To the practitioner and control men, this may be one of the underlying causes for post-vaccination trouble.

President Connaway: There are no apologies needed for this paper being presented. It has a worthy place.

Dr. A. T. Kinsley: The quietness of the audience is rather surprising after hearing splendid papers like those of Dr. Doyle and particularly Dr. Baker, and the report of this Committee. I have certainly enjoyed what has been given.

I was particularly interested to note that the Committee recommends a close survey for swine erysipelas. That is one malady that in some sections of the country is apparently on the increase. I noticed also that Dr. Baker particularly mentions swine-pox. In parts of the Corn Belt just recently there appears to have been a rather virulent outbreak of swine-pox. Please note that I say "apparently swine-pox." No other malady has been found. This disease has affected herds that have been immunised three and four months as well as herds that had not been treated with anti-hog cholera serum and virus. Thus far, as far as I have been able to find in records, there has not been a previous report of virulent swine-pox in this country. In some herds it has killed ten and fifteen per cent of swine, if the diagnosis is correct.

President Connaway: Some presidents are a little bit hard to keep down when these matters come up for discussion. A president, of course, is supposed simply to preside and let everybody else do the talking. But sometimes matters come up in which the President is justified, I think, in taking a part in the discussion.

This matter of swine erysipelas (rotlauf, as the Germans call it; rouget, as the French call it) is something I have never seen in America. It may be here. We may have something that looks like it. I have seen it in Germany. It is something that we do not want in America, if we can keep it out. If it is here we ought to get after it and eradicate it. I think we ought to restrict the use of vaccines for this disease.

In the old country they use a double vaccination. Once we get that thing started, double vaccination against it here and there over this country, we will have plenty of it.

Dr. Marsh, in another meeting, mentioned some experimental work that he was carrying on, in which he is using some of those viruses in his work. I think our experiment stations ought to have a big quarantine around to keep those viruses, that are not indigenous to America, inside of those laboratories and make it impossible for them to get away. He mentioned using some of Lederle's products in these experiments. Here is a danger-point in the spread of a disease that we may not have in this country. We may have something like it. If we do have this, it will prove a very serious thing if it gets away from us and out into the herds of the country, from the laboratories.

Are there any points in the report that you want to discuss? If there is no discussion, I would like to know who is here from Oklahoma. I had a telegram from Dr. Hisel stating he couldn't be here, and if he had been here he would have talked about the measures of control for hog cholera. Just recently they had a regional meeting of the control officers of a group of states. Dr. Wirtz, will you come forward and tell what was done at that meeting?

Dr. J. H. Wirtz: I am here, pinch-hitting for Dr. Hisel.

Last week we had a meeting in Oklahoma City, called by Dr. Hisel, of representatives of the state and federal forces of the states of Texas, Arkansas, Missouri, Kansas and our own, to discuss some of the things pertaining to hog diseases, primarily the spread of hog cholera, both as an intrastate and interstate movement.

In our state we think it is getting to be quite a serious proposition, particularly the trucking of hogs from one county to another and across our state
borders on the south, north and east. We have run down numerous outbreaks of hog cholera as well as swine plague, and others that have been directly traceable time and again to these unregulated shippers by truck and also by rail.

Of course, you know, I suppose, a number of the states are up against a similar proposition at this time in the trucking business. It is a hard thing to regulate. It has been largely unregulated. We all know it is a big proposition; yet at the same time it appears to us that there must be some restriction of it, if we are going to maintain the hog industry.

We had a full day's meeting there that we feel will be conducive to a lot of good. A lot of different thoughts were brought out there. We got some of the men thinking on the proposition from just a little different angle than they have been thinking in the past.

There was a representative from Washington there. The Bureau was represented, I believe, from about all of the states, as well as state representatives, and we had representatives from some of the principal railroads and also national stockyards representatives. In that we tried to have all phases of the situation touched on and let the different people present different angles of the thing. I believe Dr. Williams has a copy of some resolutions that were passed at that time and will probably be presented to this body for consideration and thought, before this meeting is over.

There are a number of hog-producing states—North Dakota, Iowa, Illinois and Nebraska—that we feel are undoubtedly up against a similar proposition. No doubt they will be vitally interested in some sort of regulations.

Dr. Hisel regretted very much that he was unable to attend this meeting. If he had been able to attend he probably would have been able to present the thing as he sees it and as he feels it, in much better shape than I am able to present it to you. But that, in substance, is what we had in mind, and we hope that this body will be able to give it some consideration. I am sure that if they do, we will eventually, if not now, get some regulations, either through this organization or perhaps with the cooperation of the federal government, that will help considerably in the movement of swine.

I believe the federal regulations that control the movement of swine are much more limited than they are in reference to the movement of cattle and other live stock. We feel that some addition would be very beneficial and necessary. (Applause)

PRESIDENT CONNAWAY: This is a question on which perhaps some of you might have something to say, in regard to the better control of the movement of swine from state to state. This trucking proposition is a new thing that is bringing up new problems.

Dr. Brown: I think action should be taken by this body relative to the report. I move its adoption.

The motion was regularly seconded and carried.

PRESIDENT CONNAWAY: We will take up the next item, "The Advantages and Disadvantages of Pasteurization of All City Milk," by Dr. W. A. Evans, Chicago. (Applause) Dr. Evans needs no introduction. He has been before us on previous occasions and we are glad to have him with us again. (Applause)

THE ADVANTAGES AND DISADVANTAGES OF PASTEURIZATION OF ALL CITY MILK

By W. A. EVANS, Chicago, Ill.

MR. PRESIDENT AND GENTLEMEN:

I appreciate the opportunity of renewing old acquaintances and of making new ones. It gives me a very great deal of pleasure to come to these meetings, as I have been doing for approximately a quarter of a century, and reflecting upon the progress...
that has been made in the control of animal diseases in that period of time.

We are asking you today to transfer your attention suddenly from the diseases of hogs to a matter of administrative control of milk and that, largely, from the standpoint of the human consumer. There are to be six papers in this symposium, and of the six, four are to deal with milk exclusively, one with milk and meat, and one with meat.

Again, the discussion is to be not on the general subject, but on the matter of the administrative control of certain procedures for the protection of the consumers of milk. This presentation on my part will be brief. It has to deal with but a small phase of the subject. If you will note, the subject is "The Advantages and Disadvantages of Pasteurization of All City Milk."

I take it that what you want from me is an unofficial statement of the official attitude on this question, "How does a person, who isn't an official, estimate the present opinion of men in official position, as to whether all milk, sold in the community for human consumption, should be pasteurized?" It is to that point that I shall speak, and to no other.

I heard once of a junior officer in the United States Army, a man with a rank below that of captain, who had served in many positions and in many localities in the country, and who had a reputation for being difficult to get on with. He at last found himself in charge of a small detachment of troops, at a very isolated post in a sparsely populated part of the country.

In the discharge of his duties as such, he made a recommendation to the War Department. He was acting captain, and as acting captain of his company he passed favorably upon the recommendation that he had made to his superior officer in his capacity of a junior officer, as I have said, approving of the recommendation. He was also serving as a district commander in this inconsequential district, and he then passed up these recommendations to himself in his superior capacity, first his recommendation favorably as a junior officer, and then his favorable endorsement of the recommendation as acting captain. When it came to him for consideration as an acting district officer, he disapproved of it. (Laughter) Then he sent the documents in the case to the War Department at Washington.

The man to whose attention it came there knew something of his history. He wrote back to him: "Wherever you have been, in your entire history in the United States Army, you have
quarreled with everybody with whom you have come in contact, and I now notice you are quarreling with yourself." (Laughter)

I am afraid that the official attitude of health administrators might be open to the same objection. There is no way of determining just what that action is, and all that we can say is that it is not infrequently contradictory. These officials not infrequently quarrel with themselves; in their non-official capacity, they sometimes say things which they disapprove of in their official relations.

Nevertheless I will assume that that which you want to hear from me is what I think is the consensus of opinion, in so far as there is consensus of opinion, on the question of whether all milk sold for human consumption should be pasteurized.

The question, as it is put, presupposes that pasteurization is advantageous. It presupposes that that question has been settled; that the objections to it, which were argued some twenty-five years ago, have been discounted, and that after a balance has been struck between the good and the bad, there is a matured opinion to the effect that as far as the greater part of the milk supply is concerned, it should be pasteurized, and that such action should be compulsory. Of course, that is as it should be.

Chicago passed its pasteurization ordinance twenty-four years ago, and we have had twenty-four years of experience with it, and, in consequence, are prepared to answer the objections to it out of the experience of twenty-four years.

New York City is in its eighteenth year of operation under a similar ordinance. There are scores of cities that have had more than ten years of experience, and hundreds that have had approaching ten years of experience under compulsory pasteurization, and therefore it is proper, it is natural, that opinion on that point should have matured, should have been accepted, and the question should no longer be one of discussion.

If I am asked to answer categorically how the health departments feel about the compulsory pasteurization of all milk, I think I would answer, "No, such is not the prevailing opinion of these health departments." Why that opinion? Why is it that they are not in favor of compelling that all milk should be pasteurized? In the first place, if all milk were compulsorily pasteurized, it would bring to an end the production of certified milk. There have been occasions when certified milk has been pasteurized. For instance, in 1916, in this community, for a comparatively short while, in the face of a threatened epidemic
of poliomyelitis, the certified milk of the community was pasteurized. There are other illustrations that might be cited.

Certification can persist and will, in spite of a short period of pasteurization, but if compulsory pasteurization of certified milk was enacted and became continuous over the years, a regular procedure, unquestionably, in the course of time, it would operate to wipe out the production of certified milk. Health departments do not believe that that would be advisable or even advantageous. In the first place, they are very glad to have this body of people, the producers of certified milk, and those who are engaged in its voluntary control, in the field for research work that they will do, for educational or propaganda work they will do, for public education they will bring about, for building up a public opinion that has been of service in milk control. They are against wiping out certified milk because they believe that there should be a supply of raw milk available for those who for any reason whatsoever wish to make use of it.

In the first place, it is an outlet against the charge that the milk business is on a compulsory basis. In any government activity it is a pretty good idea to have an outlet for the steam to blow off, and in the milk business this offers an outlet for the blowing-off of surplus steam; otherwise the boilers might burst.

It is of service from that standpoint. We do not know all that we should know about nutrition. We believe that most of the important things with relation to nutrition are decided, but how new is this entire matter of vitamins? There may be other things yet to be discovered. There may be factors having to deal with nutrition that are of importance, that we know nothing about. Certain it is that there are some people who are engaged in the feeding of children who want kept available a supply of raw milk. Perhaps they can defend their position, and perhaps they cannot defend it. But, whatever the decision may be, they want it. They think they are justified in wanting it, and we are not in a position to prove that they are not justified in wanting it. We are in favor of maintaining for them an available supply of raw milk that is reasonably safe. We are in favor of it for other reasons.

There is no question but that the people who are interested in certified milk have been of very great service in solving certain of the milk-control problems, for instance, the matter of epidemic streptococcic infection or streptococcic sore throat. Very valuable research work, valuable for health departments, valuable
in the control of disease in human beings, and valuable in veterinary work, has been done by the people who are interested in certified milk. We would have suffered a distinct loss had that body of people not maintained their interest in milk-production and had not supported, financially and otherwise, the valuable work that has been done on epidemic streptococcic infections.

Again, I don't think there is any question but that the certified milk people have been of very great help in our tuberculin-testing and tuberculosis-eradication programs.

We are now confronted with another problem which you know very much more about than I do, and that is the problem of undulant fever. I first heard of that infection in connection with the milk supply of a large city. I believe that it was brought to our attention by studies that were made in San Francisco, on the milk supply of a part of the city of San Francisco. I haven't a doubt but that there will be continued contributions to the study of undulant fever that will come from the research supported by the people who are producing certified milk.

I think health departments are very generally of the opinion that the safest milk is pasteurized milk, when there are breaks, and there are breaks, of course, in the production of pasteurized milk, at some point or other before it reaches the consumer. But after due consideration has been given to all of this, the safest milk that we have is pasteurized milk. Yet I think the record will show that certified milk is reasonably safe, and that health departments that permit it to be sold in the community, are not violating their obligation to protect the people. There have been breaks with certified milk as there have been with pasteurized milk, but they are infrequent; they are not of great importance. I can easily see how a health commissioner would feel, though he had done no great harm, by permitting certified milk to be sold in his community, no harm that was great enough to offset the good that was being done, by permitting it to be sold in the community. Of course, everything that we have to deal with is composed, in part, of disadvantages and, in part, of advantages. My argument is that the advantages outweigh the disadvantages.

Now this final point: As far as I know, there is left nowhere in America an illustration of what an industry can do in the way of self-control, except certified milk. In various parts of Europe there are industries that undertake to control their own industries and to guarantee to the consumer that the products they market
WHY CERTIFIED MILK?

By WARD GILTNER, East Lansing, Mich.

Dean, Division of Veterinary Medicine, Michigan State College

Milk is justly a highly recommended and a none too widely used food. Even in the diet of the most intelligent social groups of the highly civilized nations that are most advanced, economi-
cally, milk could well be used in larger quantities. It is deplorable that so little milk is used by the ignorant and economically depressed. Milk possesses the defects inherent in its virtues. It is potentially a very unsatisfactory as well as a dangerous food. Its quality may be markedly altered and its safeness may be rightly questioned in many instances. Hence, milk is naturally a variable food product. It is not too difficult for a group to become accustomed to a product of poor quality especially if the aesthetic considerations alone are involved. As far as milk is concerned this is the case in many sections, especially in foreign countries. If the altered quality goes beyond the aesthetic and involves the nutritive properties it is still possible, but perhaps both economically and hygienically undesirable, for humans to adjust themselves to the lower standard. It might even be said that it is possible for society to adapt itself to the results of the use of milk laden with pathogens of either bovine or human origin, but that would be a type of adaptation utterly out of consonance with standards which many (I date not say most) of the social groups in this country have come to insist upon during the past two or three decades.

The remedy for evils associated with a naturally variable product, whose variants are dangerous or unsatisfactory, is artificial standardization whenever that is physically possible. Theoretically it seems to me that it would be possible to standardize milk with respect to practically all its constituents and properties and within rather narrow limits, although it must be confessed that there are almost insuperable difficulties, such for instance as those imposed by seasonal effects on cattle food and the consequent effects on vitamins of milk. However, there is no widespread demand for a narrowly standardized milk. Almost without dissent we accept grades of milk. Obviously these grades must differ in some respect and equally obviously the variation must involve quality only and not safeness. I use the term safeness practically as the equivalent of the absence of living pathogens. Quality certainly does vary, from the nearest approach to the ideal, down to that which may involve elements of danger. Therefore, in standardizing market milk, we must insist on safeness and grades of quality that at least exclude offensiveness.

A definition of certified milk is virtually a definition of what may be considered as nearly ideal raw milk as is practicable. It is so nearly ideal that its practicability is restricted, since it
WHY CERTIFIED MILK?

enjoys only a very narrow distribution. The total amount of certified milk distributed in this country in comparison with the total amount of fluid milk used justifies the assertion that it plays quantitatively a negligible rôle in the fluid milk supply of the people. In very many communities of considerable size there is available no certified milk whatsoever.

Certified milk as an ideal can be criticized, aside from the economic aspects, only on the basis of the possible danger from pathogens of either bovine or human origin. It must be admitted that the possibility of this danger exists and at the same time that everything scientifically possible and economically feasible is done to obviate this danger. Like all things touched by the hand of man, certified milk has been a product of evolution. The producers have had to contend, not only with the inherent decomposability of milk, but with bovine diseases transmissible to man and with human carriers of pathogens who might make direct or indirect contacts with milk. A battle has been more or less successfully waged against bovine tuberculosis—recently with more success than formerly—and a battle is being waged quite intelligently and hopefully against brucellosis while streptococcus mastitis remains a very elusive problem. Science has furnished medicine with fairly good tools for the detection of human carriers. Bearing in mind the fallibility of mankind, it must be admitted that within his limitations man has made in certified milk a reasonably safe milk of very superior quality.

Personally I have no patience with the critics of pasteurization. I believe in pasteurization and I do not believe that scientific pasteurization *per se* has any serious drawbacks. But I am unalterably opposed to commending the pasteurization of a milk of low grade or to substituting pasteurizing for more logical methods of handling infectious diseases of cattle and human carriers of pathogens. On the other hand, I am sufficiently pragmatic to accept a low-grade, pathogens-inhabited milk properly pasteurized as an alternative to no milk at all. On the whole—not in every specific instance—I would be inclined to accept low-grade milk without pasteurization rather than the alternative of no milk at all.

I venture to assert that, because of the personal factor inevitably involved, there is just as great a source of danger due to the shortcomings of pasteurization as there is due to the rather remote possibilities of pathogens in a high-grade, raw milk such as certified milk. I further suggest for your consideration the
possibility of greater ultimate damage to the public from lowered milk consumption due to unwarranted charges and counter-charges about milk safeness than from normal or stimulated milk consumption based on confidence in all grades of milk available on the market. Neither the public nor the milk producer has anything to gain by the futile agitations of sanitarians relative to the danger of tweedledum due to the fact that scientific measurement with ultra-precision instruments has shown tweedledee to be a shade better.

My justification of certified milk is that it constitutes an ideal and I condemn any movement that will tend to weaken this ideal. We owe a great debt to the certified milk producers of America. They alone have had the courage to set their ideal for fluid milk at the ultimate of perfection. They above all others have striven toward scientific knowledge, adequate equipment and practicable methods for the production of a product above criticism. That their standards are so high that most of us cannot use their product is certainly no warrant for condemnation or adverse criticism of them and their products. Let us recognize that the comparatively high quality of the market milk available to us, the hoi polloi, owes its position to the pace set by certified milk. We all believe in education, but we can't all go to Harvard. However, we can thank God for Harvard and what she has done for education, let us say, in our state colleges.

Let the certified milk producers worry about the economics of their situation. Let them worry about whether they shall pasteurize their certified milk. If they decide to or if they are required to pasteurize it, it will still be the best milk available. I would not advise bringing public pressure to bear to the end that certified milk be pasteurized. I might advise the pasteurization of certified milk in certain cases or under certain circumstances.

In conclusion let me say that I have taken it for granted that all live stock sanitarians are equally familiar with the requirements for certified milk and with the almost chaotic state with respect to requirements for all other milk. I have tried only to present a point of view. Why certified milk? Because it is an ideal realized, it is true, only on a small scale, but realized nevertheless. It is an ideal set up in a motley company of milk products that need the stimulating influence of an ideal. It is a modest ideal, not a militant one. To paraphrase Saint Paul, it
suffereth long and is kind, it envieth not, it vaunteth not itself, is not puffed up, doth not behave itself unseemly, seeketh not its own, is not easily provoked, thinketh no evil, but rejoiceth in the truth.

The greatest compliment that can be paid to any milk is to say that it is the equivalent of certified milk. The nearer our fluid milk supply approaches certified milk in quality, hence in methods of production, the better off will be those who use raw milk and the better off will be those who desire a pasteurized milk. Any movement in the direction of substituting pasteurization for either standards of quality or standards of safeness is in the wrong direction. Pasteurization is a precaution when superimposed upon high-grade milk; it is a substitution and a makeshift when employed with low-quality or pathogens-carrying milk. Precautions are sometimes desirable and make-shifts are all too frequently necessary. But ideals are also desirable and they are necessary if progression rather than retrogression is to characterize the market-milk business. The certified milk people have furnished the only acceptable ideal for milk, they have never been legally coerced into maintaining a safe standard, they do not oppose the safeguards demanded by inferior grades of milk, they ask no favors, they spend money lavishly in enterprises that may yield benefits diffusible throughout the whole milk industry, they are engaged in a business that the dairyman, the sanitarian, the general public and they themselves may be proud of, and they mind their own business. I personally can't afford to drink their milk, but I am all for them. May their ideals ever remain high and may they find means whereby their price for milk may become low.

President Conaway: We will pass to the next number, "City Meat Inspection," by Dr. J. S. Koen. (Applause) Dr. Koen read his paper. (Applause)

CITY MEAT INSPECTION

By J. S. Koen, Saint Louis, Mo.

Chief Meat Inspector, Division of Health, Department of Public Welfare

For many years Saint Louis has had some twelve meat-packing establishments and slaughtering plants that have been operating under U. S. government meat inspection supervision. It also had about 48 other plants where slaughtering was con-
ducted without inspection. Besides these there were many processing plants operating without inspection. Nearly 50 per cent of all the meats and meat products consumed in the city came from the uninspected houses. The competition for business between the inspected and the uninspected plants was very keen. It became so keen about a year ago that a meat war between the two groups resulted. Then a number of the inspected plants banded together and started a campaign of education on inspection. They employed a publicity director who organized a Committee on Meat Inspection. Membership on the Committee includes representatives of the Better Business Bureau, Catholic Women's Council, Child Conservation Committee, Council of Jewish Women, Federation of Women's Clubs, National Congress of Parents and Teachers, Saint Louis Medical Society, Saint Louis Steward's Club and the Women's Christian Temperance Union.

An extensive propaganda campaign was waged by large newspaper and billboard advertisements, house-to-house canvassing, visiting schools and even churches, the distribution of hundreds of thousands of bulletins on the benefits and protection afforded by U. S. government inspection of meat and meat products; the organization of meat markets, restaurants, chain stores, city institutions and hospitals, country clubs, etc., to buy and sell only "U. S. Government Inspected" meats and meat products. Lectures on meat inspection were held whenever and wherever an audience could be found that would listen (and most of them listened) and in every way the doctrine of inspection was preached.

For 35 years Saint Louis had U. S. government meat inspection and did not know it. After this advertising campaign the whole world knew it.

At first the large billboards carried the announcement:

50% OF ALL MEATS SOLD IN ST. LOUIS COME FROM U. S. GOVERNMENT INSPECTED PLANTS

Several weeks after the advertising campaign was started, these billboards were changed to read:

78% OF ALL MEATS SOLD IN ST. LOUIS NOW COME FROM U. S. GOVERNMENT INSPECTED PLANTS
In the meantime, two ordinances had been introduced in the City Council providing for city inspection over those plants not under government supervision. Both were defeated. But, the latter part of June, a new ordinance was introduced and passed without opposition. It even had the support of the uninspected plants. This ordinance is one of the best, if not the best, meat inspection ordinance over passed by any city. This is true because it follows very closely the rules and regulations of the U. S. Bureau of Animal Industry. These rules represent the best judgment on meat inspection service that can come from 25 years of intensive study and experience since the Meat Inspection Act of Congress, of June 30, 1906, became operative.

The U. S. government meat inspection service is the best in the world. It is the pride of America and the envy of every other nation.

I consider it an honor to have been a member of the B. A. I. meat inspection force and to have assisted in the inauguration of the new meat inspection law. It was my privilege to remain a member of that force for seven years thereafter. Since then I have tried to keep in close touch with the progress of that service and for those reasons I make the above claims for federal meat inspection.

Saint Louis did well to pattern its ordinance after the government standard.

On August 17, I was called to Saint Louis to take charge of the new Meat Inspection Section in the Department of Health as provided for in the ordinance. During the next few weeks all I had to do was to make a survey of the uninspected plants, observe their construction and manner of operation, make recommendations for alterations or remodelling to meet the requirements of the ordinance and inspection needs, then supervise the reconstruction and secure and install the inspection equipment.

We also had to allay the many misgivings the owners of these plants entertained as to just what the city inspection was going to do to them. An office had to be found, furniture selected and placed, report forms devised and printed, and other details attended to. Civil service examinations had to be held for veterinary and lay inspectors, questions prepared and the papers graded. Ten veterinary and ten lay inspectors were selected from the eligible lists thus created. These men had to be taken on tours of inspection and instruction to the plants to which they were to be assigned.
The work of altering and remodelling the plants began the first week in September and progressed so rapidly that on October 12 we were able to inaugurate inspection service in 23 slaughtering plants and a few of the processing plants. Each inspector was provided with a copy of the rules and regulations of the U. S. B. A. I. These had been furnished by Dr. J. R. Mohler, chief of the Bureau. Half of our inspectors had more or less experience in government meat inspection service. Assignments were made in such manner that those having previous experience could supervise and assist the inexperienced ones. We have applied the government rules wherever applicable and in every essential way we are maintaining a city inspection service comparable to federal inspection.

We are conducting the same rigid antemortem and postmortem examinations, we are making the same dispositions of diseased animals and carcasses, and we are conducting the same sort of reinspections and supervision over the preparation of meat products, as provided for under government supervision. To reach the same high standard of efficiency in every detail as maintained under federal inspection is our aim. We realize this can be accomplished only in time and by hard work.

We are also maintaining supervision over some twenty processing plants that manufacture sausage, bone and boil hams, and in other ways process meats. There are six slaughtering plants and some ten or a dozen processing plants that are yet to come under our inspection service when they complete alterations and secure permits to operate. When these alterations are completed, the former "uninspected plants" will have spent approximately $200,000.00 in getting ready for city inspection. To have secured the expenditure of that amount of money under present conditions, and to get the plants in such sanitary condition that city inspection could be inaugurated within six weeks from our starting time, necessitated the utmost coöperation on the part of the owners of these plants. It affords me great pleasure to be able to report the finest coöperation imaginable and that there has been no friction worthy of mention. Because of the general business depression we asked only the minimum requirements for alterations. No attempt was made to force any one out of business, but rather to help them continue if possible. Some owners went far beyond actual requirements and have converted their old plants into veritable meat laboratories. The public is accepting city inspection in a most gratifying manner.
The ordinance provides that after October 1, 1931, no meats or meat products shall be sold within the city of Saint Louis that do not bear the stamp of inspection of either the Government or City. This time was extended to October 12 to give the uninspected plants reasonable opportunity to get ready for inspection. There were some uninspected meats in each plant and considerable in a few of the larger ones that had not been inspected at time of slaughter and therefore could not bear the legend, "Inspected and Passed." In order to permit the sale of such meats and meat products we had square stamps made bearing the inscription, "St. Louis Approved Plant No. . . . ." All meats and products that had been prepared without inspection were then inspected and the approved stamp applied to those that were passed. In this way all meats received some sort of inspection and bore a stamp that permitted its sale.

For the past month we have been giving considerable time and attention to sausage manufacturers. Farmers living in Illinois and close by in Missouri have for years been making sausage on the farm and bringing it into the public markets of the city, where it has been sold. Others peddled their products from house to house. None of the animals from which this sausage is made are inspected, so we have had to stop this practice. There are many individuals who, during the winter months, make and peddle "home-made sausage." We have had to make a ruling that no meats or meat food products shall be prepared in any part of a building that is used as a residence. This ruling is bringing us some very interesting experiences. We are finding many insanitary practices and are having to close up many such places.

Sausage peddlers have likewise offered a serious sanitary problem. As a rule these peddlers are irresponsible and very insanitary, both in habits and in person. We are now requiring that every manufacturer of sausage secure and equip a room that is clean and sanitary and that can easily be kept in proper condition. If he disposes of his products through peddlers, they must be provided with peddlers' licenses. He must first wrap his sausage in oiled or glassine paper and then place it in a tight-fitting carton. Each carton must bear a stamp of inspection which contains his official plant number. The cartons must be placed in a dust-proof container that is provided with a compartment for dry ice. In this manner the temperature of the container protects the last pound sold as well as the first. The method of
wrapping assures all that the dirty hands of the peddler do not contact the product. The government regulations governing the use of preservatives and coloring have been adopted and are being used in our inspection.

We believe in the movement now started favoring uniform meat inspection rules in federal, state and city inspection services and are trying to help it succeed by adopting the government rules and regulations for our city inspection.

We have received every cooperation from Dr. Mohler and the local Bureau forces of Saint Louis and East Saint Louis, for which we are very grateful. There is no rivalry between federal and city inspectors and there will be none. Each force will strive to give to the citizens of Saint Louis the best inspection service possible. The purple circular stamp of the Bureau and the purple shield stamp of the City now stand as guarantees that all the meat sold in the City is free of disease, is wholesome, and is fit for human food.

PRESIDENT CONNAWAY: Dr. Cary will present a paper on "Who May Inspect Milk and Meat?" (Applause)

Dr. C. A. CARY: Gentlemen, as chairman of this Committee I want to say that I have taken up the subject of meat and milk inspection with the officials, as far as I could, in every state in the Union.

With that big questionnaire that I put out to the different states and the reports that came in, I want to say that I have never been at the head of a committee which got so many varying reports, which were so difficult to summarize and report to you. You may say to me, "What is that due to?" It is due to the fact that milk and meat inspection, as far as the states go, is in a chaotic or rather a heterogeneous condition. I find that in some states it is under the head of public health; in other states, under the live stock sanitary board; in other states, under a drug board; in other states, under a dairy board, and in others it is under a regulatory board. None of these could give me a complete record of the work in the states so I could get all that I asked for in the questionnaire.

I find this is due to the fact that in a great many of the states, state veterinarians haven't control of it, and if they have had control they have turned it loose on account of politics. Some of them openly stated that to me. This is a great field, and it is our field. If we are going to occupy it, we have to occupy it regardless of politics. We have to get a little backbone and go after it. There isn't a solitary state, as far as I know, that has compulsory milk inspection or meat inspection for the entire state. That is the truth, as far as my reports go.

What are the conditions? It is mostly confined to the cities. The cities, through the state laws, have been given power to enact ordinances governing meat and milk inspection, more frequently milk than meat. Some cases reported four cities in the state having meat inspection; some of them didn't have any. Some of the states reported three or four cities having milk inspection. You see how incompletely we have covered the ground and where we are at.

Just a few words about who is doing this work. First, milk inspection. Milk inspection is most generally under the head of the boards of health. Most of the inspectors are laymen or dairymen or persons other than veterinarians. I don't say that the veterinarian is the only man who can do all the milk inspection, but he is the best qualified, if he is properly educated. I
don’t mean that he would take up every bit of it, because there are some lines that might be handled by technicians, by dairymen and by others who are especially qualified, but not the ordinary sanitary engineer, the layman, or the average dairymen; they are not qualified.

I asked the question, “How about the schools? Are they preparing men for this?” In nearly every instance the reply we got was that the veterinary colleges were not devoting sufficient time to either milk or meat inspection. We had a meeting the other day, of the deans of all the colleges. We brought this up. They are awake to this, and they are going to change their curricula to meet the condition, the demand, and it is a good thing that they are.

Let us just see a few of the things that have taken place. In some of the states we have this: The cities alone are handling nearly all of the work. In other states, we have the state and the cities; and in others, the cooperation of the federal government, the state and cities together. When they have this combination, generally speaking, they have a veterinarian at the head of it. Why? Because I think he is the only man who has the qualifications to look after the diseases connected with these two lines of work. I don’t say he is always qualified. One of the most noted men in this country on milk inspection, the author of a book on milk inspection, wrote me this reply: “One of the defects of the veterinarian is that nine out ten in my state think that all there is to milk inspection is testing cattle for tuberculosis.” When you look at it that way and don’t take hold of this field any farther than just looking at tuberculosis, you have just got started. That is all right, but it doesn’t cover the ground.

The colleges are responsible for that, probably; partly so, if not altogether. So we have to remedy this trouble if we occupy this field. Some of the colleges are rampant with the idea that we are getting an over-production. We had an over-production of crops, and now they say we are having an over-production of veterinarians. What is the matter with us? We are not occupying the field that is open to us if we will take it. How many more veterinarians would be employed in the United States if every city and every bunch of county towns and villages, would have meat inspection and milk inspection? How many would we employ? Well, I put the maximum at 5,000 in the United States. Right now there are something like 500 to 1,000 veterinarians in this work. You see what we can do. I am not here to criticize you, but I say that if the state veterinarians and the other veterinarians in the states, and the college men are afraid to go after what belongs to the graduates of these colleges and the profession, what are we going to do? It is up to you to fight for what belongs to you. I don’t say you want to oust or crowd out any other men who are qualified, but I do say this work, meat inspection especially, belongs to the veterinarian. No other man is qualified for it. Milk inspection, in the main, and especially all disease inspection, belongs to the veterinarian. Are you going to take it?

I want to say just one word and I am not going any farther because somebody will say, “You criticize.” I have the reputation that every time I get up I am going to shoot at somebody. I don’t want to do that. I just want to bring this out to you so you will see what you are up against.

I want to suggest that this organization and the American Veterinary Medical Association take this up and make it one of the live subjects of their profession and occupy this field. It is ours, so let us take it.

What will that mean? It will mean we will have a greater demand for men, and we will take charge of a field that we will hold and control. There are only one or two things in the United States handled exclusively by veterinarians. In the United States Bureau of Animal Industry, meat inspection is handled altogether by veterinarians. You remember back a few years ago, the American Veterinary Medical Association and this Association appointed men to go to Washington to get a bill through to raise the standard of the United States Army veterinarian. We did that. We got that bill through. The Army veterinarians are on a good standard now. What did they do? They took hold of the meat and milk inspection of the United States Army, and there isn’t anybody who takes care of that but the veterinarians. The M. D.’s don’t have anything to do with it. They have a right to say something about milk and meat inspection under certain conditions because it is a
public health problem, but the real work of this thing belongs to the veterinarian. I want you to get that, and I want you to hang to it. When you go home, I want you to fight for it in your cities, villages and states, and when it comes to be a government problem, fight for it just as we did in the United States Army, and as it has been worked out in the Bureau of Animal Industry.

I wouldn't talk offhand to you like this if I didn't think you needed it. I just want to say one more word before I quit. This Committee has been up for a year. As Chairman of this Committee I have just run up against problems that I didn't know anything about. I found out that I cannot get a correct survey of meat and milk inspection of the United States from the veterinarians. I am going after another source, if you will continue this Committee. All I ask you to do is to continue this Committee for another year. (Applause)

PRESIDENT CONNAWAY: I sincerely hope you will take to heart the constructive criticisms of Dr. Cary.

We will now have the motion pictures by Mr. Brock.

Mr. Brock showed motion pictures of the range conditions in Wyoming. (Applause)

The meeting adjourned at 12:35 p.m.

THURSDAY AFTERNOON, DECEMBER 3, 1931

The fourth session convened at 2:00 p.m., President Connaway presiding.

PRESIDENT CONNAWAY: The afternoon program is on tuberculosis. The first paper is by Dr. T. S. Rich, Inspector in Charge, U.S. Bureau of Animal Industry, Lansing, Michigan, on "The Control of Avian Tuberculosis." (Applause)

Dr. Rich read his paper. (Applause)

THE CONTROL OF AVIAN TUBERCULOSIS


Inspector in Charge, U.S. Bureau of Animal Industry

The subject assigned to me might lead to the assumption that this paper will discuss the control of avian tuberculosis as a national project, while, in reality, we are only bringing to your attention the result of eight years of observations in connection with the avian type of infection as it exists among poultry and swine in Michigan.

In bringing this to your attention, I have mentioned several different methods used by us in the study of avian tuberculosis. These methods are discussed in the order in which they were used. Later in the paper I have again referred to these methods in order to show the result of that work after a lapse of time.

It was recognized in the early days of our bovine tuberculosis control campaign that the poultry flocks were quite extensively infected in the southern part of the State and as the requests for information and assistance from flock-owners became more numerous each year, we considered it advisable to have our field inspectors report all infected flocks that came to their attention while engaged in tuberculin-testing cattle in their regular line of
work. In gathering material for this paper we note that our earliest office records relative to tuberculosis among poultry were dated 1922 and from that date to November 1, 1931, we have reports covering 14,815 infected flocks, which have been located by our field veterinarians while engaged in the bovine tuberculosis control program. We note also that there were 291,344 flock inspections reported during that period, a work which has been done with small additional expenditure of money but, we hope, with a big return in the reduction of tuberculosis among our poultry flocks, due to the information that we have been enabled to drive home directly to the owners of infected fowls.

Although we have never had funds or men available to follow up the infected flocks as we desired, we have endeavored to obtain information to determine the value of our efforts. As the value of field work of this nature is no greater than the records which are obtained, we began early to devise written forms for our field inspectors to include with their weekly reports, to be used as a basis for an office summary and which, when compiled, would give an intelligent record from which to make fairly accurate deductions.

Aside from our regular field inspections as mentioned, we have branched out on several occasions to make special studies concerning avian tuberculosis. We obtained information relative to the percentage of tuberculous swine in certain counties. We tested out the theory which had been advanced that tuberculosis in fowls could be controlled through a careful culling of the flock. We also studied the possibilities of the tuberculosis-free, accredited farm, that is, a farm free from this disease in either cattle, swine or poultry.

An investigation for the purpose of determining the percentage of tuberculosis in swine in Hillsdale and Clinton counties was made in the winter of 1923-1924. In this work we obtained from the U. S. Meat Inspection Division at Buffalo postmortem reports covering 46,638 hogs shipped from Hillsdale County to Buffalo, among which there were found 9,105 that were tuberculous (19.52 per cent). Of these 46,638 hogs, 13,264 were tattooed for the purpose of identifying ownership. Of the marked carcasses, 16.8 per cent were retained for tuberculosis. The tattooing enabled us to identify, at postmortem, infected hogs coming from 39 farms. Upon visiting those 39 farms we found 13 where there were swine still remaining upon the farm. A double tuberculin test, using avian tuberculin at the base of one ear and
standard tuberculin at the base of the other, was applied to those thirteen lots, which contained 214 hogs, with the result that 37 hogs (about 17 per cent) reacted as follows:

1 reacted to the B. A. I. tuberculin only.
5 reacted to both the B. A. I. and avian tuberculins.
31 reacted to avian tuberculin alone.

We also determined, either by tuberculin test or by postmortem, that the poultry flocks were tuberculous upon the farms where the 31 avian-reacting hogs were kept.

It was from this work in Hillsdale and Clinton counties that we became firmly convinced of the close relationship between the tuberculous swine and the tuberculous poultry on Michigan farms.

As there appeared to be many investigators of poultry diseases who believed that tuberculosis in fowls could be controlled through culling, a drive was started in November, 1924, to cull the flocks of Adams Township, Hillsdale County. While the entire township was not covered, there were 151 flocks (containing 15,377 chickens) culled, revealing through postmortem 85 infected fowls on 57 different farms.

The work was carried far enough to demonstrate, first, that tuberculosis could not be controlled through culling and, second, that there was occasionally a chicken found under one year of age that had generalized tuberculosis.

Furthermore, since it was demonstrated that only a small percentage of tuberculous fowls showed clinical evidence of the disease, we were convinced that flock-owners should be informed they cannot eliminate this disease from their flocks through the culling out of the birds that are suspicious.

It appeared from the work which had been done up to this time that it would afford us further information to have close supervision of the cattle, hogs and poultry relative to the control of tuberculosis upon several farms. We decided to term this "The Tuberculosis-Free-Farm Plan." This project was started, April 21, 1926. Twenty-five farms were accepted upon which no tuberculous infection of any type was known at that time to exist.

A physical examination was given the poultry, which showed that on three of the 25 experiment farms avian tuberculosis was present. Therefore, no tuberculin test was applied to the fowls on these farms. On the 22 farms where the test was used, there were 2,676 chickens tested with 3+ per cent reactors upon 13 farms. Nine farms showed no infection among the poultry.
Therefore, of the 25 poultry flocks under observation, physical examination showed infection on three farms (12 per cent) and the use of tuberculin showed infection on 13 farms (52 per cent).

In making this survey of the 25 farms according to our proposed "Tuberculosis-Free-Farm Plan," as we have already said, we included the swine on the farms. However, there were three farms on which no swine were kept. A double tuberculin test was applied to the swine on 22 farms. There were 301 hogs tested, revealing 18 reactors, located on nine farms. Of these 18 reactors, 10 reacted to both standard and avian tuberculins, one to standard only and seven to avian only. In other words, there were 17 of the 18 reactors which showed evidence of avian infection.

From the small amount of investigational work carried on in this tuberculosis-free-farm project, we made the following deductions: First, avian tuberculosis in the individual bird is very similar to the same disease in the cow and can seldom be diagnosed by physical examination. Second, many fowls in prime condition are found extensively tuberculous. Third, tuberculin-testing of swine is practical and in our judgment the double test should be used on breeding hogs on all farms where either avian or bovine infection is known to exist, and, finally, in 1926, avian tuberculosis in both poultry and swine was spreading at an alarming rate in Michigan.

We have mentioned the methods used in our studies of avian infection in Michigan to determine the most satisfactory plan to adopt in this state in the control of this poultry disease.

We will now take up the present status of the avian situation and the plan which we expect to follow in our State, until we ourselves find, or some other state shows us, a more satisfactory method.

In order to draw intelligent conclusions from the results obtained from our various activities, we made a careful survey of these findings to learn which plan appeared to be the most satisfactory and also to learn the conditions as they exist at present.

As the flock inspection that had been made by our field veterinarians was the most extensive of the measures tried, we desired to learn if the result which we had anticipated had been produced from the personal contact of the veterinarians with flock-owners. This work had enabled us to distribute about 30,000 copies of Farmer's Bulletin No. 1200, "Tuberculosis of Fowls," and about
1200 copies of Farmer's Bulletin No. 1554, "Poultry Houses and Fixtures." A personal letter was sent to each owner of an infected flock. This letter read as follows:

722-3 State Office Bldg.,
Lansing, Michigan.

DO YOU KNOW?

That if one fowl with tuberculosis is found in your flock the ENTIRE flock has been exposed and without doubt there are many others with the disease.

That a fat hen is OFTEN found to be ROTTEN with tuberculosis. That culling will NOT REMOVE all tuberculous fowls from a diseased flock.

That a large percentage of tuberculous fowls DO NOT produce eggs.

That the egg production of all flocks is GREATEST during their first year.

That the LARGEST return from sale of fowls for slaughter is soon after close of first laying period.

That to dispose of your ENTIRE flock annually and build a new flock from young chicks, provided that a FREQUENT CLEANING of the coops and yards is practiced, will not only bring you a LARGER INCOME from your fowls but will remove 75% of all diseases, INCLUDING TUBERCULOSIS from your flock.

WHY WAIT?

Start the new plan NOW and reap the reward.

T. S. Rich,
U. S. Inspector in Charge
Tuberculosis Eradication.

As we have said, we were anxious to determine just how much value to attach to personal contact, with the attendant opportunity to place the written matter. Therefore, a cross-country drive of 25 miles was made visiting every farm along a certain road.

We found that 90 per cent of the flock-owners on this particular road were building new flocks annually as advised by the field veterinarian and that not one infected flock was discovered, even though our trip took us through a section where there was extensive infection a few years ago.

Following this trip a visit was made to 59 previously infected flocks, all of which we found were being changed annually. Forty-two flocks (70 per cent) were apparently free from infection. In 17 flocks infection may still be lurking, as the owners are somewhat of a careless type.

A second locality was then chosen where our records indicated that a considerable infection had been found. A visit was made by our inspectors to every flock in two entire townships. Three hundred thirty-two flocks, containing 27,641 fowls, were inspected. One hundred fifty-nine of these flocks were being rebuilt annually.
One hundred thirty-four were partially changed annually, the change being completed every two years, and 39 were making no change. Within this area there were 60 flocks that were known to have been previously infected. Of these 60 flocks, 48 flocks were being rebuilt annually and are now free from infection. Three flocks were still infected and there were nine flocks upon which no definite conclusion could be made without the tuberculin test.

Out of this re-inspection of the two entire townships, which contained 332 flocks, only ten flocks were found to be infected. May I add that these ten infected flocks were promptly cleaned up by their owners.

We are convinced from these various investigations that the flock inspections, as made during the past several years by our field veterinarians, have been of great value, not only in locating the visibly infected flocks, but also in spreading information which is valued by the flock-owner.

Through the U. S. Meat Inspection Division we learned that above 14 per cent of the hogs slaughtered at Detroit are retained for tuberculosis. As we are convinced that the avian type of infection is responsible for the greater part of this infection among Michigan hogs, it became necessary, if we are to be successful in controlling that infection, to determine, not only what part of the 14 per cent was among Michigan hogs, but also to determine the most extensively infected areas within the State. Therefore, early in June, 1931, we made a study of the problem at the Detroit stockyards. We learned that it would be possible to tattoo the hogs upon arrival at the yards in such a manner as to identify the ownership, as well as the locality from which they came.

Up to November 12, we have tattooed, at Detroit, 8,637 Michigan hogs and followed through postmortem 29,609 hogs shipped in from other states, with the following result: Of the Michigan hogs, 359 (4.15 per cent) were retained for tuberculosis. Of the imported hogs, 4,235 (14.3 per cent) were tuberculous.

The 8,637 Michigan hogs came from 1,057 different farms located in 27 counties. There were 167 infected lots. The largest number, 50 lots, were from Washtenaw County, where we believe less educational work has been done than in any county in the State.

We also learned, from 871 hogs coming from 78 different farms in Hillsdale County, that 28 hogs from 12 farms were infected.
(3.19 per cent). You will remember that in 1923 and 1924, 19.5 per cent of the Hillsdale County hogs were infected with tuberculosis. Today it appears to be less than 4 per cent.

Upon receipt of reports from Detroit giving the names and addresses of owners of infected hogs, a letter is sent to each owner, which reads as follows:

722-3 State Office Bldg.,
Lansing, Mich.

DEAR SIR:

DO YOU KNOW?

That hogs shipped by you recently to Detroit were found tuberculous at slaughter.

That HOGS READILY CONTRACT ALL TYPES OF TUBERCULOSIS—BOVINE (cattle), AVIAN, (poultry) or HUMAN.

That DUE TO the EXTENSIVE INFECTION OF TUBERCULOSIS AMONG POULTRY IN THE SOUTHERN HALF OF MICHIGAN a great number of INFECTED HOGS from that territory HAVE GOTTEN THE DISEASE FROM POULTRY.

That WE DESIRE TO ASSIST YOU in ridding your premises of this infection, therefore, you will please find enclosed several bulletins concerning tuberculosis which WE EARNESTLY REQUEST THAT YOU READ carefully and THEN PLEASE CALL upon us FOR FURTHER ASSISTANCE.

Respectfully,
T. S. Rich,
U. S. Inspector in Charge
Tuberculosis Eradication.

The bulletins inclosed in the foregoing letter, sent to owners of infected hogs as determined by tattooing, were No. 781, "Tuberculosis of Hogs," and No. 1200, "Tuberculosis of Fowls."

To date, as a result of the tattooing, we have had an inspector visit 33 infected farms to learn the attitude the owner is taking towards this work. To this time no objector has been found, each owner expressing a desire to coöperate in getting rid of the infection. One hundred seventeen breeding hogs upon 31 of those farms visited have been given a tuberculin test, revealing 28 reactors (23.93 per cent) to avian tuberculin, located upon 19 farms. There were 12 farms where no reactors were found among the breeding hogs. The fowls upon 29 of the 33 farms were found tuberculous. The disease was detected upon 23 farms by clinical inspection and postmortem and by tuberculin test upon six farms. There were three flocks tuberculin-tested without reactors and one flock, made up of young fowls, that was not tested.

It is putting it mildly to say that we are well pleased with the result of the tattooing that is being done at the Detroit yards. It is getting us information which cannot be gotten from any other source.
Early in the present year, we received advice from the Bureau at Washington that after July first there would be a small federal fund available for use in the control of tuberculosis in poultry and swine. Therefore, as the Michigan law states, in Sec. 4 of Act 181 P. A. 1919: "The terms 'live stock' or 'domestic animals' or 'animal,' when same appears in this Act, shall be held to include poultry," we deemed it advisable, before undertaking a campaign directed against avian tuberculosis, to have official regulations providing for the suppression of contagious diseases among poultry.

Our Commissioner of Agriculture, Mr. Herbert E. Powell, formulated the following rules and regulations, which became effective, July 1, 1931:

**MICHIGAN DEPARTMENT OF AGRICULTURE**
**BUREAU OF ANIMAL INDUSTRY**

**RULES AND REGULATIONS PROVIDING FOR THE PREVENTION AND SUPPRESSION OF CONTAGIOUS AND INFECTIOUS DISEASE IN POULTRY**

By virtue of the power conferred on the Commissioner of Agriculture by Act 181 of the Public Acts of 1919, as amended, the following rules which have been adopted by the Commissioner of Agriculture are made and promulgated governing the suppression of contagious and infectious diseases in poultry.

1. If tuberculous fowls are found in any flock, the entire flock shall be considered as infected.

2. All owners of tuberculous poultry shall handle and dispose of their flocks in conformity with the regulations (or directions) of the Commissioner of Agriculture.

3. All thin, emaciated fowls showing signs of tuberculosis shall be killed and burned.

4. When the infection is found in any flock after August 1st and before January 1st of the following year, the remainder of such infected flock may be kept for egg production until August 1st of that year.

   When the infection is found between January 1st and August 1st only fowls less than one year of age may be kept until the following August 1st, but must be kept away from all farm animals until marketed for slaughter.

   No eggs from such flock shall be sold for or used for hatching purposes.

5. Poultry houses and yards must be thoroughly cleaned and disinfected as soon as the diseased flock is disposed of. A new flock should be reared from young clucks, upon clean ground, each year until it is determined that the flock is free from tubercular infection.

6. In case of valuable pure-bred flocks, an arrangement may be made with the Commissioner of Agriculture for freeing the flock of infection through the use of the tuberculin test. All fowls reacting to the tuberculin test must be slaughtered and disposed of under competent postmortem inspection.

7. No fowls are to be disposed of from infected flocks except for slaughter.

These rules and regulations shall be effective on and after July 1st, 1931.

In Witness Whereof, I have hereunto set my hand and affixed the official seal of the Department of Agriculture, this twenty-seventh day of June, 1931.

Herbert E. Powell,
Commissioner of Agriculture.
So now, with the data obtained by our field inspectors, with the information obtained through the tattooing of hogs and with the necessary regulatory measures adopted by the State, we feel that we are today in a position to arrange a fairly accurate working program.

Since field inspection has given us proof that avian tuberculosis, which was increasing in 1926, today is not only checked but markedly reduced, we shall continue the flock inspection carried on by our field veterinarians, while making their regular tuberculin tests of cattle.

The field inspections and the tattooing of hogs, which latter process we consider a most valuable source of information, have enabled us to locate the areas most in need of assistance.

We have said we learned from tattooing that the largest number of farms infected with swine tuberculosis were in Washtenaw County, consequently an intensive campaign is developing in Washtenaw. This campaign will be conducted by veterinarians who have received special training, not only in the diseases of poultry, but also in flock management. A visit will be made to every farm. And, since we have found that the progressive owners of the larger flocks are availing themselves of the information given them, and are freeing their flocks of infection, the inspectors will give their time largely to locating and helping those in need of assistance. We have usually found those needing help to be the owners of small flocks, those who keep from 25 to 75 fowls.

The tuberculin test is not to be applied to all flocks but will be used upon both swine and poultry, wherever it is believed that its use will assist in controlling tuberculosis.

Washtenaw County is probably the most extensively infected area of any locality in the State, so we believe that a thorough study of conditions as they exist there will determine whether it is advisable to continue the work in other counties where conditions have so greatly improved.

From the data which we have obtained and have now presented to you, we believe that to continue the work as it has been conducted during the past few years will, in time, bring avian tuberculosis under control. We also believe that it will be of great benefit to the owners of poultry and swine for us to speed up and intensify our campaign in order to hasten the day of tuberculosis control in Michigan.
DISCUSSION

PRESIDENT CONNAWAY: Mr. H. R. Smith will open the discussion of this paper. (Applause)

MR. SMITH: Mr. Chairman and Gentlemen: I want to say in the beginning that I regard this as one of the most important subjects to come before this group for consideration, because in the problem of avian tuberculosis two great industries are involved. If we estimate the loss in swine alone, on the basis of five cents per head, caused by avian tuberculosis, it represents an annual loss to the country of $2,400,000. But the loss to the poultry industry itself is far in excess of that amount.

First of all, it lowers the nutritive powers of the birds and lessens vigor. It makes it almost impossible to get response through forced methods of feeding in our feeding establishments, and then, too, we know it lowers egg-production through diminished vitality.

We have, of course, all over the avian tuberculosis belt, a large number of specimens that die on the farms. It is impossible to estimate the loss to the poultry industry, but it must be a very, very large sum.

We have in this country several packing-plants, canning establishments, where they can poultry. In one of these plants the loss from condemned poultry is so great that it amounts to about two cents a pound live weight on the birds in that section. If we had postmortem inspection of poultry, as we have on other classes of live stock in this country, we would be appalled with the loss from condemnations. I hope we can avoid postmortem inspection, and I am sure we can. The money that would be required to establish post-mortem inspection of poultry, spent in field work will, I think, accomplish the same result, and it will be a great deal easier to do it.

I wish to say in regard to Dr. Rich's paper that I don't know of a state in the Union that has formed greater contacts with the people, than Michigan, on this problem. I don't know where there has been a greater spirit of cooperation between the federal and state forces, the Agricultural College, through its Extension Department and particularly its Poultry Department, the Detroit packers, the agricultural journals, and certain other agencies in that state. I think without doubt a larger number of farmers have been approached and have responded in that state than in any other state with which I am familiar.

There is one thing that Dr. Rich didn't mention that I think has quite an important bearing on the success of the work in Michigan, and that is the practice of withholding indemnity on reactors until the premises are cleaned up. I think that is justified. We know that a certain amount of tuberculosis in poultry is transmitted to cattle, and calves in particular. There are many people who believe that many of the no-lesion cases may be attributed to the avian type of tuberculosis; that is the no-lesion cases in cattle may be due to the avian type. We don't know. But if that is true, aren't we justified in requiring the poultry premises to be cleaned up to avoid possible confusion, to avoid the slaughter of cattle that might react as a result of the avian infection? It seems to me we are justified.

The field work, the contacts the federal and state men have had with farmers in the testing of cattle have had wonderful results in that state. Michigan is on the eastern border of the avian belt. But, as Dr. Rich has pointed out, it was at one time a badly infected state. I will never forget this one case that came to me when I went to Buffalo to see the first load of hogs that received the ten cents indemnity. There were something like eighty head slaughtered and several sterilized but not a single carcass was condemned. We had tuberculosis on our own farm, and many neighbors had the disease in their flocks in that county. So specimens—glands—were taken out of the Hilldale County hogs. Some were shipped to Washington; some were sent to Dr. Van Es in Nebraska, and they showed a high percentage of avian bacilli in those hogs.

As you all know, the research work in many other places had definitely established that a very high percentage of the tuberculosis in hogs is due to the avian type. I am not sure but what it represents eighty or ninety per
cent, or more. Dr. Rich's work in Michigan shows, where they tested hogs on
the farm, that it went up above ninety-five per cent of the avian type in the
hogs tested.

The work done under the direction of Mr. Robinson, of Illinois, where they
tested 4802 hogs on farms in accredited counties where the poultry flocks were
infected, showed 13.3 per cent of the hogs reacting, and of that number
reacting, 96 per cent reacted to avian tuberculin. That is very conclusive.
Remember that those were in the accredited counties scattered over the state
of Illinois.

I don't know just why we have so much in this group of states, beginning
with Michigan on the east and with the Dakotas on the west. But we have
some pretty good ideas on that, and the farther we go the more we think we
are right. We are pretty certain this disease came through foreign importa-
tions, because Europe has a lot of avian tuberculosis. We have every reason
to believe we had just as much avian tuberculosis in the eastern states twenty
years ago as we have in the avian belt today, yet in the East they have very
little avian tuberculosis now. Dr. Grossman told me that in a questionnaire
sent throughout the six New England states, a large number of farmers
replied, and that a large proportion, almost all, said they were changing their
flocks each year, selling at the end of the first laying year. Of course, in the
East poultry-farming is more specialized. The farms are smaller. Those
farmers in the East realize that they get a third more eggs the first year than
they do any succeeding year. They realize it is a much more profitable method
of handling poultry for egg-production. So that practice is general. The
college men, the poultrymen, from the eastern states, tell me that it is the
exception to find a man who holds them over, unless they are standard-bred
flocks kept for breeding purposes. It is the common practice in all the eastern
states to sell the whole flock at the end of the first laying year.

I think it is quite clear that that is the explanation of the low percentage of
infection in the eastern flocks. We don't have much in the South. I don't
suppose so many imported birds have gone into the South. Of course, the
summers there are longer; the poultry are kept out in the open more, and that
may be a factor.

We have it on the western coast but not so bad as in the north central states.
There is some in the range territory. I want to say that more research work
has been done in the last ten years in this country than in all time preceding.
It has been a valuable accumulation of material, a wonderful foundation upon
which to build a program. Think how much we have learned about this in
the last ten years, that so much of the disease in hogs comes from poultry;
that it is more in the old birds and less in the pullets, and many other things
that have been learned and definitely proved on this problem.

Already the practice of these things has begun to yield results. Dr. Rich
has pointed out the effect in the state of Michigan. I can see a great difference
in the flocks there now as compared with what they used to be. I have only
to call your attention to the barometer to show the presence of the disease in
Michigan flocks, which I think will give you a still better idea.

Nearly all Michigan hogs go to Detroit and Buffalo. In 1916, 8.5 per cent
of Buffalo hogs were retained for tuberculosis. You understand, some of these
come from the West, but practically all Michigan hogs go to Buffalo and
Detroit. Retentions increased until 1922, when they reached 17.7 per cent.

As a result of the educational work, the retentions have been going down-
ward. This is the barometer of the tuberculosis situation in the territory
tributary to the Buffalo market. It has gone down now to 10.3 per cent, on
October 1 of this year.

Now we take Detroit. There was a great increase in retentions at the
Detroit market up to the year 1924, when the figure reached almost 22.9 per
cent. The movement has been downward since that time.

More testing has been done in poultry in Illinois than in any other state.
They have tested nearly 1,400,000 birds in the accredited counties alone, in
Illinois. Mr. Robinson gives me these figures: Out of 1,400,000 tested in
Illinois, the average percentage of reaction was a little over 4; old birds, 9 per
cent, and young birds, 1.2 per cent. Forty-nine per cent of the flocks were
found infected, one or more birds.
Chicago, of course, draws heavily on Illinois, and we have reason to believe that the educational work in testing has been an important factor in bringing retentions down in Chicago. Back in 1908, 3.8 per cent of the hogs killed at Chicago were retained for tuberculosis. The percentage increased until in 1922, when it reached 19.3 per cent. There has been a downward trend in recent years.

Chicago draws on Wisconsin. A good deal of work has been done in that state. Chicago draws on Iowa. Quite a little work has been done in that state.

Omaha furnishes a fine example of what can be accomplished through educational means on the poultry problem. In this connection I would like to say that in Nebraska, as you know, Dr. Van Es has gotten out a great many bulletins on avian tuberculosis. These have been given wide circulation. The State Department has circulated a large number of the pamphlets, "Give the Old Hen a Right." Two big railroads, the Burlington and Union Pacific, have run special poultry trains over the State. An exhibit of avian tuberculosis was on those trains. Dr. Spencer has followed up countless hogs tattooed in the country, writing back to the farmer indicating the number of diseased hogs in the shipment, and giving them instructions as to how to eliminate the disease.

Here is the picture of what has been accomplished in Omaha. There was a great increase in retentions up to the year 1922, when they reached 16.6 per cent. Then there was a downward trend. The last year it showed a little upward trend. The work in Nebraska has not been nearly so aggressive the last year as heretofore.

Sioux City draws on northeast Nebraska, southwest Minnesota, southeast North Dakota and northwest Iowa. The trend was upwards, and then later it was downward. The retentions at Sioux City have dropped approximately 40 per cent. A great deal of work has been done in northwest Iowa, northeast Nebraska, and considerable work in South Dakota.

We have next South Saint Paul, Minnesota. South Saint Paul draws on Minnesota, North Dakota, to a certain extent, and South Dakota. There is a very great increase in retentions in hogs. We know there is a large amount of tuberculosis in poultry in that state, but there has been some decline in recent years.

Not much work has yet been done on the avian problem in North Dakota. They have been very busy with their cattle problem and no doubt will go into the avian side very soon. I was greatly interested in noticing, at the Fargo plant in North Dakota, the hog retentions are three times as high as at Huron, South Dakota, but the condemnations in hogs at Huron, South Dakota, are three times as high as at Fargo, North Dakota, showing that the work Dr. Crewe has been doing in eliminating the disease in cattle, in North Dakota, has brought the condemnations in hogs way down, but the retentions are still very high. That is the comparison between those two points.

Then we have the results at all plants in Wisconsin. Starting with the year 1916, retentions go up way up to 27 per cent in 1923. There is a downward trend in recent years in Wisconsin hogs. A good deal of educational work has already been done in Wisconsin.

As we go south, we don't get nearly so much avian tuberculosis. Kansas City is very low and always has been. It has gone up and down. Now it seems to be up again a little. But Kansas City retentions are about one-fourth lower than they were in the beginning.

A great deal of work has been done on this problem in the state of Kansas and it is showing its effect.

Indianapolis shows an upward trend and then something of a downward trend.

National Stockyards, East Saint Louis, presents a different situation. The increase at that point might be influenced slightly by the fact that they may be getting more northern hogs. But we are quite confident that that increase in retentions at East Saint Louis is due to the spreading of avian tuberculosis southward in the last few years. There is no question about it. Retentions at Saint Louis used to be very low. Now they are up to 13 per cent. They are higher than Chicago right now. I am confident that perhaps a lack of work in the state of Missouri is a factor here. I remember that Dr.
T. S. RICH

Connaway told me some time ago they are finding more tuberculosis in their poultry, as examined in his laboratories, than they used to find.

Saint Joe has been going upwards. Cleveland has been climbing upward and not yet downward. Ohio has had a big job. They have made wonderful progress on the cattle program. They really haven't had time to give to the avian problem. Now that they are going to be through in Ohio in another thirty days, we may except some wonderful results on their work.

Now we take the United States as a whole, all plants in the United States under federal inspection. The trend was upward, of course, until it reached 1923. It went up until it reached 15.2. Then it went down; it is starting up again. The thing that is pulling it up right now is the higher retentions at East Saint Louis and other southern markets.

I have noticed that in Cincinnati the retentions have gone up a little; condemnations are half. But I am confident that this disease in poultry is gradually going southward from the avian belt.

I want to say, Dr. Lewis, those regulations that the southern states adopted, requiring the test on all breeding poultry coming into the South, were a very important safeguard. If something is not done, you are going to get more of it down South, I have every reason to believe.

There is just another point I want to bring up. We will have a lot of it at the interior plants in Iowa: Cedar Rapids, Waterloo and Mason City. Of course, the Iowa people have had so much to look after, they haven't had much time for avian work recently. But I want to say to you that if it takes publicity to solve the avian problem, we have a star performer in the state of Iowa. I don't know of anybody who has been given more publicity than our friend, Dr. Malcolm, in the state of Iowa. It was done with a very clever device, the common, farm pitchfork. So when Dr. Malcolm gets started on publicity on the avian problem, I think we may expect some results in that state.

There is one thing that I believe could well adopted. If the states in the badly infected avian district could withhold indemnity until they clean up their poultry, I think it would be of very great help. I think this is also true: We have got to give attention to the hatcheries. We are not saying the disease is spread through the young chicks; we think it is not, to any great extent. But we do know this, that you are not going to get farmers to buy chicks every year if they have a high mortality in what they buy. For this reason the work on bacillary white diarrhea should go hand in hand with tuberculosis, because I understand that is the principal cause for the high mortality in young chicks. If that is true, it would seem to me that just as much attention ought to be given to bacillary white diarrhea to bring down the high mortality. I think we have to inculcate in the farmer's mind a discrimination in favor of hatcheries that do follow the practice of testing for both tuberculosis and white diarrhea, so that these hatcheries will clean up the flocks. These hatchery flocks probably don't constitute over 10 per cent of all the flocks in the country. If any testing is done, it ought to be the hatchery flocks and standard pure-bred flocks that supply the eggs for the country.

In closing, I want to say that the sanitary officials of the United States have shown what great accomplishment can be made on the cattle problem. I have every confidence that these same men, with all of their experience on the cattle program, putting that into effect on the avian, along the lines that have been laid out as a practical program, will bring forth the same good results in solving the avian problem in the next few years. (Applause)

President Connaway: I hope all of the control officers here will take these things very much to mind. The first avian tuberculosis I ever saw was in a bottle, and that bottle came from the state of Michigan, brought down by our professor of poultry husbandry. Professor Smith used to be one of my associates. I wish we still had him. I didn't think we had a case of avian tuberculosis in the State. We have plenty of it now, as shown by these figures.

I regret very much that my own state veterinarian is not here to get the benefit of what has been given at this session and to impress him with the
great importance of this. I wish to state, however, he is doing all he can, and we have the help of one federal man in that task. It is a serious problem and one that deserves the fullest consideration of this group.

We will pass on to Dr. Wight's paper, "Progress of Cooperative Tuberculosis Eradication Work." (Applause)

. . . Dr. A. E. Wight read his paper. . . . (Applause)

PROGRESS OF COOPERATIVE TUBERCULOSIS ERADICATION WORK

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

Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, United States Department of Agriculture

It is a great satisfaction to be able to report to you at this time highly favorable progress in tuberculosis eradication throughout the country during the last twelve months.

LEGISLATION

Several important features have developed in this project in the course of the year. During a portion of the time, the legislatures of nearly all the states were in session, and their action has made it possible to continue the work of tuberculosis eradication among livestock to a greater extent than ever before. Changes made in certain state laws should have a very good effect in assisting those who direct the campaign. Some of these enactments already have proved their value.

A new law in Michigan permits all testing of herds in that State to be conducted at the expense of the State, in cooperation with the federal Bureau. This provision does away with the necessity of county appropriations, which are rather difficult to obtain, especially in counties in the modified accredited area, where considerable amounts of county funds have already been expended in the work. A provision in the Indiana law made possible the completion of area tuberculosis eradication work in four counties in that State where county aid was insufficient because of poor crops incident to the drought of 1930.

In California, provision was made by the legislature to supply funds so that in the future the State can pay its share of indemnity for tuberculous cattle. These examples, together with others that might be mentioned, indicate how well the legislative program, which is absolutely necessary, has been managed.

Credit should be given the leaders of this livestock sanitary work in all the states for their untiring efforts to bring about the
enactment of the necessary laws and appropriations to proceed with the work as rapidly as possible under existing conditions.

Funds made available by state and county appropriations for this work during the last year amounted to approximately $14,000,000, of which $10,000,000 was for indemnity. The Congress of the United States, as usual, has supported the campaign in a liberal manner. The federal appropriation for the present fiscal year makes available about $6,500,000.

In some of the eastern states, where tuberculosis exists to a very great extent in certain counties, the legislatures meet annually, and it is believed that substantial appropriations will be made to continue the work in those sections next year. In the states where the legislatures meet every two years, provisions have been made to supply the necessary funds for this work during the next year.

**Tuberculin Testing**

In an official statement published a number of years ago, reference was made to the fact that, during a 15-year period ending in 1908, 400,000 tuberculin tests were applied to cattle with tuberculin prepared by the federal Bureau of Animal Industry, resulting in the disclosure of tuberculosis in about 40,000 animals, or an infection of 10 per cent. Compare, if you will, this old 15-year record with the record for the year ended June 30, 1931, when more than 13,000,000 tuberculin tests were applied in the cooperative campaign, disclosing an infection of 1.5 per cent. Since November, 1930, more than 1,000,000 tuberculin tests have been applied to cattle each month, excepting the months of June, July and August, 1931, the average for the 12 months being more than 1,000,000 per month. This indicates the vast amount of effort being put forth to conquer tuberculosis among cattle.

Members of this Association appreciate under what great difficulties the work is performed in many cases. Much credit must be given to the field workers and to the cooperating live stock owners for their willing support of the campaign.

Unfortunately, as in a few counties in Iowa, there is still misguided opposition which seeks to obstruct the work and may even do so temporarily. But I have great faith in the intelligence, progressiveness and courage of the American people. Each year there is a clearer public understanding of this important work and a deeper appreciation of the need to eradicate tuber-
culousi in its early stages. Hence, we may expect opposition to be less aggressive and shorter-lived in the future than in the past. The public is in no mood to tolerate the presence of dangerous diseases for which there are well-established, practicable means of eradication.

**Area Work**

Since the first of November, 1930, 216 counties have been added to the list of those in the modified accredited area, where the degree of infection of bovine tuberculosis has been found to exist to not more than one-half of one per cent. In addition to these 216 counties, 11 towns in the state of Vermont also were placed in the modified status. On July 1, 1931, the last county in the state of Indiana was declared to be a modified accredited area, making that the fourth state in which all the counties have been modified.

During the last 12 months, 3,192,181 cattle, located in 241 counties and nine towns due for remodification, were tuberculin-tested, the results disclosing 12,740 reactors, or approximately four-tenths of one per cent of the number tested. Thus, it has been possible to remodify all these counties. The retesting of cattle in modified accredited areas will, necessarily, have to be continued to a certain extent in order to prevent any serious reinfection.

On November 1, 1931, there were 1,271 counties, parts of two other counties, and 55 Vermont towns located in the modified accredited area. This is nearly 42 per cent of the total number of counties in the United States. A very gratifying feature in this connection is the fact that modified accredited areas are located in all but eight states in the Union. Additional area work is being conducted in additional counties, the purpose being to have them placed in the modified accredited area at the earliest possible date.

Through the efforts of this Association last year, a plan was devised whereby it is possible to place in the modified accredited area certain counties in areas where range and semi-range cattle are handled to a considerable extent. This plan was adopted by the federal Bureau and the various states in which it could be applied, with the result that since our 1930 meeting 34 counties, located in six states, have been placed in the modified accredited area under the new provision, which is known as Section 27 of the Uniform Plan. Work under this section is now being
conducted in several other states. The officials who are directing the work in those areas feel very well satisfied with the progress that has been made.

Many interesting incidents have been brought to attention through the development of this form of tuberculosis eradication. For example, in one of the far-western states, a very large herd of range cattle was being moved at the time of the semi-annual round-up, making it very difficult to hold the cattle for a three-day observation. Therefore, a scheme was developed to identify the injected cattle by a series of paint-marks of different colors. Thus, it was possible to observe the proper animals at the proper time. In one of the southern states, where range cattle are handled to a considerable extent, it has been possible to take up the area plan under Section 27 in conjunction with the final dipping in tick eradication.

One of the greatest undertakings in connection with county area work has recently been completed in Ottertail County, Minnesota, where 116,018 cattle were tuberculin-tested in a period of 15 days, resulting in the disclosure of 509 reactors. These cattle were maintained in 7,245 different herds. Working under the direction of several Bureau and state supervisors, 78 accredited veterinarians conducted the testing. The results of this undertaking were satisfactory with regard to the small degree of infection—less than one-half of one per cent—and also the work was done in a very economical manner. Much credit is due those who made the arrangements and, also, those who did the work, in cooperation with the willing and agreeable live stock owners in that important dairy county.

Area tuberculosis eradication work continues to be a satisfactory and practicable method of exterminating this disease. In some of the more heavily infected counties of the eastern states, it is necessary to work part of a county at a time in order to provide for the necessary retesting, replacements, marketing of reactors, etc. Indications are now that all counties in Ohio, North Dakota and Wisconsin will be in the modified accredited area within the next 12 months.* Possibly the work will develop so that additional states will qualify for this distinction within the same time.

Accredited Herd Work

We can not overlook the importance of the part played by the accredited-herd project in connection with this campaign.

*Ohio and Wisconsin became modified accredited areas, January 1, 1932.—Editor.
From the very beginning it has been a most helpful and satisfactory method of conducting the work in many localities. On November 1, 1931, there were 160,415 herds, containing 2,595,962 cattle, in this status. The number of accredited herds is not increasing throughout the country, due to the fact that in many sections of the country it is not deemed advisable to go to the expense of retesting herds of clean cattle every year when such herds are located in modified accredited areas that are known to have been practically free from bovine tuberculosis for some time. Reinfection occasionally creeps into accredited herds the cause being sometimes known and at other times unexplainable. On the whole, the subject of reinfection of such herds is not a serious one, but it is one that must always be kept in mind.

**INTERSTATE SHIPMENT OF CATTLE**

During the last year, the number of dairy cattle shipped interstate has been somewhat less than it was a few years ago, but in recent months it seems to be increasing. But very few reactors are found among dairy cattle presented for interstate shipment because a great majority of them originate in sections of the country comparatively free from the disease. The regulations of the various states, with reference to the introduction of cattle for feeding and grazing purposes, are not so uniform as they might be, but a study of the question is in progress with a view of bringing about an improvement if possible. When more counties in the cattle-growing states can be placed in the modified accredited area, the problem will be greatly simplified.

The question of the proper steps to take in maintaining tuberculosis-free public stockyards is another matter that is being given consideration. It will also have a more favorable outlook as soon as the number of modified accredited counties can be somewhat increased in the sections of the country where feeding and grazing cattle originate.

**APPRAISAL, INDEMNITY AND SALVAGE**

During the last year, as a result of depressed cattle prices, there has been a noticeable reduction in the amount of salvage received for reactors throughout the country. The average appraisal of reactors, which are now mostly of the dairy type, has been reduced to quite an extent in most states. The maximum federal payment for cattle reacting to the tuberculin test has been reduced from $35 to $25 for grade cattle, and from
$70 to $50 for pure-bred cattle, the changes having been effective July 1, 1931. The average appraisal for reacting cattle during September, 1931, was $85.66; the average salvage, $16.39; the average state indemnity payment, $35.33, and the average federal payment, $10.

**IMPORTANCE OF RESEARCH**

As this campaign continues, research work and the general study of tuberculosis in live stock continue to be of great importance. It is gratifying to know that research work is being conducted at a number of state experiment stations, as well as by the United States Bureau of Animal Industry. Studies for the improvement of field work have been continued with beneficial results.

**AVIAN TUBERCULOSIS**

The Congress of the United States, at its recent session, made a provision for approximately $60,000 additional operating funds for tuberculosis eradication in live stock, so that the federal Bureau of Animal Industry might be able to cooperate with the various states and other organizations, as well as the poultry-owners, in the elimination of tuberculosis of the avian type. It will be recalled that a great amount of work has already been done in connection with the observation of poultry flocks in areas where tuberculosis eradication is being conducted among cattle. The results of this feature have been quite satisfactory, and it probably has done much to reduce avian tuberculosis. However, there still remains a very high percentage of infection among the flocks in certain sections of the central and north central states. The live stock sanitary officials of 12 states in these regions have arranged to take up this work to a greater or lesser extent in cooperation with the federal Bureau and other interested organizations.

During June, 1931, an important conference on this subject was held at the University Farm, Saint Paul, Minn. Out of this conference developed a uniform working plan which has been of great assistance in furthering the campaign. During the latter part of July, a two-week short course was held at the Iowa State College of Agriculture, at Ames, to give the state and Bureau veterinarians who were to take part in this work an opportunity to brush up on the subject and develop ideas as to better management of the campaign. Much credit is due our great friend,
Dean C. H. Stange, for developing and making such a short course possible.

The outlook for the favorable development of the campaign to control and eliminate avian tuberculosis from poultry and swine is very bright, and I trust that sufficient appropriations will be made available to continue the work.

**Tuberculosis in Cattle and Swine Decreasing**

According to reports received from the Meat Inspection Division of the federal Bureau of Animal Industry, there continues to be a very satisfactory reduction in the amount of tuberculosis found among cattle and hogs examined in connection with meat inspection. The percentage of tuberculosis in hogs was increasing steadily up until 1924. Since that time it has decreased. During the fiscal year ended June 30, 1931, approximately 88,000 hogs slaughtered under federal supervision were declared to be unfit for food or in a condition that made it necessary to sterilize the carcasses. If the same degree of infection existed last year as was present ten years ago, the number of hogs condemned and sterilized would have been twice that many or, expressed in another way, more than 1,100 additional carloads of 75 hogs each would have been condemned.

In regard to cattle, exclusive of known reactors, the figures are interesting also. Three times as many cattle were condemned as unfit for food or passed for sterilization on account of being affected with tuberculosis in 1921 than was the case last year. In other words, instead of the 12,500 cattle so classified last year, had the high infection of 1921 prevailed, a total of more than 37,500 cattle would have been condemned or passed for sterilization. The saving amounts to more than 1,000 carloads of 24 cattle each. These two items, showing the saving of more than 2,000 carloads of cattle and hogs annually, alone indicate the benefits that are being derived from tuberculosis eradication.

The employees of the federal Bureau of Animal Industry engaged in meat-inspection work are putting forth special effort to identify cattle and hogs found to be affected with tuberculosis in order that their origin may be traced. It is impossible to do this in many instances because the animals change ownership quite often before reaching the packing-house. However, as time goes on, and the disease is reduced, it will be possible to have this feature of the plan worked out in a more
satisfactory manner. Tattooing hogs has proved to be a very satisfactory method of identifying them at the packing house.

JOHNE'S DISEASE (PARATUBERCULOSIS)

The subject of Johne's disease (paratuberculosis) is being given special attention on this program today. Accordingly, only brief mention will be made here of the fact that the federal Bureau and several states are cooperating with the live stock owners in attempting to reduce this infection. Results thus far obtained are not altogether satisfactory, but the disease does not seem to be very serious except in a very few localities.

CONCLUSION

Among the more interesting items of publicity that appear in the various publications, it is believed that the ones of local interest attract the most attention. Much favorable sentiment can be produced from time to time by such articles as have been noted by many of you with reference to the disposition of cattle that react to the tuberculin test. I believe that this feature of publicity should be continued as much as possible. Employees of the Meat Inspection Division of the federal service are always willing to cooperate with the state and local veterinarians in demonstrating lesions of the disease in known reactors. Just recently, an employe of that Division, located in southern Iowa, had an opportunity to demonstrate his ability in this connection.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CATTLE TESTED</th>
<th>REACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NUMBER</td>
<td>PER CENT</td>
</tr>
<tr>
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<td>20,101</td>
<td>645</td>
</tr>
<tr>
<td>1918</td>
<td>134,143</td>
<td>6,544</td>
</tr>
<tr>
<td>1919</td>
<td>329,878</td>
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<td>1920</td>
<td>700,670</td>
<td>28,709</td>
</tr>
<tr>
<td>1921</td>
<td>1,366,358</td>
<td>53,768</td>
</tr>
<tr>
<td>1922</td>
<td>2,384,236</td>
<td>82,569</td>
</tr>
<tr>
<td>1923</td>
<td>3,460,849</td>
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<td>1924</td>
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</tr>
<tr>
<td>1925</td>
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<td>214,491</td>
</tr>
<tr>
<td>1926</td>
<td>8,650,780</td>
<td>323,084</td>
</tr>
<tr>
<td>1927</td>
<td>9,700,176</td>
<td>285,361</td>
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<td>1928</td>
<td>11,281,490</td>
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<tr>
<td>1929</td>
<td>11,683,720</td>
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<tr>
<td>1930</td>
<td>12,845,871</td>
<td>216,932</td>
</tr>
<tr>
<td>1931</td>
<td>13,782,273</td>
<td>203,778</td>
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<tr>
<td>Totals</td>
<td>88,652,937</td>
<td>2,183,689</td>
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## Table II—Record of tuberculin-testing, cooperative tuberculosis eradication work, fiscal year 1931

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<tr>
<th>State</th>
<th>Herds Tested</th>
<th>Cattle Tested</th>
<th>Reactors</th>
<th>Inferred Premises</th>
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<td>160,061</td>
<td>127</td>
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<tr>
<td>Arizona</td>
<td>3,355</td>
<td>43,768</td>
<td>507</td>
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<tr>
<td>Arkansas</td>
<td>5,371</td>
<td>33,622</td>
<td>66</td>
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<td>Colorado</td>
<td>587</td>
<td>9,070</td>
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<td>9,666</td>
<td>142,387</td>
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<td>46,253</td>
<td>1,630</td>
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<td>2</td>
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<td>0</td>
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<td>Florida</td>
<td>8,842</td>
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<td>Iowa</td>
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<td>23,202</td>
<td>1.5</td>
</tr>
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<td>199,807</td>
<td>1,080</td>
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<td>96,598</td>
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<td>Missouri</td>
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<td>3,144</td>
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<tr>
<td>Nevada</td>
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<td>New Hampshire</td>
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<tr>
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<tr>
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<tr>
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<td>5,589</td>
<td>89</td>
<td>1.6</td>
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<tr>
<td>Interstate</td>
<td>23,987</td>
<td>249,648</td>
<td>640</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Total: 1,162,414 | 13,782,273 | 203,778 | 1.5 | 68,344

Table includes records of tuberculin-testing done under the area plan.
to many owners of reactors and others in a section of the State where sentiment towards the test was anything but favorable. The results of the efforts of this employe will, no doubt, be of much assistance in bringing about a better understanding among those people.

The shortage of public funds which prevails throughout the country at this time has somewhat handicapped the progress of our work. This remark applies particularly to county funds. For this reason, as previously mentioned, it would be well for the states in the sections where county aid is obtained to give consideration to the matter of adjusting the law so that the state itself will take care of the necessary funds in the future. The amount of state funds that will be necessary in many of the middle western states, where such good progress has been made in tuberculosis eradication, should be somewhat less each year. Many millions of dollars, however, will have to be expended in the sections of the eastern states where tuberculosis in cattle is still so prevalent. It is extremely unfortunate that the disease has been allowed to spread through the herds of cattle in those localities, but is it there, and it must be eliminated. There is a determination on the part of the people of those states to get rid of tuberculosis as rapidly as possible in keeping with the funds that can be found available for the work.

To those of you who are located in the more lightly infected sections of the West and South, I wish to convey the hope that steps will be taken to make the necessary surveys to place all the counties in these states in the modified accredited area as rapidly as possible.

I thank you for your kind attention to this paper, which I hope will be freely and fully discussed.

**DISCUSSION**

**PRESIDENT CONNAWAY:** Mr. M. G. Thornburg, Secretary of Agriculture of Iowa, will discuss this paper. (Applause)

**MR. THORNBURG:** Mr. President, Ladies and Gentlemen: I hesitated to accept the place on this program because you have heard so much about Iowa. It has been in the limelight. I thought maybe we had better stay in the back row. But I am sure you all agree with me that the paper by Dr. Wight pretty nearly covers the subject in regard to the eradication of bovine tuberculosis, especially the progress. However, if you will bear with me, I would like to make just a few comments about this work.

First of all, I want to pay my appreciation to Dr. Mohler, Dr. Wight, and the Bureau, for the very excellent cooperation that they have given us in this work. I sometimes wonder just where we would have gotten to if we hadn’t had federal supervision to head up this work. Each state would have been operating separately, and the work wouldn’t be uniform at all. But with this cooperation, with this leadership, with the excellent field forces that the federal
other tested at least once. We are handicapped little high, and we are handcapped cattle month, approximately that we are not testing cattle out in Iowa. We are testing some flocks in Iowa to determine the percentage of infected flocks and a whole lot of testing of poultry, but I believe that the work should be carried feel that we feel that those cattle are a great source of infection. However, we have areas-feeder and stocker cattle. We don't feel that we have been penalized by doing it. Of course, we are a little peculiarly situated out there, compared with some of your states. We feed annually close to 1,000,000 head of cattle and ship from 500,000 to 750,000 from the western range country. We don't feel that those cattle are a great source of infection. However, we have in some of our modified counties feeders that are willing to get cattle from clean areas, tested cattle. So they are thinking along that line, and it is a good thing. But we are not in favor of any unjust rules and regulations that are going to increase the cost of feeders to our Iowa farmers.

The interstate movement of cattle was discussed last night. Most of you were there, and I don't want to take up any time to re-discuss that question. However, in Iowa, we are ready to accept identified cattle from accredited areas—feeder and stocker cattle. We don't feel that we have been penalized by doing it. Of course, we are a little peculiarly situated out there, compared with some of your states. We feed annually close to 1,000,000 head of cattle and ship from 500,000 to 750,000 from the western range country. We don't feel that those cattle are a great source of infection. However, we have in some of our modified counties feeders that are willing to get cattle from clean areas, tested cattle. So they are thinking along that line, and it is a good thing. But we are not in favor of any unjust rules and regulations that are going to increase the cost of feeders to our Iowa farmers.

The avian question has been discussed. We were very glad to cooperate with the Bureau, out in Iowa, with their $60,000 that they have to carry on this work. However, it is my opinion that this work should be carried on very cautiously and very carefully. I am not of the opinion that we should do a whole lot of testing of poultry, but I believe that the work should be carried along more on educational and demonstration lines than testing. We are testing some flocks in Iowa to determine the percentage of infected flocks and feel that we are going to get some very good results from that work.

As to the progress in Iowa, you may think from some of the publicity that you have had from that state, that we haven't been testing any cattle out in Iowa. Well, we have, and we will test probably this year just about as many cattle as we did any other year. We will have applied, at the end of this month, approximately 1,000,000 tests in Iowa. So don't let anybody tell you that we are not testing cattle out in Iowa. At the present time we have 70 accredited counties out of 99, and in the other 29 counties I should judge from 65 to 75 per cent of the cattle have been tested at least once. This is in the section of the State where our infection is a little high, and we are handicapped just a little bit in the way of finances.
I think we will add two more counties to that list in the next month. We have reaccredited 34 counties, and the test is standing up very nicely, and we know we are eradicating bovine tuberculosis.

We have one county out in Iowa that I always like to point to in showing that it is possible to eradicate bovine tuberculosis. That is Jones County. By the way, it is right adjacent to Cedar County, which you have all heard about. It was modified a little over three years ago. There was quite a heavy infection there. It ran better than 10 per cent. On the modifying tests there were almost 6,000 reactors taken out of that county. It was remodified this year and approximately 400 reactors were taken out. Maybe some of you think of that county as being one of the first settled counties in the state of Iowa, with a lot of old bank barns down there, with dirt floors, and barns without ventilation. The infection was down to a point where it could be remodified. So we feel it is proof that bovine tuberculosis can be eradicated.

Then right in that same section, that same county, there is one township, Monticello township. Before the tests were started in that county all the hogs that were shipped out were being bought by the packers subject to test, bought subject to test. Today they can ship their hogs to any market in the United States.

To show the progress that we are making in Iowa, in 1925 we tested approximately 1,200,000 cattle. We took out a little over 28,000 reactors. In 1930 (the figures are not completed for 1931) we tested approximately the same number of cattle, 1,200,000, and took out about 18,000 reactors, about 10,000 less. So you see our infection is gradually getting lower.

Just a word or two in regard to some of the publicity that you have been hearing about Iowa. It is true that we had to use the militia to test cattle in that state, and I hope that not another state in the Union will have to do it. But if you ever do, I pray to God you have a governor who will back you up in the law. (Applause) The troops were not called out necessarily to enforce the tuberculosis eradication law, but we say they were called out to hold up the opinion of the courts. In Cedar County, where we first called the militia, there were approximately 2,000 herds. All but about 400 or 500 of them had been tested. By the organization of a very small minority of the farmers in that county, they defied the testing. We took some of those men before the justice court and were unable to get a conviction on account of a hung jury. We realized that it would be almost impossible to get a conviction in the J. P. court. So we maneuvered around until we got them into the district court. They were enjoined for interfering with the test, some forty-five or forty-eight farmers. We thought we were sitting on top of the world then. We went out to test their cattle. We would go to a man's farm and he would say, "Yes, there are my cattle. Go ahead and test them." By the time we would start the test, forty or fifty men from the other county would keep us from testing. After they had abused some of the veterinarians and told us we couldn't test, the militia was called in. There was no resistance after that. We tested between 500 and 600 herds in Cedar County by the use of the troops. With only a few of those herds was it really necessary to have the troops. While we were there we cleaned up that county.

We went on down to Henry County, and we tested 300 or 400 herds there so as to clean up that area. We went on down into Lee County. There were six herds down there where we used the troops in helping us test. Whether it was really necessary, I am unable to say, but, as I said a minute ago, we wanted to clean up that section, and where they told us it was going to need the militia, we took them at their word, and we used it.

There was one county where we tested the entire cattle population while the militia was there. That was Des Moines County, of which Burlington is the county seat.

The Army has been discharged, and we don't feel that we are going to meet with a great deal of resistance. In fact, after the troops were called in, there was really no resistance, what we call passive resistance. I think their game was to run up the expense just as much as they possibly could, so as to use that as an argument to get the state-wide area law repealed.
There are other factors that enter into this test that I don’t want to mention at this time. But I think I can safely say that the law will not be repealed, and that we are going to continue to test cattle in Iowa. I predict that in two to three years we will have a modified area. (Applause)

President Conaway: We will now hear from Dr. Faulder. (Applause)

Dr. E. T. Faulder: It is indeed a privilege and a pleasure to be assigned the task of discussing the excellent paper just presented by Dr. Wight.

I know we all agree that what we have heard convinces us that unparalleled progress has been made in the great undertaking of controlling and eradicating bovine tuberculosis. Many of those present have had the privilege of hearing previous reports by Dr. Wight, before this Association and at tuberculosis eradication conferences, and we must not forget the wonderful presentations made by the late Dr. Kiernan, both before this Association and before various tuberculosis eradication conferences.

Dr. John R. Mohler and his associates of the federal Bureau of Animal Industry should be highly complimented on their efforts to establish a tuberculosis eradication project in every state in the Union. Since the inception of the work these officials have pointed out to the various state officials the proper way to do the work, and to maintain inspiration and interest. Their guidance has inspired confidence in state and county officials, and this inspired confidence has reacted favorably in phenomenal progress being made each year during the past twelve years. The various states should continue to follow the lead of the federal officials and the advice of the U. S. Live Stock Sanitary Association until this great task has been completed.

Unlimited credit is due this Association also for its untiring efforts in creating the Accredited Herd Plan and promoting legislation and in stimulating the work at every angle.

Dr. Wight discusses appropriations of funds by Congress, by the various state legislatures and by county boards of supervisors. Public officials advocate an increase in public building projects to help the unemployment situation. If it is just and proper to appropriate funds for this purpose, then I believe it is just and proper to appropriate funds for the control and eradication of diseases of humans and domestic animals, and I do not believe any appropriation, either federal, state, or county, should be curtailed on account of depression.

We can help, to a certain extent, in these days of depression by increasing speed in the eradication of tuberculosis. We are doing this right now in New York State. During the months of November and December, our plans call for the condemnation of 20,000 tuberculous animals; 48,000 initial cattle will have to be tuberculin-tested to produce this number of reactors. This means that 800 carloads of reactors will be shipped to the stockyards at Buffalo and New York during November and December. This makes business for the railroads, for the stockyards, for the live stock commission merchants, for the slaughterers and for the by-product manufacturers. This also increases labor among butchers and keeps many veterinarians busy.

I am glad that Dr. Wight has discussed area work. This is a hobby with me. I have talked area work for the past twelve years.

While I advocate no decrease in appropriations for disease control work, I do advocate that the money appropriated by Congress, by the various state legislatures and by county boards of supervisors, should be spent in an economical manner and not one dollar wasted. This can be done by confining our work to area work, eliminating unnecessary miles of travel on the part of the veterinarians and appraisers. A saving will be made also on the disinfection of premises, all of which reacts to the benefit of the cattle-owner. If we use our county and state funds in an economical manner, we shall retain the respect and confidence of those making the appropriations and they will stay with us until tuberculosis has been eradicated.

In the eradication of tuberculosis by the area method we not only eradicate tuberculosis from the various herds but we eradicate the disease from the entire district; and this eliminates at once the objection that comes from the owner of a clean herd in having an infected herd right next door or in close proximity.
In 1899, the first move was made to complete the Panama Canal project abandoned by the French. In April, 1904, Congress appropriated $10,000,000 to purchase certain rights from the French government and, on May 4, actual work started on the gigantic project.

The French failed in their undertaking because they did not take into consideration the important factor of sanitation and disease. When they quit they left plenty of machinery and a graveyard with many tombstones.

The task of sanitation by the United States was assigned to Col. W. C. Gorgas. He visited the Isthmus in 1904 and found disease, also the necessity of destroying the mosquito and its breeding places. He created a plan and carried it out, killing the larvae by cutting down brush and burning the grass, and by spraying all water surfaces with a larvicide. He put this in effect not only in a village where some soldiers were stationed but in the entire zone. When the French were engaged in the zone the death rate was 240 per 1000. Col. Gorgas reduced it to 49 per 1000 and finally to 21 per 1000, where it has remained. The death rate among the employes was reduced to 7.5 per 1000.

We should all benefit from what Col. Gorgas accomplished and bend all our energies to completing bovine tuberculosis eradication under the area plan, getting the work done as rapidly as possible but in a thorough manner, and thereby be in a position to take up in a more active way the control and eradication of other diseases now under consideration by the Association, namely, Bang's disease, mastitis, avian tuberculosis, Johne's disease, pullorum disease, hog cholera, parasitic diseases, etc.

Another important item discussed by Dr. Wight is the retesting of accredited herds. In New York State we soon found out that the plan of expecting cattle-owners to pay the veterinarian for the retesting of their accredited herds was not successful. During the past two years, the legislature has appropriated funds to pay accredited veterinarians for the retesting of accredited herds at state expense. These accredited veterinarians have been given special instructions relative to the application of the test, the preparation of reports, etc. They work under blanket authorizations issued by our Department and each one is assigned to a zone made up of one or more townships. They are compensated at the rate of $2.50 for each herd tested, plus 30 cents for each animal in the herd. Tuberculin, tags and reports are furnished free to the veterinarians. From January 1 to October 1, 1931, approximately 300 accredited veterinarians retested 56,082 accredited herds, made up of 625,072 cattle. Percentage of reactors, .57; cost of testing, per head, 52 cents.

While our minds are still on area work I wish to congratulate the federal Bureau of Animal Industry, the live stock sanitary officials of the states of North Carolina, Maine, Michigan, Indiana, Minnesota, Ohio, North Dakota, Idaho and Iowa, and the other states for the wonderful progress they have made.

Dr. Wight has pointed out the progress made in the reduction of tuberculosis in the bovine family. It might be well to point out, at this time, the reduction of tuberculosis in the human. Attention is called to an article by Dr. W. A. Evans, Health Editor, Chicago Tribune, and well known by the members of this Association. The article is entitled, "Improvements in Control of Consumption," the data being collected, I believe, by one Dr. Frederick L. Hoffman. The statement reads as follows:

"We are doing very well in wiping out consumption. According to Dr. Frederick L. Hoffman the average death rate from consumption in fifty-nine American cities in 1930 was only thirty-eight per cent as high as it was in 1910. In these cities there live more than thirty-two million people. If the same rate of improvement could only continue there are persons living who would see consumption as rare as typhoid now is and that disease is not much more than a memory.

"In 1910 the average rate for these cities was about 175, and it is now about sixty-six. The far better records of some of the smaller places give additional hope. For instance, instead of sixty-six in 1930, the record of Lakewood, O., was only 8.4; that of Cedar Rapids, Ia., 8.9; of Williamsport, Pa., 9.4; and of Oak Park, Ill., 10.9. Nineteen smaller cities had records of less than twenty. These places have less consumption now than Chicago had typhoid fever twenty years ago."
"In Hoffman's report on 147 cities there were several Canadian cities with rates as low as those that prevailed in the good cities in the states. The honor roll of countries is led by the Union of South Africa, with New Zealand second, and Australia third. The United States is fifth and Canada sixth. "The consumption problem is decreasing so rapidly that it becomes possible to analyze it to advantage, as was not possible when the disease overwhelmed us. Negroes are still far too susceptible. But they are becoming less so, and Africa is showing the possibilities of meeting the difficulties of consumption among Negroes. The decline in the prevalence of tuberculosis is greatest among children under five years of age. Pasteurization and tuberculin-testing of cows are bearing fruit. Women are less subject than men to the ravages of the disease, but between ages ten and twenty-nine women are more in danger than men. Occupation has much to do with the prevalence of consumption. Miners pay a heavy penalty. This does not apply to coal-miners. These have the lowest consumption rate found amongst underground workers. The five occupations with the highest rates are: Miners (other than coal-miners), pottery-workers, stone-cutters, waiters and hotel servants, and cutters and grinders. The lowest are: City firemen, stationary engineers and firemen, roofers, railway engineers and trainmen, and coal-miners."

In New York State, in the year 1918, when tuberculosis eradication was being inaugurated and at least 35 per cent of all the cattle in the State, 2,000,000 in number, were tuberculous, the deaths among humans from tuberculosis outside of New York City were 6,875. The figures for the year 1930 show 3,878. The deaths from tuberculosis in New York City in 1918 were 10,098; in the year 1930, 5,089. I believe every one will agree that tuberculosis eradication should not be delayed in any manner.

In closing I have one suggestion to make and that is that the members of the Committee on Tuberculosis ask this Association to pass a resolution urging that all states confine their testing, as far as possible, to area testing; that the work of tuberculosis eradication be done as rapidly as possible in an economical manner; and that, if this resolution is passed, a copy be sent by the secretary of the Association to the commissioner and live stock sanitary officials in each state.

A STUDY OF SO-CALLED SKIN-LESION AND NO-VISIBLE-LESION TUBERCULIN-REACTING CATTLE

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For several years, it has been noted that a large percentage of the tuberculin-reacting cattle killed in Utah fail, on routine postmortem examination, to show any gross lesions, or the lesions found are confined to the skin or to the subcutaneous tissues. The former have come to be called "no-lesion" reactors, while the latter are usually referred to as cases of skin tuberculosis. Table I gives the figures for Utah during the past few years and shows the high incidence of the groups mentioned.
It will be seen, from table I, that in the five-year period, 59.7 per cent of the lesions were confined to the skin, 32.8 per cent of the animals gave no gross evidence of lesions and 7.6 per cent had systemic lesions. Of the 3,313 animals killed as reactors, 3,020 represent the ones which concern us in this study. We are aware that a large proportion of the so-called "no-lesion" reactors probably would show lesions if a detailed laboratory examination could be made. Without this examination it is impossible to estimate the proportion of the 1,090 "no-lesion" reactors that would show skin or systemic lesions. It seems fair, however, to conclude that at least 75 per cent of the total number of animals killed would have lesions confined to the skin.

The project of tuberculosis eradication in cattle, undertaken jointly by the United States Bureau of Animal Industry and

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<th>YEAR</th>
<th>NUMBER TESTED</th>
<th>REACTORS SLAUGHTERED</th>
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<td></td>
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<td>84,620</td>
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<td>72,603</td>
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*Data furnished by Dr. F. E. Murray, U. S. Bureau of Animal Industry. The term, "skin lesion," in the table, as well as in the paper as a whole, refers to skin and subcutaneous lesions.
†In 1930, 84,620 head were tested, of which 622 reacted. Of the 622 reactors, 51 showed systemic lesions.
reactions to tuberculin in these cases are often not typical and some go so far as to claim that they can sometimes identify a skin-lesion case by the nature of the tuberculin reaction. Because of these facts and also because attempts to demonstrate the presence of typical organisms of bovine tuberculosis in the skin lesions have been almost uniformly unsuccessful, there has arisen a doubt that these are really cases of bovine tuberculosis.

Some of these facts were called to our attention in 1922, by the late Dr. Wm. A. Stephenson, at that time Utah State Veterinarian, and, since that time, we have attempted, at irregular intervals, to obtain some information on this vexing problem.

As early as 1916, Traum reported six cases of lymphangitis in cattle in California, which, according to his description, showed typical skin lesions. In the earlier attempts he was unsuccessful in cultivating any acid-fast organisms, although he demonstrated their presence in the lesions. In 1919, he was successful in obtaining a culture of an acid-fast organism from a similar case. On account of his failure to produce lesions in guinea pigs and rabbits he was led to consider the organisms as not being true mammalian tubercle bacilli.

In 1922, J. G. Olsen, working in our laboratory, obtained a culture of an acid-fast organism from a typical skin lesion with which we were unable to obtain successful animal inoculations. Cultures submitted to Dr. Day failed also in his hands to produce lesions in laboratory animals.

Traum, again in 1923, under the title, "Lymphangitis in Cattle, Caused by an Acid-fast Organism," reported the demonstration of acid-fast organisms in lesions in two out of three cows which gave positive intradermal tuberculin reactions and which also had well-developed subcutaneous nodules. Guinea pigs which he inoculated from these lesions failed to develop tuberculosis, even though some were not killed until fourteen weeks after inoculation. From these lesions he succeeded in cultivating, on cooked-blood-agar, a pleomorphic Gram-positive organism which did not react uniformly to the acid-fast stain. Guinea pigs and rabbits, inoculated subcutaneously, developed subcutaneous abscesses at the point of inoculation, which yielded organisms similar to those inoculated. A calf developed a similar lesion sixteen days after inoculation. Although he made many attempts, Traum was unable to obtain this organism from any other case and, on this account, he "hesitated definitely to incriminate it as the bacterial cause in the disease described."
He concluded that the organism did not belong to the mammalian type of tubercle bacilli.

In 1921, Day\(^4\) reported the examination of eighty-five tuberculin-reacting cattle in Star Valley, Wyoming. At autopsy he found skin lesions, either alone, or in combination with other lesions, in forty-seven (53.3 per cent) of them.

In 1928, Day\(^5\) gave the results of his extensive study of skin lesions in tuberculin-reacting cattle. It was his opinion that "accumulations of manure on the skin produce irritation and inflammation which lead to the formation of fissures in the skin through which tubercle bacilli gain entrance from infected manure." He reported negative results in attempts to infect four calves and four pigs by means of inoculations direct from skin lesions from four cattle. Later, six other calves were inoculated with material from different skin lesions. One of the calves developed a positive tuberculin reaction and at autopsy a tuberculous anterior mediastinal lymph-node was found. The cow which furnished the skin lesion for this inoculation showed, in addition, an abscess on her side and an iliac lymph-node which contained pus. Material from the infected calf inoculated into seven guinea pigs and one rabbit produced typical lesions of tuberculosis in all of them, killing them in from fifty to seventy days after inoculation. Day gives as his opinion that "all of the skin lesions found in cattle that give a positive reaction to the tuberculin test, and in which acid-fast bacilli are found, are tuberculosis lesions caused by Mycobacterium tuberculosis which has gained entrance in the skin through abrasions, because we know of no other acid-fast organism capable of producing such skin lesions, and at the same time giving a positive reaction to tuberculin." He reported negative results in approximately one hundred attempts to obtain, from skin lesions, cultures on Petroff's medium.

Calmette\(^6\) said that tuberculosis of the skin in cattle is regarded as very rare, and suggested that inasmuch as the skin and subcutis are unfavorable locations for the tubercle bacillus to develop, the virulence is markedly decreased.

Beach and Hastings\(^7\) reported unsuccessful attempts to obtain cultures and animal inoculations from fifty-four skin lesions from as many tuberculin-reacting cattle.

Carpenter and Goldberg\(^8\) failed in every attempt to infect guinea pigs, rabbits and chickens with extracts from bovine skin lesions. They did succeed in producing nodular skin lesions by
the inoculation of a small amount of a culture of the bovine tubercle bacillus into the skin of cattle.

After making a comparative study of the histological material from bovine skin lesions and cases of lupus vulgaris in man, Carpenter and Goldberg concluded that "the cutaneous lesions described in cattle are identical with skin tuberculosis (lupus vulgaris) in man."

Crawford suggested that several factors seemed to indicate other acid-fast organisms than the bovine tubercle bacillus as causative organisms in "skin-lesion" tuberculosis. He mentioned the following factors:

1. Reactors with skin lesions only are at times found in herds in which there is no history of tuberculosis.
2. Acid-fast organisms usually present in skin lesions do not grow on culture media favorable to the growth of mammalian tubercle bacilli, a condition which was encountered in the cultivation of the acid-fast organisms of Johne's disease and leprosy.
3. The reaction to mammalian tuberculin is often atypical, which suggests a group, rather than a specific, mammalian tubercle bacillus sensitization.
4. This condition is more prevalent in some localities than others.

In this article, Crawford reported that three acid-fast organisms, the B. phlei, the mist bacillus, and the "hog skin" bacillus, produced, in guinea pigs, fairly well marked reactions to mammalian tuberculin.

In a later study, Crawford used the above three organisms, together with one strain each of avian, human and bovine tubercle bacilli, to determine if any of the organisms in question were capable of producing lesions in cattle similar to those commonly described as "skin lesions." All of the organisms, with the exception of the bovine tubercle bacilli, failed to produce lesions. The inoculation of the abraded skin with bovine tubercle bacilli of the one bovine animal so treated, produced only internal lesions of tuberculosis. All attempts to grow acid-fast organisms on artificial media, or to cause lesions by subinoculations of sections of skin lesions into guinea pigs, rabbits, mice, rats, chickens and cattle failed.

Elder and Lee produced local lesions in three cows by subcutaneous injection of avian tubercle bacilli, and these animals reacted to mammalian tuberculin when injected intradermally. The Royal British Commission had previously produced local lesions in cattle and hogs by subcutaneous injection of avian tubercle bacilli.

Mitchell, after making approximately 100 unsuccessful attempts to infect laboratory animals from subcutaneous lesions,
finally succeeded in infecting a rabbit which died in 131 days after intraperitoneal inoculation. Subsequently other animals inoculated with this strain died and showed, at autopsy, tuberculous lesions fairly widely distributed throughout the body, as was the case also with the first rabbit infected. Cultures of this strain also were obtained and these produced, on inoculation into a calf, a lesion which had the appearance of a skin lesion. Many attempts to cultivate an acid-fast organism directly from skin lesions were unsuccessful, although he described an acid-fast pleomorphic organism in the lesions.

Van Es\textsuperscript{13} fed tuberculosis-free hogs a considerable amount of bovine skin lesions. Some months later, these hogs failed to react to both avian and mammalian tuberculins and no tuberculous lesions could be found at autopsy.

Although forty different sets of bovine skin lesions, most of which were shown to contain acid-fast bacilli, were subjected to typing experiments by Van Es, all the typing experiments yielded negative results. Van Es concluded that “apparently no living tubercle bacilli were present.”

Traum\textsuperscript{14} reported, in 1928, a large number (104) of animal inoculation tests from 38 different cows with skin lesions only. One guinea pig obtained a Preisz-Nocard infection and a rabbit developed a nodule in the lung which yielded a large number of acid-fast organisms. Traum reported that cultures appeared to be a rapidly growing mammalian type in the first generation. Traum compared the findings in leprosy with those in cattle skin-lesion cases in that the transmission of leprosy to animals experimentally has failed, and the artificial cultivation of lepra bacilli has been successful in only very few instances.

In discussing Traum’s paper, Watson\textsuperscript{15} expressed the opinion that the organisms isolated from skin lesions and from no-lesion reactors are tubercle bacilli and that “it is really a question of type.” He reported the successful inoculation of guinea pigs from bovine skin lesions and from no-lesion cattle.

Hastings, Beach and Thompson\textsuperscript{16} isolated a number of cultures from the tissues of no-lesion, tuberculin-reacting cattle. These cultures which produced no lesions in cattle, guinea pigs, rabbits and fowls, when injected into tuberculosis-free cattle, caused a sensitization to tuberculin. These workers state that “from the evidence available it seems safe to conclude that all or nearly all skin lesions are due to other than tubercle bacilli,” and that
"some other of the mycobacteria than tubercle bacilli may invade the tissue and sensitize to tuberculin."

Schalk obtained sensitization to avian tuberculin in cattle which were exposed in a barn-yard occupied by positive-reacting tuberculous chickens. He also sensitized cattle to the avian tuberculin by instillation of avian virus into the conjunctival sac and rubbing it into the scarified skin. He reported that these cattle did not react to mammalian tuberculin, but he did not state the method of testing in these cases, whether subcutaneous, intradermal or ophthalmic.

Van Es quoted Plum, of Denmark, on this question as follows:

The subcutaneously provoked reactions appear to be more specific than intracutaneous ones, inasmuch as cattle infected with various acid-fast bacilli are to a higher degree inclined to react to a heterologous tuberculin intradermically injected.

Another example of group tuberculin reactions is given by Hagan and Ziessig, who demonstrated that avian tuberculin apparently gave results identical with those obtained with johnin when applied to cattle and other animals naturally or artificially infected with the organism of Johne's disease.

It has been shown by several workers that a water-soluble protein is apparently one of the common fractions of the acid-fast family and that this is the substance in tuberculin which is responsible for the skin reaction. Funk and Huntoon obtained skin reactions in about 95 per cent of their tuberculous patients with the protein fraction of the timothy grass bacillus.

Walker gave the results of 2,363 cultures from 194 cases of human leprosy and concluded that acid-sensitive and acid-fast coccoid, diphtheroid and actinomyecoid organisms, cultivated repeatedly by himself and others, are different stages in the life cycle of the same organism. He claimed that the Hansen bacterium in leprous lesions is probably the tissue stage of this organism and that this organism belongs to the genus Actinomyces. He isolated a similar organism from the soil and he suggested the probability that leprosy is primarily an infection from the soil through wounds.

Walker and Sweeney pointed out the similarity in the bacteriological findings in rat and human leprosy and concluded that "rat leprosy has the same etiology and endemiology as human leprosy; that it is an actinomyces infection from the soil."

Muir objected to Walker's conclusions with respect to the facts that the pleomorphic diphtheroids are identical with the Hansen bacillus and the bacillus of Stephansky, and that leprosy
is usually a wound infection. His objections were based mainly on what he claimed to be a lack of experimental proof.

Sweaney,24 Kahn25 and others pointed out the presence of a variety of forms and granules in a probable developmental cycle of the tubercle bacillus. Kahn mentioned ovoid units, diplococcoid forms, dust-fine particles, tiny rods and mature bacilli in the cycle.

Eberson26 called attention to the marked pleomorphism of the general group of the diphtheroids.

The Preisz-Nocard bacillus (Corynebacterium ovis) has been identified by several workers as the bacterial cause of lymphangitis in different animals. It was first isolated by Preisz and Guniaird27 from necrotic material from abscess-like areas in the kidneys of sheep. In the United States, Norgaard and Mohler28 reported it in sheep; Lienaux,29 in cattle; Hall and Fisher,30 in horses and in a subparotid abscess in a five-month-old calf; Hall and Stone,31 in sheep; Sheather32 in abscess formation with lymph-gland involvement in four adult cattle; and, finally, Traum,31 in 1923, reported the finding of this organism in two cases and, later, in another case14 of a large series of so-called skin lesions of cattle. Traum noticed the resemblance of this infection to what he called the acid-fast lymphangitis in cattle but differentiated between them by the uniform results obtained by guinea-pig inoculation and cultural reactions in the Preisz-Nocard infections. He did not consider this organism as the cause of the ordinary skin lesions of cattle.

Hall recently38 corrected the misunderstanding obtained by some authors as to the acid-fastness of the Preisz-Nocard bacillus. He stated that the organism is not acid-fast and that he is convinced that it should be placed in the corynebacterium group.

Several workers have noted the presence of both non-acid-fast and acid-fast stages in the same organism. Sweaney,34 in 1928, reported the occurrence of non-acid-fast forms of tubercle bacilli in patients dying of tuberculosis. Walker21 and, later, Walker and Sweeney22 called attention to the acid-sensitive and acid-fast stages of organisms associated with human and rat leprosy. Walker described the transformation from acid-sensitive to acid-fast states and vice versa and concluded that the changes "appear to be independent of lipoids in the culture media." Miller35 and Dreyer and Vollum36 reported the cultivation of non-acid-fast virulent strains of human tubercle bacilli. The granules of Much37 and the non-acid-fast granular forms
mentioned by Kahn\textsuperscript{25} appear to be stages in a cycle of the tubercle bacillus. Eberson\textsuperscript{26} and Sweeney\textsuperscript{38} were able to transform acid-fast tubercle bacilli into acid-sensitive forms and \textit{vice versa} by altering their environmental conditions.

On account of the fine cooperation of local members of the Bureau of Animal Industry of the U. S. Department of Agriculture and practicing veterinarians of Salt Lake City and Ogden, we have had the opportunity of studying a fairly large series of lesions within a very short time after their removal. The Utah Agricultural Experiment Station has also given us invaluable aid in conducting inoculation experiments with cows. This paper is a partial report of the results obtained in the study of lesions from the last 211 animals.

In the earlier part of our work, attention was focused entirely toward the finding and cultivating of tubercle bacilli or similar acid-fast organisms, and any other organisms encountered were looked upon as contaminating agents. As the observations continued, however, we noticed the rather constant appearance of non-acid-fast forms, so that our interest extended to all of the organisms occurring in the lesions.

More than 75 per cent of the lesions reported in this series came from animals which had given positive tuberculin reactions. Less than 25 per cent were obtained in routine examination of regular abattoir material and therefore the animals had not been tested.

Because of the fact that you are all familiar with the character of the lesions, we shall not attempt to give a detailed description of them. The specimens as they reach us consist of strips of skin and subcutaneous tissue containing the lesions undisturbed. The tissue is fresh and no preservative of any kind has been added to it. This gives us an opportunity of obtaining uncontaminated material. The lesions are mainly subcutaneous but they often involve the skin, sometimes apparently being confined entirely to the skin. About one-third give gross evidence of external connections either closed or not. It is possible that evidence could be obtained of external connections at some period of development in every case if complete microscopic examinations could be made.

Each specimen contains from one to several nodules, mainly subcutaneous, varying from pin-head size to as large as an ordinary hen's egg. There are three general types of nodules: (1) those made up of granulation tissue with no apparent necrosis,
(2) those with central necrosis without calcification and (3) those having central necrosis with calcification. In the last two types the centers usually contain a thick, semi-fluid, odorless material which usually varies from a greenish-yellow to an orange color. Often dense cords connect several nodules in chains and sections of these cords show them to contain this same necrotic material.

The lesions are opened from the under surfaces through thoroughly cauterized tissue, thus avoiding external contamination and, from the lesions, cultures and microscopic smears are made. At first the material was treated with HCl or H₂SO₄ of different strengths, then centrifugalized and the sediment cultivated. Later this procedure was abandoned because it was soon observed that pure cultures may rather consistently be obtained from untreated tissue, provided there are no external openings present. Staining of smears is carried out by the ordinary Ziehl-Neelsen method, decolorizing with 3 per cent HCl in 95 per cent alcohol, care being taken to secure thorough decolorization. Occasional Gram stains are made, using Sterling's modification.

Acid-fast organisms are found in every typical lesion from reacting cattle, varying in number from one in several fields to large numbers in a single field. These acid-fast organisms vary in morphology from coccoid and diplococcoid forms to short or long, straight and curved rods—solid or beaded, and diphtheroid forms of various sizes and shapes. The most constant acid-fast form is the solid, medium-size, straight rod about the size of a typical bovine tubercle bacillus.

All of the above-mentioned morphological forms are found also in various lesions without having retained the fuchsin stain (acid-sensitive). The most constant non-acid-fast forms are the diplococcoid, which occur usually in small numbers in nearly every typical lesion from reacting cattle.

For some time we naturally concluded that these different morphological forms represented various organisms, but our cultures soon began to give evidence of the presence of very few—perhaps only one—species which is markedly pleomorphic and which has the property of becoming either acid-fast or acid-sensitive.

All of the cultures obtained grow under aerobic conditions and, with the exception of one culture of the bovine tubercle bacillus, they appear to develop equally well at room temperature as
well as at temperatures up to 37° C. They grow on various kinds of rich media. The one we have come to use most is a modified Petroff’s medium. This consists of 550 cc of lean-beef infusion; 500 cc of whole egg; and less than 1:100,000 gentian violet. No glycerin is used. This gives a desirable soft medium. Apparently the only advantage of the gentian violet is to give a better background for the early identification of colonies. In case cultures are to stand for some time the tubes are sealed with paraffin. Cultures are not obtained from the necrotic material. Successful results are secured only when scrapings are made of the wall of the abscess or when pieces of the wall are ground in a mortar.

Our cultures, up to the present time, seem to fall into three fairly definite groups on the modified Petroff’s medium:

1. Cream-colored colonies appearing after about eight weeks. This type developed from the lesions of only one animal and proved to be a typical bovine tubercle bacillus, killing guinea pigs in about 18 days with a generalized tuberculosis. The cow from which these cultures were obtained had internal as well as skin lesions. This type is not described further.

2. Dry, rough, friable colonies varying from non-chromogenic to cream color, yellow, red, and dark brown. The chromogenic variations seem to be determined largely by the character of the medium, especially with respect to the amount of dye present. Growth appears in 24 to 48 hours. At first most of the organisms are acid-sensitive, but in some of the cultures a few may have acid-fast properties, the degree of acid-fastness and the numbers concerned increasing as the cultures become older. On inspissated egg in a few weeks practically all of the organisms retain the fuchsin stain. A few of the strains of this group even after months of cultivation, have failed to become acid-fast.

3. Deep orange, smooth, moist, spreading colonies; growth appearing from lesions, usually in about seven weeks, subcultures appearing earlier. From 90 to 100 per cent of the organisms in all cultures are acid-fast from the beginning and remain so indefinitely.

A majority of the cultures belong to group 2.

Cultures have been made from the kidneys of several tuberculin-reacting cattle, with or without visible lesions, and cultures apparently identical with those of group 2 have been recovered in every case.

The morphology of the organisms is as follows:

**Group 2:** On modified Petroff’s medium these are, from the beginning, diphtheroid organisms with a variable number of deep-staining granules from two to six. Later, as they become acid-fast, they tend to develop involution forms, becoming clubbed at the ends or swollen at the centers. There are always fairly large numbers of straight acid-fast rods. Some of the short diphtheroids appear to be diplococcoids.

When this form is grown in litmus milk, inspissated egg-yolk, or lactose broth, acid-fastness increases more rapidly and many coccoïd, diplo-coccoid and streptococcoid forms appear. These forms appear larger than they do on Petroff’s medium. They are Gram-positive.
**Group 3**: On Petroff’s medium they vary from large rods, either solid or beaded, to short, solid forms or diphtheroids. They are Gram-positive. Fermentation reactions of group 2 in the common sugars are variable. All of Walker’s diphtheroid groups are represented and, in addition, we have at least one other definite group. Group 3 has given no fermentation reaction.

In our cultures from three of the subcutaneous lesions, we obtained what we think are larvae of ox warbles. This finding is very significant in view of the possibility of infection being carried into the subcutaneous tissues by these larvae.

Cultures made from the soil and barnyard manure from various places yielded, in a majority of cases, acid-fast organisms morphologically identical with our group-2 strains. Direct examinations also give organisms similar to group 3.

Because of the close similarity morphologically between the organisms we have isolated from skin lesions and from the organs of tuberculin-reacting cattle and the Preisz-Nocard bacillus of suppurative lymphadenitis of sheep, we have compared them from the standpoint of cultural characteristics.

Two strains (95 and 809) were obtained from the American Type Culture collection and several cultures were obtained by us from typical lesions of suppurative lymphadenitis from old ewes. Strains 95 and 809 produce no apparent effect in guinea pigs, probably because of attenuation through culturing for a long time on artificial media. Cultures obtained by us from sheep produce, in very small doses, the typical suppurative orchitis in guinea pigs, and also generalized pseudo-tuberculosis.

There is one marked difference between our Preisz-Nocard cultures and strains 95 and 809. The American Type Culture strains rapidly hemolyze rabbit and human corpuscles, while our cultures from sheep do not. Our group-2 strains from cattle do not hemolyze the red corpuscles from rabbits and human beings, agreeing in this respect with our Preisz-Nocard organisms from sheep lesions.

For a while it appeared that the facultative acid-fastness of our cultures from the skin lesions of cows separated them definitely from the Preisz-Nocard organism. But continued cultivation of American Type Culture strain 809 on inspissated egg-yolk and in milk soon results in the production of fairly large numbers of acid-fast organisms. This facultative acid-fast property is shown also by our Preisz-Nocard organisms from sheep. In the case of strain 809, we obtained cultures from the American Type Culture
collection on two separate occasions and used special precautions to prevent contaminations.

**ANIMAL INOCULATIONS**

We have endeavored by means of animal inoculations to obtain some information as to the place of these acid-fast organisms in the bacterial groups. The following animals have been used: guinea pigs, rabbits, white mice, wild rats (two species), white rats, sheep and cows. A brief summary of the results obtained to date will be given.

Guinea pigs inoculated with material direct from the lesions have thus far yielded no results. Seventy-three have been inoculated with our groups 2 and 3 in about equal numbers for each group. Most of these animals have died in periods ranging from 14 to 235 days. In every case the inguinal lymph-nodes are moderately enlarged and injected and the organisms are recovered in culture from these nodes. The adrenals are always moderately to deeply injected. The organisms are also recovered in culture from the kidneys and heart-blood of animals dying within two months after inoculation.

Whenever group 3 is used for subcutaneous inoculation, there is practically always produced a firm hard nodule or a less firm abscess at the point of injection. In a few cases this is also true of group two. Organisms of the respective groups are recovered in culture from these lesions. If intraperitoneal injection is made, usually in or under the peritoneum, there is a small abscess where the needle had passed through. Five of the male animals had small to fairly large abscesses in the testicles or the enveloping membranes. Organisms of the group used in each case are recovered from these lesions. In three cases a fairly typical pseudotuberculosis was produced in the liver, on the peritoneum and in the enveloping membranes of the testicles.

Whenever group 2 organisms are used in female guinea pigs, and these are later allowed to become pregnant, invariably abortion takes place and the animals die. This group also produces severe diarrhea in a large proportion of the animals injected. Positive reactions are obtained with mammalian tuberculin in a large percentage of the guinea pigs—10 out of 14 tested, 8 from group 3 and 2 from group 2.

Although most of the guinea pigs died, apparently as the result of the inoculations, in only one case were there produced typical lesions of tuberculosis. This was the case of the one
typical bovine tubercle bacillus isolated from skin lesions of a
cow that also had internal lesions.

Only a few rabbits have been inoculated with our groups 2
and 3 and in every case the animals have died in two or three
weeks. At autopsy they showed no gross lesions.

Chickens have failed to show any gross changes. Tested
sixty days after inoculation, with avian tuberculin, they gave
no reaction. Mice have not responded to the inoculation with
any gross manifestations. Experiments with sheep have not
continued long enough to justify the recording of results. Four
male rats out of twelve died from four to six months after ino-
culation. The principal postmortem findings consisted of firm
nodules at the point of injection. A marked alopecia developed
in about sixty days after inoculation, but this later disappeared.

Because of the generous assistance and interest of Directo-
Vincent Cardon, of the Utah Agricultural Experiment Station,
and the active cooperation of Dr. F. E. Murray, of the U. S.
Bureau of Animal Industry, and Dr. D. E. Madsen, Director
of the Animal Pathological Laboratories of the Utah Agricultural
Experiment Station, and their associates, it has been possible to
undertake the inoculation of several cows with our organisms.
This project has continued for over ninety days with the follow-
ing results to date:

Eight cows were inoculated on August 31, 1931, with various strains
and with combinations of strains. In all, 22 inoculations were made
intracutaneously, subcutaneously, in the teats, in the prescapular lymph-
odes, and by scarification into the skin. Observations on September 15,
1931, showed twelve lesions in or under the skin, varying from hard
nodules about 0.5 cm. to 5 or 6 cm. in diameter. Some of the larger ones
gave evidence on pressure of containing a fluid. One was easily broken
and yielded a thick pus which contained large numbers of acid-fast rods.

October 16, 1931, four of the same
cows were reinoculated with the same
strain or strains in each case. At that time five of the twelve original
lesions remained, while seven had disappeared, as far as could be deter-
mined by gross observations.

On September 30, 1931, four of the cows were given an intradermal
tuberculin test and one of the four gave a slightly suspicious reaction.
None of the other three reacted. November 24, 1931, seven of the cows
were given an intradermal tuberculin test with the following results, as
determined on November 27, 1931: Two cows that had received injec-
tions of group-3 organism gave suspicious reactions, recorded as X 1 1/2
to X 2, and X 2, respectively, the thickening being diffuse in both cases.
The five other cows failed to react. At the same time a concentrated
glycerin broth culture of a group-3 organism was injected intradermally
into the seven cows with no reaction in any case.

Observations (on November 24) of the results of the inoculations showed
that in the six remaining cows which have received one or two injections
of our organism, eight lesions persist. These are all in the four animals
that received group-3 organisms alone, or in combination with group 2.
Some of these lesions resemble very closely in appearance typical spontaneous so-called skin lesions. The two remaining cows that received group 2 organisms alone, gave no evidence of lesions of any kind.

One of the cows inoculated with a group-2 strain, after becoming markedly emaciated and too weak to stand, was killed on November 10, 1931. Autopsy showed multiple lesions in the liver, heart-muscle and kidneys, varying from pin-head size to 2 cm. in diameter. The centers of these lesions contained greenish-yellow, odorless, thick, necrotic material, microscopic smears of which show a few diplococcoid or diphtheroid non-acid-fast organisms. Cultures yielded an organism agreeing in every respect with the one inoculated. The parenchyma of the kidneys of this animal contained many small petechial hemorrhages and the left stifle joint was markedly swollen. Intradermal injection of tuberculin in this animal four days before she was killed failed to give a reaction.

A second cow inoculated with a combination of groups 2 and 3 developed a swollen and very tender right knee joint about November 6, 1931. She had a very severe diarrhea for some time and this has persisted.

On November 14, 1931, one cow was inoculated subcutaneously with large doses and a second cow was inoculated intracutaneously with small doses of Preisz-Nocard organisms, including a recently isolated virulent and the two non-virulent strains from the American Type Culture collection. At the point of inoculation of the virulent strain in the first cow, a large abscess formed and ruptured on November 22, 1931. In the second animal, two firm, marble-sized abscesses appeared at the points of inoculation of the virulent strain. These were painful on pressure. The latter cow had received inoculations of group-2 organisms on August 31 and October 14. Following the October injection, rice-sized hard nodules had persisted in a test which had received superficial skin injections. On November 23, this animal died with what appeared to be a "dry bloat," but autopsy revealed multiple abscesses in the liver, containing a thick necrotic material. Microscopic smears of this showed many non-acid-fast diplococcoid organisms. There was also a marked peri-splenitis. The calyx of one of the kidneys also contained pus.

Skin lesions have been removed surgically from several cows to obtain cultures and to determine the effect on the tuberculin reaction. The following is a typical protocol:

December, 1929, an intradermal tuberculin test was negative. September, 1930, an intradermal tuberculin test was positive, but no lesions were demonstrable. April, 1931, a second intracutaneous test was positive and extensive skin lesions were present over the right prescapular area. July, 1931, these lesions were removed surgically and pure cultures of group-2 organisms were obtained. July 1, 1931, an intradermal tuberculin test was negative. September 25, 1931, a second negative tuberculin test was obtained.

In all of the few cases which we have observed, the complete removal of skin lesions has resulted in early negative tuberculin reactions.

Several wild deer have recently been observed with skin lesions indistinguishable grossly from the skin lesions of cattle and also with internal lesions resembling the Preisz-Nocard infections of sheep. This is interesting because of the close contact these animals have with sheep. We have had no opportunity to make a study of the organisms of these lesions.
Several wild rats obtained from slaughter-houses have been examined for evidence of rat leprosy. So far no indications have been found of this disease.

Cows with typical skin lesions are being held for observation as to the later effect of the lesions on the animals. A study of the immunity reactions in these animals is to be undertaken.

A study has been made of the histological pathology of the lesions mentioned in this paper. This includes various types and stages in the skin lesions of cattle as well as the lesions produced by the Preisz-Nocard bacillus in sheep and the experimental lesions produced by our group-2 and -3 organisms. This study is too extensive to report at this time, but we believe we are justified in stating briefly some of the findings.

The Preisz-Nocard infection in sheep produces a lesion which consists of a central necrosis surrounded by an exudate consisting of lymphocytes, plasma cells, leucocytes, and a few new connective tissue cells. There is very little stimulation of endothelioocytes and no giant cells are present. We are perhaps safe in referring to these as subacute or subchronic lesions.

All of the available experimental lesions produced by us with our organisms in guinea pigs, rats and cows appear identical with the Preisz-Nocard lesions. These have consisted entirely of fairly early skin and testicular lesions in guinea pigs, skin lesions in rats, and systemic lesions in two cows. No chronic lesions have been available up to the present. We hope to obtain skin lesions in various stages in our cows as time progresses.

The histological structure of the spontaneous skin lesions of cows varies markedly with the age of the lesions. The earliest lesions that have been available from tuberculin-reacting cattle are apparently chronic, as indicated by the amount of connective tissue present. And still these give no evidence of changes which are usually considered to be characteristic of tuberculous tissue. The outstanding changes consist of a marked perivascular infiltration of plasma cells and lymphocytes, high vascularity, and a marked sclerosis of the arterioles. There are no giant cells, and hyperplasia of endothelioocytes is not prominent. In studying these tissues one sees very little, if any, resemblance to ordinary tuberculous tissue. As the lesions become more chronic giant cells appear and endothelial hyperplasia becomes a prominent part of the picture. It should be remembered that these later changes are not absolutely specific for tuberculosis, but rather a reaction to stimulation by certain substances which may
be common to the acid-fast group. Ray and Shipman\textsuperscript{40} showed that defatted tubercle bacilli and the lipins of tubercle, grass and colon bacilli may each induce tubercle formation. In the older skin lesions of cattle, necrosis is very prominent, but this seems to be true also of some of the fairly early lesions, especially those which seem to be secondary to a primary focus. We are impressed with the possibility that allergic changes have much to do in determining the character of the lesions.

**DISCUSSION AND SUMMARY**

Available evidence points to the probability of wound infection through the skin as the usual mode of entry of whatever organism or organisms produce the usual so-called skin lesions of tuberculin-reacting cattle. The lesions occur in almost all cases on the legs, shoulders and teats, where skin wounds are most frequent. The larvae of ox warbles must be considered as a possible means of carrying in the infecting organism.

The occasional recovery of true bovine tubercle bacilli from skin lesions indicates the possibility of skin lesions of the bovine tuberculosis type. In this study only one out of 211 cases appears typical of this group. Could this be the explanation of the rather rarely successful animal inoculations of Day, Watson, Mitchell and others?

Definite determination of the organisms responsible for the large majority of the lesions is still to be accomplished. We believe that this study has given us a considerable amount of evidence which indicates some organism or organisms other than *Mycobacterium tuberculosis* as the cause of these lesions.

Whenever careful search is made of microscopic smears taken from skin lesions of tuberculin-reacting cattle and stained by the Ziehl-Neelsen method, it is possible to find acid-fast and usually also non-acid-fast organisms of different shapes and sizes. By careful cultural methods we have also been able routinely to obtain organisms from these lesions, which are either acid-fast from the beginning or which develop acid-fastness on certain culture media. These cultures yield a pleomorphic, coccoid, diplococcoid, or diphtheroid organism or a solid rod. When great care is taken to cauterize surrounding tissue thoroughly before entering a closed lesion, usually pure cultures of this organism are obtained. It appears that the various forms are different stages in the life cycle of a single pleomorphic species, and because of its constant presence in these lesions, usually in
pure culture, we think it is probable that it is the cause of the lesions.

The production of lesions in guinea pigs, rats, and especially in cattle, similar in gross appearance to the original lesions, and the recovery months afterwards of the same organisms from these lesions is further evidence of causal relationship.

With the possible exception of acid-fastness, and the stimulation of a tuberculin reaction which is not always typical, these organisms do not resemble *Mycobacterium tuberculosis*. They do not produce tuberculosis in guinea pigs, rabbits, chickens or cattle, and, according to Van Es and others, probably not in hogs. The lesions produced by cultures in guinea pigs approach more nearly those produced by the Preisz-Nocard bacillus of suppurative lymphadenitis. It is significant in this connection that Traum isolated, on three different occasions, virulent Preisz-Nocard organisms from typical skin lesions. Morphologically and culturally our organism is similar to the Preisz-Nocard bacillus except for its inability to hemolyze blood, although strains of the Preisz-Nocard organism isolated by us also failed in this hemolysis. Preisz-Nocard bacilli in our cultures have developed definite acid-fast properties, thus making resemblance to our skin-lesion cultures more striking.

Preisz-Nocard infection is very common in old ewes, in Utah, occurring at times in the form of epizootics, and perhaps less common in horses, cattle and hogs. The organism has been recovered in large numbers from the droppings of apparently healthy sheep and it is therefore widely distributed in places where skin wounds of cattle can be readily contaminated. It seems possible that Preisz-Nocard or similar organisms entering in relatively small numbers in these wounds may, in the presence of the fat of the subcutaneous tissue, develop acid-fast properties and produce the typical skin lesions as well as stimulate a tuberculin hypersensitivity. While sheep are susceptible to the organisms which enter with food, cattle apparently are not. However, if excessive doses are injected subcutaneously into cattle, it seems that generalized pseudotuberculosis may be produced in them. This seems to be true of the two instances in our series.

The foregoing theory has not been completely substantiated by experimental evidence but, by patching together the available information, there is reason to think that the theory is plausible. If the Preisz-Nocard bacillus is the organism we recover from
the skin lesions, it is usually, though not always, attenuated for
guinea pigs. We already have evidence that its virulence may
be increased for these animals by repeated transfer and allow it
to take on typical reactions for the *Corynebacterium ovis*.

Bacterium pyogenes and even Johne’s bacillus must be con-
sidered as possible factors in the causation of the disease.

We have not demonstrated definitely that our group-2 and -3
organisms belong to the same species, although some evidence is
available in favor of this. The production of similar lesions in
guinea pigs and mutual tuberculin hypersensitiveness in guinea
pigs and their occurrence together in lesions are all significant.
Could these groups be smooth and rough variants of the same
organism? Or is it possible that there is a symbiosis between
these two groups and that they are different species? If the
latter is true, it is probable that the group-3 organism is an
undescribed species.

It must be kept in mind that these organisms may represent
different stages in the life-cycle of tubercle bacilli and that their
pathogenic properties might have been modified. This seems
rather unlikely to us for the reasons indicated above.

There is a striking similarity between our group-2 strains and
those described by Walker and others in connection with leprosy
and rat leprosy. In our strains we have organisms which seem
to repeat Walker’s three diphtheroid groups as judged by morpho-
logical, cultural and biological characteristics. We also have
additional fermentation groups and our group-3 organism seems
to be entirely different from any that Walker describes.

The cultural differences in the Preisz-Nocard bacilli isolated
by us, from sheep, and the American Type Culture strains
indicate the probability of different groups within this species.
The definite development of acid-fastness of this organism on
various media opens up the question as to its proper generic
classification. Should it be placed with the *Mycobacterium*, or
probably with the *Actinomyces*, group?

The organisms which we have obtained from skin lesions in
cattle may be:

(1) Contaminating saprophytes from the soil capable of pro-
ducing abscesses in the skin, or

(2) Symbiotic forms necessary in the development of the
lesions, or,

(3) The active cause of the lesions.
If they are finally shown to be the cause of the usual skin lesions of tuberculin-reacting cattle, it is probable that a method may be developed whereby the nature of the infection may be readily determined and probably make unnecessary the slaughter of large numbers of cattle. The surgical removal of lesions whenever possible seems to effect a complete cure.

If the causative organism is found to be the ordinary Preisz-Nocard bacillus or some other similar organism pathogenic to other domesticated animals than cattle, its complete eradication from cattle will of necessity be delayed until it is brought under control in these other animals. We are fearful that the number of tuberculin-sensitive cattle in some districts will not materially further decrease until this problem is solved.

ACKNOWLEDGMENTS

We wish to extend our thanks to the following who have assisted in various ways in this work: Dr. F. E. Murray, Dr. W. D. Wright and Dr. E. P. Durham, of the Bureau of Animal Industry, U. S. Department of Agriculture; Dr. A. J. Webb, meat inspector, Ogden, Utah; Dr. D. E. Madsen, Director of the Animal Pathological Laboratory, Utah Agricultural Experiment Station; and Director Vincent Cardon, of the Utah Agricultural Experiment Station.

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DISCUSSION

CHAIRMAN FAULDER: This paper will now be discussed by a scientist, a good friend of this Association, one well known to all members of this Association. I take great pleasure in presenting Dr. J. Traum, of the University of California. (Applause)

DR. TRAUM: Mr. Chairman and Gentlemen: I had the opportunity, several months ago, to listen to a somewhat similar paper by Dr. Daines, in Los Angeles. I have also had the occasion to read a rough copy of the paper presented before this meeting.

The results obtained by Dr. Daines and his co-workers are evidently, in some respects, markedly different from the findings of other workers who have devoted considerable time to the study of this condition or conditions in cattle.

In some respects, however, his findings agree with those of some of the other investigators. He reports that in only one of over 200 cases of skin lesions was he able to induce the usual picture of inoculation tuberculosis in his experiment animals. The percentage of cases of unquestionably tuberculous nature of the skin lesions has been roughly estimated by me as about five percent. I believe this figure is not too low. No matter how we feel about this matter, we must be open-minded. At present we can safely say that only a very small percentage of skin lesions, probably less than 5%, has been proven to be tuberculous. This admits that tuberculosis of the skin does occur. There is no reason why it shouldn't be so, but to claim that the other 95 or higher percent of cases must also be due to tuberculous infection, just because we find acid-fast organisms, and because a good proportion of them react to the tuberculin test, cannot be accepted in the light of present knowledge. The status of the 95 percent or more must await further developments.

The variety or varieties of organisms that Dr. Daines routinely and constantly isolated from skin lesions have not been found by other workers, and the reason for this will no doubt be explained by further studies.

I have previously reported three cases of skin lesions in which nothing but Preisz-Nocard organisms were found. I have also found an organism which, according to Daines, agrees with one of the varieties isolated by the Utah workers. The differences between the California and Utah findings are, in the first place, in California we isolated the Preisz-Nocard and the other organisms mentioned, in about one percent of the cases. Secondly, two of the Preisz-Nocard cases showed no evidence of a tuberculin reaction, and in the third Preisz-Nocard case this was not determined. Further, in our Preisz-Nocard cases, cultures appeared within forty-eight hours, and the material from the lesions induced experimental Preisz-Nocard infection in guinea pigs.

Dr. Daines has not induced a single case of guinea-pig infection following the direct inoculation of material from the lesions. I must admit that I was aware of publication of reports where a German investigator claimed that the Preisz-Nocard is at times acid-fast. Perhaps I should have given more consideration to it.

I might also state here that direct smears from my Preisz-Nocard cases failed to show any acid-fast. Acid-fast organisms might, of course, have been present without finding them in smears. I must leave the Preisz-Nocard infection with the comment that Dr. Daines doesn't definitely claim that any of his organisms is a Preisz-Nocard strain. He, nevertheless, intimates that strongly. He suggests those may be variants of our organisms. Of course that remains to be proven.

I have very little to add with regard to Dr. Daines' organisms excepting that a single extensive attempt by us to prove relationship between the other
organism that we isolated and the acid-fast organism which I isolated in 1919 and tubercle bacilli, by skin tests in guinea pigs, was entirely negative.

The acid-fast organism isolated by me in 1919 was discussed in my last report, in 1928. Some of you will recall that then I presented some observations on skin hypersensitiveness of definitely known tuberculous cattle or tuberculin reactors to a filtrate of the acid-fast that we isolated in 1919, which showed that tuberculin reactors and definitely known tuberculous cattle possess very little sensitiveness to this filtrate. I repeated this again last month with other filtrates from the same non-pathogenic acid-fast from skin lesions, upon over 100 cattle. Here tuberculin was injected in the left caudal fold and the filtrate in the right fold. About 80 per cent of these animals reacted to tuberculin, most of them with a very large reaction, and not a single reaction with the filtrate.

In concluding, it might be stated that the oneness or the plurality of the incitant of the skin lesions should be taken into consideration. There is no question that there is definitely mammalian tuberculosis of the skin, but at the present time we cannot accept that all cases, or even a large percentage, are due to mammalian tubercle bacilli.

Feldman recently described a case (I believe the only proven one) of skin lesion in which only avian tubercle bacilli were isolated. We have recently found a skin lesion which is microscopically actinomycotic in nature and culturally appears to be caused by Actinomyces bovis. Hagan advises me that he also encountered such a case.

I have already referred to Preisz-Nocard infection in approximately one per cent of our California cases. From the East no reports of such findings have as yet appeared. There will doubtless appear other forms of skin lesion. The skin lesions in Utah, from descriptions, appear, for the most part, to be similar to those in other parts of this country, but whether or not they are etiologically very similar, in the main, remains to be settled by later work.

CHAIRMAN FAULDER: The paper by Dr. Daines will now be discussed by another research worker. He is also a good friend of this Association and certainly well known to all of us. It is again a pleasure to introduce Dr. L. Enos Day, of Chicago. (Applause)

DR. DAY: Mr. Chairman and Members of the Association: I am very much interested in the work that Dr. Daines has been doing. I have known something about his work for some little time. Quite a number of years ago he was one who succeeded in getting a culture from some of these peculiar skin lesions that we find. The problem of skin lesions, to me, is one of the biggest problems that we have at the present time in connection with tuberculosis eradication. This work, of course, has two very important features, as I see it. The first feature, of course, is its scientific significance and the value that may come from it through that particular channel. The other feature, as I see it, is what are we going to do with these particular animals? If we have an animal that reacts and we know there are nodules in the skin we can palpate and find them; yet we are not justified, I don't believe, in passing that particular animal. While I know from the examination of many animals with these lesions in the skin, that they do not have any internal lesions, or not very many of them do, there is the problem, as I see it. I feel that at the present time we should keep on considering them as really tuberculous in origin.

Another thing: I know of no other organisms that we are liable to have in cattle, other than the organisms of tuberculosis, that will cause a reaction, that will sensitize the animals to tuberculin. Of course, there are, all the time, new organisms coming up. We must expect that.

There is another feature that is of great interest to me anyway, in connection with these skin lesions, and that is the change that actually takes place in the tissue. Dr. Daines, in his paper, pointed out three different cases. He called attention to one case where there was considerable granulation of tissue produced. In all of the cases that I have sectioned (and I have sectioned many) I have always found a typical tubercular change in the tissue, with the small-cell infiltration, giant-cells and necrotic points, and so forth. I have found that in practically all of the cases of skin lesions that I have ever examined. I
do not know of giant-cell formation in connection with the Preiss-Nocard infection. I have examined a number of tissues, and I have failed yet to find any giant-cells. In looking over the work of others, they do not mention it, so perhaps they are not there. I believe Dr. Daines said he didn't find any giant-cells present.

I have made many cultures, as I have reported here before, from the skin lesions, and I have never succeeded in getting an organism that I felt corresponded to the organism that I find in the skin lesions. I did at one time, in one culture, find an organism that seemed to have some acid-fast properties, but it was lost so soon that I simply discarded it and felt that it was of no further value for the work that I was doing. Perhaps if I had kept on with it, as Dr. Daines has done with some of his, I might have found something; I don't know.

As I understood Dr. Daines' paper he was unable to get any reactions from any of his experiment cows. Is that true, Doctor?

DR. DAINES: Yes, no true reaction.

DR. DAY: He spoke also of a peculiar sort of a reaction, by which some of the workers felt they could tell whether they were skin lesions or not.

Some years ago I was out in Utah, and at that time this particular question came up, and it was suggested then that definite and accurate statistics be kept concerning these particular reactions. This gentleman who had done quite a good deal of testing claimed that the reaction of the animal that had skin lesions was doughy and soft, as he explained it to me, while the reaction of those that had internal lesions was more firm. I don't know anything about what resulted from the figures. I don't know whether they did keep them. I suggested they be kept at that time because I thought if there was anything in the type of reaction, it surely would be of value if they could be separated on that type. I think they must have abandoned it. I haven't heard anything further of it.

I think this work should go on and it should be run down to a definite conclusion. I think Dr. Daines feels at this time that the work is not yet completed, and there is much work to do in order that a definite conclusion may be reached. (Applause)

CHAIRMAN FAULDER: Our next paper is entitled, "Recent Research Throws Some New Light on the Tubercle Bacillus," by Dr. A. F. Schalk. (Applause)

DR. SCHALK: Mr. President, Ladies and Gentlemen: I want to make just one or two preliminary statements previous to offering this paper. You will note that the title is "Some New Light" on the subject. It isn't going to be new to men who have been following the fate and fortune of tuberculosis and its literature, but I think it will be of material help to a large number of our members who do not have library facilities and the opportunity of keeping up with the literature on this subject.

I hesitate to offer this paper also on the grounds that I am very apt to become too scientific, but we have put forth every possible effort to eliminate the details and to offer it just as simple as we possibly could.

Dr. Schalk then read his paper. . . . (Applause)

RECENT RESEARCH THROWS SOME NEW LIGHT ON THE TUBERCLE BACILLUS

By A. F. SCHALK, Columbus, Ohio

College of Veterinary Medicine, Ohio State University

The establishment, in 1865, of positive proof that tuberculosis was an inoculable and transmissible disease, the discovery of the tubercle bacillus, in 1880, and the production of the first tubercul in for diagnostic purposes, in 1890, may be appropriately
termed the cardinal building-stones of the very extensive tuberculosis fabric that has so universally involved man, beast and fowl. From this basic knowledge there have emanated numerous other findings of a fundamental nature that has made possible the vast store of knowledge we presently possess in the science of tuberculosis. By intelligent application of the knowledge obtained and prudent practice of the principles derived from this science, mankind has succeeded in making material progress in the prevention, control and eradication of this disease as it pertains to both public health and live stock sanitation.

While the advancement made and ground gained, in our own country, in the solution of this tremendous tuberculosis problem is, in reality, a signal achievement in itself, the much larger work of complete eradication of all the tuberculosis from our herds, our flocks and our families, lies before us. As a matter of fact, the initial progress that has been made has been accomplished with comparative ease. Tuberculosis infection in both man and animals has been significantly reduced in recent years and there has been a corresponding reduction in human grief and sorrow, as well as decreased economic losses in live stock. These are truly worthy accomplishments, to say the least.

Perhaps the most organized effort being made in the way of tuberculosis studies during the recent past is that of various workers enrolled under the auspices of the National Tuberculosis Association. Under the guidance of the Research Committee of this organization, many highly qualified investigators have delved more deeply into the biological, bacteriological and chemical aspects of the tubercle bacillus than ever before in tuberculosis history. Some of these researches bid fair to result in material clarification of some of the mysteries hitherto enshrouding the relationships between bacterial parasite and host and possibly the fundamental mechanism of the disease itself.

While these new findings are not miracles in themselves, doubtless they will serve as valuable aids to the already established methods available to the clinician and sanitarian in the furtherance of their knowledge to detect the presence of tuberculosis in animal hosts more readily, to determine its course and termination more accurately and to cope with its prevention and eradication more efficiently. In brief, they mean more intimate acquaintanceship with the tuberculosis organism in its various phases and ultimately more detailed knowledge of this insidious, mysterious germ is required before we can hope
satisfactorily to explain some of the apparent idiosyncrasies of the disease.

**The Newer Bacteriological Studies**

One of the latest innovations in tuberculosis studies is that of culturing acid-fast organisms on plates in single colonies, by Petroff. This method provides the opportunity for isolating an individual bacillus from which a single colony can be propagated and specific studies made regarding same as to its form and structure as well as its physical and tinctorial properties and chromogenic characteristics. In this way the genetics of the offspring of the different bacilli can be followed in detail and the hereditary possibilities of a particular germ determined quite definitely.

Pursuing the single-cell method of culture, Petroff and his collaborators succeeded in demonstrating from among both the avian and bovine types of the organism two rather distinct genetic strains of bacilli. The one strain invariably develops into smooth, round colonies simulating moth-balls. They are composed of small, pleomorphic organisms which are faintly acid-fast and possess a high degree of virulence. These colonies are always moist and readily disintegrate into uniform suspension. These are termed "S" colonies.

The colonies produced by the other strain are dry, rough and granular in nature. Morphologically, the bacilli are long and inclined to branch. They are beaded and clump typically and are very strongly acid-fast. When put in suspension, they usually occur in flocculi, thus evidencing difficulty in uniform emulsification. This strain of organism is much less virulent than those encountered in the "S" colonies. From their rough appearance they are known as "R" colonies.

Apparently two points of practical importance to the clinician are suggested by Petroff's findings. First, be very careful and avoid over-decolorizing in the staining of tuberculosis material. If decolorizing is carried too far, many of the smaller virulent organisms that are but slightly acid-fast will be overlooked. Cooper's modification of the Ziehl-Neelsen stain, in which 10 per cent NaCl is added to the carbol fuchsin and counterstained with methyl green, appears to avoid this condition by satisfactorily fixing and contrasting all acid-fast organisms present. Secondly, not only is an estimation of the number of tubercle bacilli present often quite important, but equally valuable is the
determination of the relative percentage of different morphological forms present in a certain specimen at a given time. To illustrate, tuberculosis disease of a chronic nature and relative quiescence is invariably present in the host when the bacilli are present in clumps composed of bacilli of long, beaded, branching, angular form that are strongly acid-fast. They are more typical of what we recognize as the ideal organism as regards morphology and arrangement and when cultured by Petroff's technic they produce a predominance of the so-called "R" colonies.

Contrarily, when the acid-fast material is in the form of granules or coccobacilli and stains but faintly, the disease is usually of an active, invading or cavitating nature. When plated out according to Petroff, the "S" type of colony prevails and the organisms therefrom manifest a higher degree of virulence when inoculated into susceptible animals. The feasibility of this work seems to be satisfactorily attested by the fact that Petroff has been able to foretell quite accurately the pathologic changes that occur in the course of the disease in the host by determining the morphology of the organisms and ratio or percentage of "S" and "R" colonies obtained on culture.

Petroff's work has been confirmed by other tuberculosis investigators. Various workers inoculated both chickens and rabbits with definite numbers of "S" and "R" colony organisms. After thirty-three days or longer, they were able to isolate the respective bacilli in pure culture from various organs of the animals injected experimentally. The recovered organisms produced colonies true to the parent type in all cases with the exception that one "S" colony was found in each "R" seeding. This amounted to approximately one colony in one hundred (about 1 per cent). However small this may seem, it may prove to be of considerable significance. Does it mean a reversion or slipback of the apparently avirulent "R" type to the markedly virulent "S" type of bacillus? The condition is a very delicate and important one and it may possibly have considerable bearing on the use of supposedly avirulent strains of organisms for either preventive or curative purposes.

The Significance of Recent Chemico-Biological Studies of the Tubercle Bacillus

In the field of experimental tuberculosis the separation of the chemical constituents of the tubercle bacillus into basic groups and fractions has recently been given detailed analytical con-
sideration. Likewise, the various groups and some of their fractions have been subjected to critical tests in experiment animals by what is known as biological assay. Among others, perhaps those foremost in these chemical activities may be mentioned Drs. Long and Seibert, of Chicago, for developing a standard medium of synthetic composition for growing the organisms, and Drs. Johnson, Anderson and associates, of Yale, for detailed analytical work in isolating the various groups and fractions of the tubercle bacillus. As a result of these chemical studies, it has been found that the chief chemical constituents of the organism can be classified into three general groups or divisions: the tuberculo-lipoids, tuberculo-proteins and tuberculo-polysaccharides. From among these three groups, the lipoids have been studied most and given specific investigation by Anderson, who has further fractionated them into (1) wax, (2) glycerides and (3) phosphatides. The wax consists of more than one-half of the lipoid content and insofar as can be determined is practically inert as regards tuberculin action and reaction upon host. The same may be said of the glyceride fractions, as no reactive or disturbing influence to animal tissues has, as yet, been ascribed to them.

However, the phosphatides make up a surprisingly large part of the bacilli, as they represent more than 5 per cent of the dried organisms and the purified products possess unusually important biological properties. Dr. Anderson and co-workers have partitioned the lipoids from the human, bovine, avian and the non-pathogenic timothy acid-fast organisms and have succeeded in isolating a number of phosphatide factors.

**Biological Assay of the Phosphatide Fractions**

It was first shown by Sabin and Doan that the entire or complex phosphatides, when introduced into animal tissues, produced a sterile reaction which was indistinguishable from that seen in the disease in that there developed epithelioid cells and epithelioid or Langhans' giant cells with accompanying lymphocytic infiltrations. If the inoculated animals were allowed to live for some time, regression set in and no clinical symptoms or untoward results were shown by the subjects. Later, Sabin, Doan and Forkner showed that this epithelioid, giant-cell formation was elicited by certain liquid, saturated, fatty acids isolated from the phosphatide and other lipoid fraction by Anderson. This indicates that this reaction does not necessarily
involve the whole complex phosphatide but can result from one or more fractions thereof.

In the hands of Pinner and Doan, the salts of the phosphatide fractions have not shown antigenic properties when injected intravenously at intervals into animals, whereas the combined or complex phosphatides have proven the contrary. When the latter are injected intravenously in antigenic dosages, there develops an antibody, apparently specific, as indicated by precipitin, complement-fixation and absorption tests. Finally, Doan, working with the Anderson phosphatide fraction (designated A-3) and an antibody, demonstrated in rabbits after antigenic injections of this material have frequently given positive evidence of active tuberculosis when applied in precipitation tests with pleural effusions, joint fluid, ascites and blood serum from tuberculous animals. By this technic he has been able to show positive findings in a majority of 350 cases, as subsequently shown by x-ray, autopsy lesions and actual demonstration of the bacilli.

Tuberculo-Proteins and Polysaccharides

Evidently tuberculo-proteins are not so complex in nature or chemists have not been able to isolate them into their component parts. However, it is quite generally acknowledged that it is the protein constituent that is chiefly, if not entirely, responsible for tuberculin action. It is also the stimulus that leads to the production of the clasmatocyte cells, which in turn bring about the fragmentation or disintegration of the bacilli in the tuberculosis lesions. Aside from the foregoing qualities, protein as well as polysaccharides resident in tubercle bacilli are capable of producing hemorrhage, fever toxicity and sometimes death in injected animals. It is quite desirable that the factors responsible for protein toxicity be completely separated from those accountable for toxicity incurred by the specific polysaccharides. When this is accomplished and the accompanying reactions are more completely understood and interpreted, a purer and more specific protein product will, in all probability, be forthcoming with which we may improve our present-day tuberculin which has served us so nobly and ably in the past as a diagnostic agent for tuberculosis disease.

The Significance of the Peripheral Blood Picture

The discovery and application of the supravital staining technic of the formed elements of blood and some tissue cells
by Sabin, in 1923, has practically revolutionized experimental procedure and diagnostic methods in many fields where hematologic studies are indicated. The relevancy of this method affords a clearer and more definite differentiation of the mononuclear cells of the blood into monocytes and lymphocytes. Applying this to the peripheral blood picture in experimental tuberculosis, new knowledge has been brought out by which progression and regression of tuberculosis lesions in animal tissues can be quite accurately foretold. Accordingly, in blood studies in tuberculosis it is the monocyte-lymphocyte ratio which is significant in determining the course of this disease. This ratio is referred to as the M/L index in order that it may be of material assistance to the clinician in determining the relation of the tuberculous process and the monocyte-lymphocyte ratio to resistance and susceptibility in tuberculosis; frequent carefully conducted differential counts of the peripheral white blood cells are quite essential.

Time will not permit me, in the short period set aside for this discussion, to enumerate and explain the results of workers engaged in this phase of experimental tuberculosis. However, I think a brief résumé of some recent researches will adequately explain the value of the peripheral white blood cell picture in this disease. These findings quite generally concur with those of many other investigations. First, it is taken for granted that a relatively uniform M/L index is maintained in healthy animals that may be considered an average. These studies revealed that rabbits with a high M/L index, i.e. monocytes approaching in relative number the lymphocytes, die more quickly, and animals with a low M/L index survive for considerably longer periods than those with the average M/L index, after given a dose of culture of bovine tubercle bacilli of known virulence. If rabbits with an average M/L index are given, by special experimental procedures, a higher or lower index, their anticipated resistance to the same given dose of organisms can be altered, as shown by a shorter or longer survival period respectively.

Thus not only may the monocyte-lymphocyte ratio be an index of the state of activity of the disease in cases of tuberculosis already established, but on the basis of many experimental studies pursued thus far, it appears as though it may also be taken as a measure of susceptibility to primary infection.
Filtrability of the Tubercle Bacillus

Fontes announced to the world in 1910 that he had succeeded in demonstrating that tuberculosis is a filtrable virus. Since that time, frequent and numerous researches have been conducted on the problem, the results of which are quite controversial in nature, and leave the subject in a more or less nebulous state.

In reviewing the available literature pertaining to the question, it appears as though but scant attention has been given to the true meaning of the term "filtrable virus." In justice to established terminology, the term filtrable virus should, as an obvious misnomer, be replaced by filtrable form of the tubercle bacillus. The fact that an occasional single bacillus, by virtue of its smallness or of a faulty filter, passes a supposedly competent filter, if of no particular biological interest and certainly does not justify a claim for the existence of a filtrable virus.

The affirmative side of the question, upheld mostly by the French investigators, chiefly maintains that there is a morphologic stage in the life cycle of the organism which passes standard filters. If such morphologic stage exists or such forms of bacilli are produced under certain biological conditions, and not as a mere freak, as it were, in most instances, their presence should be ascertained under proper conditions, with a vastly greater frequency than has been the case.

In practically all of the filter work that has been done, neither Koch's postulates nor the generally accepted requirements for a filtrable virus have been fulfilled. If a fluid containing tubercle bacilli is filtered occasionally, a true typical tubercle bacillus or a special filtrable form of the organism may pass the filter. If the former condition prevails, the filtrate should produce cultures of true tubercle bacilli when seeded on appropriate media and likewise it should cause the classical disease when inoculated into susceptible animals. On the other hand, if it is a filtrable virus or a filtrable form of the bacillus that has passed the filter, that also should be demonstrated in animal passage. Neither of the foregoing conditions is experienced except in extremely rare cases. Thus, the data on the subject are far from conclusive and convincing, and it seems premature to draw such far-reaching conclusions as has been done by some workers.

It might be well to recall that Levinthal succeeded in producing progressive caseating tuberculosis in experiment animals.
with one, two and eleven individual tubercle bacilli, using the
one-cell technic for isolation.

Considerable discussion could be stimulated on the subject,
with perhaps no nearer approach to a solution. However, I
personally believe that it resolves itself into a question of filters.
We are sadly in need of more enlightenment on the phenomena
of filtration and particularly pertaining to the physico-chemical
membranes used for filtration purposes. We have available
supposedly reliable filters of different porosities, but, is it humanly
possible to make the perfect filter, with absolutely gauged
porosities, that can be entirely depended upon? With the
porosity factor variable, it is keenly hoped that the recently
advanced hypothesis is correct, in that the filter qualities of
physico-chemical membranes depend upon the electric charge
rather than porosity. Evidently, the whole problem requires
considerable more carefully controlled study.

FATE OF AVIAN TUBERCLE BACILLI IN THE LIVER OF BIRDS

Rogers,\textsuperscript{11} who has given this phase of experimental tubercu-
losis considerable study, summarizes his investigations with the
following conclusions:

1. Intravenous injections of tubercle bacilli into pigeons
result in rapid and extensive localization of the bacilli in the
liver. This localization is accompanied by the phagocytic action
of the vascular endothelium constituting the intima of the
venous sinusoids.

2. The great bulk of the bacilli thus localized are digested
within the phagocytic cells very rapidly, there being no evidence
that tubercle bacilli are more resistant to digestion than other
bacteria, notably pneumococci.

3. Except in those instances in which enormous numbers of
bacilli are injected, no morphological changes result in the liver
other than those displayed by the hemophages.

4. When large doses of virulent avian bacilli are injected,
permanent tissue changes do occur, which include the formation
of tubercles and giant cells.

EXPERIMENTAL EPIDEMIOLOGY OF TUBERCULOSIS

In an experimental study of tuberculosis in guinea pigs,
Perla\textsuperscript{12} has contributed some very interesting data on the sub-
ject. He found that normal guinea pigs confined with tubercu-
loous cage-mates acquired tuberculosis of alimentary origin,
characterized by marked involvement of the cervical and mesenteric lymph-nodes.

On the other hand, guinea pigs confined in the same room but not in the same cage acquired tuberculosis of respiratory type, characterized by extensive lesions in the lungs and the tracheobronchial lymph-nodes. The incidence of the disease increased with the intensity and duration of the exposure.

This same investigator demonstrated, by intraperitoneal inoculations of virulent tubercle bacilli, that some of the injected animals gave off the organisms in both the urine and feces during the first week after inoculation. In the later stages of the disease, virulent tubercle bacilli could always be demonstrated in these excreta.

References


Chairman Faulder: Our program calls for a report of the Committee on Tuberculosis. This report will be made tomorrow in place of today.

Dr. C. E. Cotton: Mr. Chairman, I wish to state that the Committee on Tuberculosis is responsible for this program as well as the following papers. We tried to make an innovation at this meeting, which we are not ashamed of. We arranged that each author would be directed to furnish a copy of his paper to each of the men who were asked to discuss it. It has been a rather long program, but I hope that you are satisfied with the results. As I say, this is an innovation in this organization. In the past years we have always endeavored to get some men from the medical profession on this program. We were very happy to succeed in having Dr. Daines, from Utah, present the results of his work.

At this time I want to move you, sir, that this Association extend their appreciation to Dr. Daines for his paper, by a rising vote.

The audience arose and applauded.

President Connaway resumed the chair.

The session adjourned at 5:05 p.m.

Friday Morning, December 4, 1931

The fifth session convened at 9:20 a.m., President Connaway presiding.

President Connaway: We have an unfinished part of yesterday’s program to take up. The first item will be “Problems in Controlling and Eradicating Johnne’s Disease.” This will be presented by Dr. V. S. Larson. (Applause)

Dr. Larson read the paper prepared by himself and Drs. B. A. Beach and W. Wisnicky. (Applause)
PROBLEMS IN CONTROLLING AND ERADICATING
JOHNE'S DISEASE

By V. S. Larson,* B. A. Beach† and W. Wisnicky*

Madison, Wis.

Johne's disease is a specific chronic enteritis of cattle caused by a member of the group of mycobacteria or acid-fasts, to which the tubercle bacillus also belongs. The causal organism grows in the mucous membrane of the intestines and in the mesenteric lymph-nodes. It produces a diffuse thickening of the bowel wall which interferes with the absorption of necessary nutrients. The disease is marked by intermittent diarrhea and by emaciation.

Although primarily a disease of cattle, it is found also in sheep, horses, deer and goats. Its importance in the sheep industry cannot be estimated because it has been confused with other diseases of sheep.

England, Holland and Switzerland, three of the world's chief original sources of dairy cattle, have apparently harbored for a considerable time herds infected with Johne's disease. Countries importing cattle from these sources evidently import the disease with them, since outbreaks are never met in native herds but only in those which include animals of imported breeds.

Twort and Ingram believe that records show its presence in England in the first half of the nineteenth century. It seems to have been present in Holland for many years, Marcus (1904) reports that Koorevaar, a Dutch veterinarian, had noted the thickening of the intestinal wall of emaciated cattle and that in some districts the name "scheisser" was used as a probable synonym of "scourer."

The importation of various breeds from the countries mentioned has given an opportunity for the introduction of Johne's disease into the United States. It has been reported from South Africa and from India as well, and is probably present in all regions to which the English, Dutch, Swiss and Channel Islands breeds have been sent. Our federal quarantine authorities have never considered it directly. Due to the lack of practical means for detecting it, other than by clinical symptoms, it is not probable that much could have been done to prevent the entrance

*Wisconsin Department of Agriculture and Markets.
†Department of Veterinary Science, University of Wisconsin.
of incipient cases. A prominent importer of cattle from the Channel Islands has stated that animals have died in our quarantine stations from what was apparently Johne's disease.

It is obvious that it is as important to prevent the importation of animals affected with Johne's disease as it is to prevent the entrance of tuberculous cattle. Since a diagnostic agent is now available, cattle should be tested at the point of export in order to prevent the further introduction of the disease into this country. During the past year a bovine animal originating in Canada was imported into Wisconsin, which showed clinical symptoms of Johne's disease a few months after entry and became so emaciated at the end of the year that she was considered worthless. She reacted to the johnin test and showed marked postmortem lesions of the disease. There is no doubt but that the disease could have been detected in this animal by the johnin test prior to importation.

Once introduced into a country, it spreads imperceptibly, first, because veterinarians are not on the lookout for it, and second, because of its chronic nature. The efforts which may be made to eradicate Johne's disease in this country in the herds in which it now exists will be lessened in effect if more cases are constantly being imported from abroad.

The disease is not limited to any breed in particular, though it has been reported as occurring so frequently in cattle of the Jersey and Guernsey breeds that the inclination is to consider all other breeds resistant. It has been observed also in Devon, Shorthorn, Hereford, Brown Swiss and Holstein cattle. We have encountered it more frequently in herds of the Channel Islands cattle than in those of other breeds. Its prevalence depends on opportunity for infection, rather than on the susceptibility of the different breeds.

It seems probable that Johne's disease is widely distributed in the United States. Reports regarding it have been received from twenty-seven states. The herds belonging to colleges of agriculture in eight of these states have been or are infected. In Wisconsin seventy-six herds have been given consideration since this disease first compelled our attention.

The distribution extends to a majority of the counties of our State in which the cattle industry is of any consequence.

The following data cover the herds tested since November 1, 1927, under supervision. In each of these herds the test was
applied because clinical cases, resembling Johne's disease, were present.

Cattle tested since Nov. 1, 1927..................1,373
Herds tested...................................37
Infected herds..................................34
Reactors.........................................151
Lesions...........................................99
No lesions........................................22
Autopsies not available.........................30

**Prevalence of the Disease**

Nothing definite can be said concerning the prevalence of the disease in the various sections in which it is known to exist. It is certain that a very small percentage of the infected herds is known. The only cases which have been recognized are those in herds belonging to especially alert farmers, or cared for by veterinarians who have had the disease in mind as a possible factor in explaining losses from the herd. Meat inspectors, veterinarians and leaders in live stock sanitation have been largely oblivious of its presence, until it has been brought to their attention by the farmers. This condition should be reversed and, no doubt, will be within a short time.

The disease has, at present, a limited number of sources from which it can spread. These sources are largely the herds of pure-bred cattle, especially those of the Channel Islands breeds. These sources of infection will continually increase, unless agencies are operative to offset the constantly increasing commerce in cattle from such herds. Dr. V. A. Moore (1924) has compared the present position of Johne's disease with that of bovine tuberculosis sixty years ago and has prophesied that, if not controlled, it may become a more troublesome scourge for future generations than tuberculosis is for the present generation of cattle-owners.

There is no need to contemplate extremely drastic measures concerning the disease. It certainly spreads no more rapidly

<table>
<thead>
<tr>
<th>Herd</th>
<th>Number in Herd</th>
<th>Duration of Infection (Years)</th>
<th>Number Removed Because of Infection</th>
<th>Yearly Losses (Per Cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>8</td>
<td>30</td>
<td>8.5</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>17</td>
<td>41</td>
<td>4.7</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>15</td>
<td>20</td>
<td>2.2</td>
</tr>
<tr>
<td>4</td>
<td>35</td>
<td>10</td>
<td>22</td>
<td>6.2</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>10</td>
<td>22</td>
<td>12.0</td>
</tr>
</tbody>
</table>
than tuberculosis, and probably less so. The relatively low percentage of bovine tuberculosis in important dairying districts, such as central and northern Wisconsin, indicates that bovine tuberculosis required many years to become very prevalent. Johne's disease seems to exemplify a condition to which the old adage, "a stitch in time saves nine," may be applied.

**Losses Occasioned by the Disease**

The losses which may come to the owner of a herd infected with Johne's disease is a matter quite apart from its regional distribution and its prevalence.

Recently Ernest (1927) has reported on a herd of 207 animals from which twenty-seven cows had been removed on account of this disease during eighteen months. After this, a test was made and nearly one-half of the remainder was found to be infected.

A somewhat similar experience may be cited in Wisconsin. A herd in Dunn County was first tested in 1927. Number of cattle tested, 33; number reacted, 8; all of which showed visible lesions of Johne's disease upon postmortem examination. Aside from this, there was one aged bull in the herd that was not tested, due to the fact that he was at that time dying with Johne's disease and was destroyed.

The next test was applied in April, 1928. Twenty-eight head of cattle were tested with only one reactor. This animal showed visible lesions of the disease upon postmortem examination.

The next test was applied the following November, when 50 per cent of the herd reacted and it was feared that some error might have been made in making the test. These reacting cattle

<table>
<thead>
<tr>
<th>Herd</th>
<th>Number of Animals Over Two Years Old</th>
<th>Infected (Per Cent)</th>
<th>Number of Animals Under Two Years Old</th>
<th>Infected (Per Cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>139</td>
<td>45.3</td>
<td>31</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>69</td>
<td>37.7</td>
<td>25</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>67</td>
<td>34.5</td>
<td>26</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>148</td>
<td>10.8</td>
<td>73</td>
<td>5.5</td>
</tr>
<tr>
<td>5</td>
<td>99</td>
<td>10.0</td>
<td>78</td>
<td>10.0</td>
</tr>
<tr>
<td>6</td>
<td>291</td>
<td>13.0</td>
<td>77</td>
<td>8.0</td>
</tr>
<tr>
<td>7</td>
<td>85</td>
<td>23.5</td>
<td>29</td>
<td>0.0</td>
</tr>
<tr>
<td>8</td>
<td>89</td>
<td>9.8</td>
<td>19</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Avian tuberculin was used as the diagnostic agent on herds known to be free from tuberculosis as shown by testing with mammalian tuberculin. No data were presented as to the actual losses encountered in such seriously infected herds.
TABLE III—The extent to which Johne's disease was found in some German herds

<table>
<thead>
<tr>
<th>HERD</th>
<th>FIRST TEST</th>
<th>INTERVAL (MONTHS)</th>
<th>SECOND TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NUMBER TESTED</td>
<td>PER CENT REACTING</td>
<td>NUMBER TESTED</td>
</tr>
<tr>
<td>1</td>
<td>19</td>
<td>36</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>28</td>
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</tr>
<tr>
<td>4</td>
<td>36</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>77</td>
<td>22</td>
<td>10</td>
</tr>
</tbody>
</table>

were placed in isolation until the following May and retested, all giving positive reactions. All postmortem examinations showed visible lesions of the disease.

Bruggé and Cordsen (1908) describe a herd of approximately 120 milk cows, besides the young animals, from which 110 head had been lost in fifteen years.

The period of incubation of Johne's disease is unbelievably extended in some cases. From observations made in England, it seems that at least six months must elapse after invasion before symptoms become evident. This implies that the disease is not frequently noted in young animals, a fact which is evident from the data of table II. The lack of symptoms in young animals does not mean, however, that such may not be infected. Ernest (1927), in testing a herd of 207 animals with Johnin, found nearly one-half of the animals responding to the test. Among those giving positive reactions were seventeen calves, ranging from three weeks to six months of age. No postmortem data are available on the young animals.

Statements are frequently met which indicate that symptoms in young animals are exceedingly rare, as, for example, Edwards (1926) states that the infection is nearly always noted in adult cattle over two years old, probably due to the long period of incubation.

It is known that animals may harbor the infection for years and yet show no symptoms of the disease. Krautstrunk (1918) describes an animal which had been kept five years after reacting to the test for Johne's disease without showing clinical symptoms. Soon after calving, the animal failed rapidly. A six-year-old cow developed Johne's disease from which she died three to four months later. At six months of age, this animal had been purchased from a herd in which the disease was known to exist. As far as could be determined, this was the only contact with
Johne's disease this animal had ever had. There is, in the case of Johne’s disease, as in tuberculosis, a tendency for the rapid progress of the disease in some animals which have not previously shown symptoms thereof. Such decline frequently follows parturition. Wilkins (1926) states that affected animals may remain apparently healthy for at least two years, and some may never become visibly ill though suffering from the disease, a fact which must be taken into consideration in any effort to eliminate the disease by removal of animals showing clinical symptoms thereof.

O. Bang (1914) followed the history of fifty-four animals which had reacted to avian tuberculin. Five years later, eleven such animals were still apparently in perfect health. During the five-year period forty-three animals had either been killed or had died; over one-half of these had never shown any physical symptoms. On postmortem examination the supposedly causal organism was found microscopically in 86 per cent of the forty-three examined.

Johne's disease is probably one of the most chronic of all of those caused by bacteria. An animal may show unmistakable symptoms of the disease and remain alive for a number of years, exhibiting neither marked improvement nor decline. One of the animals under observation by us showed, in April, 1925, what were then considered symptoms of a rather advanced case of the disease. There was little change during the subsequent two and one-half years. Positive reactions to johnin were obtained a number of times during the period. The animals died in November, 1927. Typical lesions were found and acid-fast bacilli were demonstrated in the affected tissues.

The most striking symptom is the gradual loss of flesh. This may continue until the animal becomes a mere skeleton. The eyes remain bright but become sunken, due to absence of intraorbital fat. The muzzle remains moist. Commonly there is no fever and the appetite is not impaired. These conditions are very similar to those frequently noted in tuberculosis; the latter, being the more common disease, is likely to be the one thought to be present in the herd, and even non-reaction to tuberculin does not always relieve the suspicion of tuberculosis.

The other marked symptom is diarrhea, which appears and disappears to appear again sooner or later. Diarrhea is not always a constant symptom of the disease, since well advanced cases sometimes show no evidence of this trouble. Some authors speak of the disagreeable odor of the feces during the period of
diarrhea; still other authors state that no disagreeable odor was noted.

The most that can be said for the symptoms of Johne's disease is that marked emaciation and intermittent diarrhea should arouse the suspicion of the owner. Non-reaction to tuberculin increases the probability of Johne's disease being present. The final answer can be obtained only through a postmortem examination or through the use of the specific diagnostic agent, johnin.

The exceedingly slow development of the disease and its ebb and flow in the animal are likely to lead to the conclusion that some physiological disturbance is the cause of the condition, rather than the presence of an infectious disease. This lack of recognition of the nature of the trouble frequently gives opportunity for widespread infection of the herd.

The characteristic lesions occur in the intestine, the wall of which is thickened over a greater or smaller area. In cases of long standing there is a thickening of the jejun-ileum extending twenty or more feet. Cases are reported of a thickening of the entire intestinal tract. Such a marked involvement is rare. Inflammation of the ileo-cecal valve is frequently observed. At times the valve is greatly swollen, becoming fifteen to twenty times its normal size. A piece of thickened bowel presents on its mucous surface a peculiar wrinkled appearance; the mucosa seems to be thrown into folds and ridges. Normal gut at times presents wrinkles which, however, will disappear on stretching.

It is not uncommon for a piece of normal bowel to be interposed between two thickened pieces. This patchy tendency is frequently noted in cases in which the cecum is involved. We have noted nothing characteristic as to the color of the infected mucosa. Occasionally there may be small petechiae, irregular in outline and distribution. Twort and Ingram noted a characteristic pinkish yellow color. This yellow color does occur, but has not been constantly observed by us. At times the intense inflammation in the region of the valve will impart a dark red color.

It is entirely possible that these acute inflammatory changes are due to the secondary invasion with other types of bacteria. Part of the reacting cattle slaughtered by us had never shown symptoms of Johne's disease. In several of these animals the ileo-cecal valve was markedly enlarged and inflamed. On the other hand, in some cases of long standing, inflammatory changes were slight or entirely absent. We have never observed ulcers
or nodules. The macroscopic changes of the lymphatic glands are meager and confined to a slight enlargement and softening of the substance. On section a serous fluid frequently exudes. In one case of long standing, a marked induration was noted.

The tissue destruction, so characteristic of tuberculosis, is lacking in the case of Johne's disease. Frequently the lesions seem to bear no relation whatever to the physical condition of the animal. Indeed the changes in the intestinal wall, even in advanced cases, may be so slight as to pass undetected at a postmortem examination unless one has Johne's disease clearly in mind while making such an examination. The lesions will not commonly be found unless the intestine is opened and the internal wall examined. Macroscopic evidence of the disease may be lacking, yet acid-fast bacilli, resembling Johne's bacillus, may be demonstrated microscopically.

There is no evidence to show that an infection is ever overcome. As has been stated, the period between infection and the appearance of symptoms may be many months or years in length. Symptoms may be noted for a period, which may be followed by an interval in which none is evident, and in which the animals gain flesh rapidly. Such has led to reports concerning the value of certain drugs. Sooner or later, however, the parasite begins its onward march, with the battle always ending in its favor, unless some other agency causes death before the parasite has a chance to finish its work. Apparently the same condition prevails in this disease as in tuberculosis, namely, that infection is never overcome by the bovine animal.

As has been stated in the discussion of the pathology of Johne's disease, the necrosis and caseation so evident in tuberculosis are absent. There is, then, no opportunity for the widespread distribution of the organism in the animal through the flooding of the blood-stream from an abscess as occurs in tuberculosis, nor an opportunity for the organism to be eliminated in large quantities, except with fecal material, as again is true with tuberculosis.

Apparently the organism is eliminated only with the material coming from the lesions of the intestinal wall. There is constant desquamation of the epithelium and probably from the areas in which the organism is growing the desquamation would be more rapid than is normally the case. This would imply that the shedding of the organism would be a steady process rather than an intermittent discharge, as is common in tuberculosis. This
would also imply that the feces would be the only carrier of Johne’s bacillus.

The chronic nature of the disease and the approximate commensal relation of host and parasite undoubtedly mean that the organism may be eliminated over a period of years. The constant contamination of the stable and hence constant exposure of the animals may account for the extensive spread of the disease in a herd, in spite of the low infectivity of the causal organism.

Meyer (1914) states that Meissner and Trapp (1910) and Main (1912) have demonstrated that affected animals give off the organism in forty to fifty per cent of cases. Meyer (1914) claims to have established that the elimination is intermittent. Such observations must be based on microscopic examination of the feces, a procedure somewhat questionable on account of the minute amount of material which can be examined.

The growth of the organism outside the animal has been considered by Twort and Ingram (1914) as a possibility, since they obtained some growth on media containing an extract of certain seeds. The infection with organisms which have grown in other locations than in an animal is questionable. Some have thought that the disease is most prevalent in cattle pastured on low and marshy lands. The correctness of this belief may well be doubted. From the practical viewpoint it is safe to assume the diseased animal as the chief source of the organism.

It seems probable that infection is acquired only by way of the digestive tract. Feeding experiments have given positive results in the hands of a number of investigators.

Krautstrunk (1918) thinks infection occurs much less easily than in the case of tuberculosis. It seems from the nature of the two diseases that this is true. In tuberculosis the organism is carried out of the body by the sputum, feces, milk and urine, and at times in immense numbers. The elimination of Johne’s bacillus only in the feces must certainly have a retarding effect on the spread of the disease as compared with tuberculosis, in which there is opportunity for direct passage of the bacilli from animal to animal by licking each other, and through the soiling of mangers and watering-troughs with contaminated material. The body has but one exit for Johne’s bacillus and a number for tubercle bacilli.

Smears made from the intestinal mucosa from cases of Johne’s disease reveal the presence of minute acid-fast organisms, which cannot be distinguished microscopically from the tubercle
bacillus. The mycobacteria, to which both Johne's bacillus and the tubercle bacillus belong, are characterized as a group by the resistance which the stained organisms show toward decolorizing agents such as acids and acid alcohol. The resistance is not so marked in saprophytic members of the group as it is in Johne's bacillus and the tubercle bacillus. The action of decolorizing agents on Johne's bacillus is scarcely more marked than on mammalian tubercle bacilli and much less marked than on the avian tubercle bacillus.

The beaded appearance which is often observed in the tubercle bacillus, as well as branching forms, may be found also in Johne's bacillus. The extreme minuteness of the organism has been emphasized by M'Fadyean, Sheather and Edwards (1912), who say it is the smallest known member of the acid-fast group. This will hardly serve, however, to distinguish it from other acid-fast organisms which may be encountered in the animal, and hence no positive statement can be made on the basis of microscopic findings alone, especially where the organisms are not numerous in the tissue.

The conditions under which the test is applied should be comparable to those observed in making the tuberculin test. Since the rise in temperature in a positive reaction may not, on the average, be so marked as in the tuberculin test, it is important to avoid conditions that shall affect the temperature of the animals. It seems especially important to avoid the injection of those which show an abnormally high temperature (103°F.). If such temperatures are noted in any considerable portion of the herd on taking the preliminary temperatures, it seems wise to defer the test since the condition responsible for the fever in some may cause, at some time during the test, a fever in animals which at the beginning showed a normal temperature. O. Bang (1914) believes that, when the preliminary temperature does not exceed 102.2°F., a rise to 103.6°F. may be considered as a positive response.

It seems clear that the thermal reaction will appear more quickly following the intravenous injection than following the subcutaneous. However, so little is known regarding the matter that it seems wise to begin the post-injection temperatures within one hour after injection, either intravenous or subcutaneous, and to continue preferably to the eighteenth hour. If the temperature shows no tendency to rise up to the tenth hour after injection, the probability for a reaction is slight.
It will be seen from the data in table IV that approximately 80 per cent of the highest temperatures fell between the fifth and eighth hours. The increase in temperature following the injection of johnin is presented in table V.

These data were obtained from johnin of a low degree of potency compared with that now available if the amount of cells per unit volume of the medium is a criterion of potency. A more potent johnin might have some effect in increasing the thermal rise. Ernest (1927), employing a johnin which should have been more potent than that used in most of our work, with 5 cc injected intravenously, obtained a majority of the maximum temperatures within three to six hours following injection. The temperature rise was approximately the same as in a reaction to tuberculin, both in extent and duration.

Among the objections raised to johnin by O. Bang (1914) was the lack of knowledge concerning its effect on healthy animals. We believe our results have shown that this objection is without foundation.

There are manifestations of sensitization following the administration of johnin other than a rise in temperature. The majority of infected cattle exhibit a roughened hair-coat from thirty minutes to four hours following the intravenous injection. The condition is more noticeable in some cattle than in others. We
have never seen a roughened hair-coat that was not accompanied by a thermal reaction, and that did not correspond approximately in time of appearance with the initial rise in temperature.

At any time between four and twenty-four hours following the administration of johnin, approximately twenty-five per cent of infected cattle exhibit a marked softening of the feces. At times a severe diarrhea is noted, the bowel discharge being thin and watery, and rarely streaked with blood. A foul odor is sometimes to be noted.

Sometimes an uneasiness accompanied by muscular tremors and more or less dyspnea may be seen. These symptoms usually appear fifteen to thirty minutes after injection and persist for from one to two hours.

A peculiarity of the johnin test was noted when some cattle having the disease reacted physically without giving a rise in temperature. Such a reaction may be manifested by a chill, either slight or severe. At other times it is evidenced by a depression which may start within an hour after the injection of johnin, or it may not appear until several hours later, when the cow will merely hang her head with her ears hanging low, eyes partly closed and dull, with no rise in temperature or other manifestation of a reaction. Such cattle, if condemned and slaughtered, usually show lesions of Johne’s disease.

In these cases it is very seldom we find a rise in temperature, but if retested a few months later, they most invariably give a marked rise in temperature and when slaughtered show advanced lesions of Johne’s disease.

In three cases out of approximately 1,000 cattle tested, severe constitutional reactions were noted. The first case was an adult cow that had shown clinical symptoms of Johne’s disease for about two months. About one minute after the intravenous injection of johnin, she fell prostrate and remained in an unconscious condition for several minutes; temperature was 102.6°F. The highest pre-injection temperature was 101.2. The pulse was not perceptible. In about one and one-half hours, recovery had apparently taken place. She reacted at this time. Postmortem examination revealed infection with Johne’s bacillus.

The second subject was a three-year-old heifer that had been tested six months before, but did not react. About one and one-half hours after injection, this heifer fell prostrate; dyspnea was marked; the temperature was 101.2. The pulse was not perceptible. In about one and one-half hours, recovery had appar-
ently taken place. She reacted at this time. Postmortem examination revealed infection with Johne's bacillus.

The third case was that of a six-month-old heifer. About fifteen minutes after injection, she was markedly dyspneic with a pronounced flank breathing, the tongue protruded and the temperature had risen from 101.8 to 102.6. In about thirty minutes she was dead. Postmortem examination revealed marked congestion in about twelve inches of the ileum situated about two feet from the ileo-cecal juncture. Acid-fasts were demonstrated microscopically.

Clinical cases seldom gave a thermal reaction but usually give a physical reaction although that may be hardly noticeable, and it would be good judgment to condemn all clinical cases with a history of Johne's disease, on physical examination.

Another point which appears rather puzzling is the fact that in a number of herds where Johne's disease has been detected with this test and the herds have been accredited on the state and federal accredited list for tuberculosis, and where for many years there was no history of tuberculosis whatever, tuberculous lesions were reported by the inspector who performed the autopsy. In one accredited herd, where four cattle reacted to johnin, all showed lesions of Johne's disease and all showed lesions of tuberculosis. In another herd where three cattle reacted to the test, two of the three showed lesions of tuberculosis. In another accredited herd, where four reactors were found, two of them showed lesions of tuberculosis.

Ernest (1927) noted constitutional reactions in a number of reacting animals.

The following experience may be related where, in a part of the cattle reacting to the johnin test, we have had opportunity for confirmation of the results by a retest. In one herd, consisting of eighteen animals ranging in age from two to twelve years, five reactors were found. These reactions were all definite; the lowest post-injection maximum temperature was 104.2. This herd was kept intact and retested one year later with the result that the same animals again gave definite reactions, and in addition a four-year-old cow that had failed to react the year before. In the meantime, no clinical cases had developed. The only irregularity in connection with this herd was the fact that one cow gave a suspicious reaction to the first test and failed to react on retest. Five cows in another herd reacted to the
johnin test. On retest five months later, two gave definite reactions and one a suspicious reaction.

In a portion of the reacting animals, opportunity for post-mortem examination has been presented. No lesions other than the digestive tract and adjacent lymph-glands which could be attributed to this disease have been noted. Our observations are based on twenty-four postmortem examinations of cattle reacting to the johnin test. Four of this number revealed no macroscopic lesions of the disease; three, a slight enlargement and reddening of the ileo-cecal valve with no visible intestinal lesions; four, a marked enlargement and reddening of the ileo-cecal valve with no visible intestinal involvement; two, a marked intestinal thickening with no visible changes in the valve; and seven, marked involvement of both intestine and valve. Four showed a slight involvement of both valve and intestine.

The appearance of a piece of infected gut in Johne’s disease is no indication as to the number of acid-fast organisms which can be demonstrated microscopically. They may be numerous in material showing slight lesions and difficult to demonstrate in a markedly thickened gut.

The specific organisms can usually be demonstrated by histologic section and many times also by smears. In specimens which we have been unable to demonstrate acid-fasts readily by direct examination, we have substituted a method of concentration by means of antiformin. The mode of procedure has been as follows: A small piece, not more than \( \frac{1}{4} \) inch square, of the suspected intestine is placed in full strength formaldehyde for from one to two hours, depending on the size of the tissue. It is then removed and placed in the incubator or drying chamber until thoroughly hard and dry. The tissue is then ground to a fine powder in a mortar and this powder treated for two hours with a twenty-five per cent antiformin solution. This is diluted with an equal volume of distilled water and centrifuged. The supernatant liquid is decanted, the tube filled with distilled water and again centrifuged. The sediment is examined for acid-fasts. This method has given good results.

Acid-fast organisms have been found in the tissues of thirty-six of the thirty-seven reacting animals examined.

The purpose of our interest in this disease was to determine the possibility of eliminating the disease from herds, through use of the methods shown to be effective in eradicating tuberculosis. It thus involved the isolation of the causal organism,
its continued cultivation, the preparation of the diagnostic agent and its use in the field. It was recognized that the slow progress of the disease in the individual animal would undoubtedly make the task of freeing a herd from the disease a long one. Practically nothing was known concerning the length of the period of incubation, nor was anything known concerning the stages of the disease in which an animal may not react to the test.

The herd on which the most work has been done was known to have been infected for fourteen years at the time the work was begun. During this period, twenty animals had been lost because of the disease. The average number of animals in the herd was forty-five. Table VI presents the results obtained in the various tests made on this herd.

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<tr>
<th>TABLE VI—Results of test on herd I</th>
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<tr>
<td>Date</td>
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<td>November, 1917</td>
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<td>July, 1923</td>
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<td>April, 1931</td>
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*Animal condemned for physical reasons but no lesions of Johne's disease were present; neither could the organisms be demonstrated.

The owner of this herd felt very hopeless in his struggle against this disease because of the fact that there was no way of ascertaining which were the infected animals until clinical symptoms appeared. It is probably true that long before these symptoms are to be noted the organisms are being given off by the affected animals. It was hoped that the test would enable the affected animal to be recognized before she became a source of danger to the other members of the herd. It was this hope that led the owner to continue to use the test in his herd.

The specific organism has been found in the tissues of all but one of the twenty-eight animals examined. The animal reacting in 1923 was not examined for acid-fast bacilli. In the test made in June, 1919, one adult member gave a suspicious reaction. At the following test in November, 1919, there was no indication of a reaction to the johnin. The animal however, did,
give a clear-cut reaction in June, 1920, and was removed from the herd.

Another herd has been tested once yearly for three years. One reactor was found in the first test. No animals have reacted during the second and third tests. One clinical case developed in this herd. The infection was demonstrated by postmortem examination in both the clinical case and the animal reacting to the test.

Field experience with the control and eradication of Johne's disease in individual herds is not very encouraging. Even with the present diagnostic agent, johnin, considered far better than the product which was originally made, it is extremely difficult to eradicate the disease from a herd. Perhaps the test itself is as efficient as one could expect a diagnostic test to be, but the fact remains that with our present test and with such knowledge as we have relative to the disease, and the procedure to be followed in eliminating it from a herd, we find it extremely difficult, frequently impossible, to rid herds of the disease.

Some have suggested that the johnin test in its present form is not able to pick out all infected animals. Others have offered the explanation that the mode of transmission and the behavior of the organism are such that even though the johnin test picked the infected animals accurately, the disease germs would still be prevalent on the premises and later reinfect susceptible animals. Whatever the situation is, we feel that our field control efforts in connection with this disease have not been rewarded by a commensurate success. In reviewing our work in connection with this disease on a considerable number of herds, we can look back to only one heavily infected herd in which, at the present time, we have reasonable grounds to feel that the disease may have been eliminated. Even in this case we are not absolutely sure that the disease may not reassert itself again in the future.

Johne's disease is being handled on a basis similar to tuberculosis, in respect to indemnity, by the federal Bureau of Animal Industry and by many of the states. At the present time it is not feasible to quarantine a herd and prevent the disposal of animals from a herd infected with Johne's disease, for the reason that no assurance can be given the herd-owner that the disease can be eliminated from his herd within a reasonable period of time. Since such assurance cannot be given, the herd-owner could not endure the economic loss which necessarily must be experienced if the herd were quarantined for a period of a number of years.
As the situation works out practically, herds infected with Johne's disease are not prevented from being disseminated and as a result the spread of the infection from the various foci continues. It would be desirable to devise some means by which herds having this disease could be placed under quarantine to prevent the dissemination of this disease. Under the present scale of indemnity, it is not possible to do so.

It would be to the interest of future live stock health if some provision could be made to condemn the entire herd where the infection is disclosed in more than a slight degree. Such procedure would be advisable at this time when the amount of infection is comparatively small. But if we are to go along for a number of years and permit this disease to become more prevalent, then, of course, it will be too late to use such drastic measures.

The prompt removal of any animal from a known infected herd is undoubtedly a wise step in limiting the spread of the disease. The use of other means to limit the infection is desirable even though it is more or less questionable whether doing so will destroy all germs in infective material.

There is little reason to believe that the disease can be introduced into a herd other than through an infected animal. It may be that contact through fences might result in spread. It seems that the disease is much less easily acquired than is tuberculosis, and that the danger sometimes emphasized, in the case of tuberculosis, of infection by limited contact as in cars, stockyards, shows, etc., can scarcely be sufficient to cause any number of infections.

The protection of the herd must be based on the consideration of the animals introduced. Any animal from a diseased herd is a possible danger. Purchasers of breeding cattle should satisfy themselves as to the condition of the herd from which animals are to be acquired. The disease, as far as we are aware, is never considered by purchasers of stock at sales. Cattle are consigned to sales from herds known to be infected. With this disease, as with others, the farmer's protection must come from his own efforts, as well as from the live stock sanitary officials.

The greater danger at present is associated with the more valuable herds, since most of these have had much more opportunity to become infected than has the average farm herd.

Various problems in relation to this disease require more research study. More definite information relative to the efficacy of the diagnostic agent, johnin, and the response of infected
animals to it is necessary. Likewise, more information is necessary regarding the behavior of Johne's bacillus within the animal body as well as its outside habitat, and also its relationship to other closely related acid-fast organisms.

**DISCUSSION**

**PRESIDENT CONNAWAY:** This will be discussed by Dr. W. A. Hagan.

(Applause)

**DR. HAGAN:** Mr. President and Gentlemen: There is, aside from a few minor points, nothing in the paper as presented by Dr. Larson with which I would want to take issue. It remains for me, therefore, only to emphasize some of the points that he has made and to add a few observations which I have made myself.

I have been interested in this disease for a number of years. During the last five years we have had available a small appropriation in New York for maintaining a few cattle for the study of this disease. Most of the facts that I have on it have come from my observations on this small herd now a little over five years old, and on observations made on a number of private herds which I have tested and studied as opportunity has presented itself.

The first thing is with regard to the period of incubation. Dr. Larson has said the incubation period may be unbelievably long. I can heartily agree with him on that. We have observations showing that in some cases it may be as long as five years, and I don't know how much longer. I could cite a number of cases in which animals had been definitely known to be infected. I actually found the organisms in the rectal mucosa, and the symptoms had not appeared for as long as two and one-half years thereafter.

I have at the present time a cow that will be of interest to you, I believe. She was one of the three original animals in this experiment herd, about which I was telling you. On the fourth of November, 1926, these three animals, which were nine months old, were drenched with the mucosa of the intestine of an animal naturally infected with Johne's disease.

Following this period, a test was made in about four months; two of the animals reacted and one did not. In about seven months a second test was given and all three reacted. These heifers were bred. Before one of them had an opportunity to calve, however, she developed signs of Johne's disease, went down very rapidly in flesh and died about thirteen months following the time the infection was given.

The second animal calved normally. Within a month from the time of calving she began to go down. She developed a paper skin, a rough coat. She began to scour, and she died of Johne's disease, a typical case, twenty-five months from the time of infection.

The third animal calved normally. Shortly after that she began to show signs of Johne's disease. She developed a well-marked case. We thought she was going to die, go like the rest, but after a time she began eating again. She began to take on flesh, and shortly she was nearly back to her normal state of health. So we bred her a second time. In due time she calved, but before she reached the calving period, she showed signs of a return of the disease.

In the meantime, I had found the bacillus in rectal scrapings a number of times. She was reacting regularly to the thermic tests given, as well as to the complement-fixation test. Following her second calf, she began again to scour. She developed a marked case, and within three weeks she was so weak she could not get up in the morning. We had to help her. We thought it would be a matter of a few days when the end would come. Soon she began to pick at the hay and began to put on flesh. We weighed her, and she weighed 650 pounds. Six months previously she had weighed 1100 pounds. She had lost about 450 pounds. As she began to pick up, within six months she weighed over 1200 pounds, a 600-pound increase approximately, in six months.

About six months later, she began to stop reacting to thermic tests as well as to the complement-fixation test. For the last year and one-half I have not been able to find any bacilli in the rectal mucosa. This animal today weighs over 1400 pounds. She is a very large, smooth, nice-looking animal. I would
emphasize this point, however: In Johne's disease there is a great deal of
difference depending on whether the animal is being pushed in production or
not. This animal was not being pushed. The question today is: Do we
have here an animal that is recovering? I would say no; I don't believe so.
She may be. I am going to keep her. If our funds are continued we will keep
her to see what happens. She is now six years old and certainly shows no
signs of the disease, although she was infected when she was less than a year
old.

The extent of the lesions of Johne's disease correspond very slightly, in
my experience, to the severity of the symptoms. We find some cases of
Johne's disease, very marked clinical cases, in which the lesions are relatively
slight at autopsy examination. On the other hand, I have killed several
animals, as a result of the test, showing very marked involvement of the
bowels and not showing symptoms before slaughter. So there is no direct
correspondence between the two.

A lesion which I have seen very frequently, especially in these cases of Johne's
disease that terminate in death, is widespread fat necrosis. I don't know that
anybody has referred to that previously. It has been a common finding in
our cases. I don't know what that means.

In the diagnosis of the disease we have, of course, the scrapings from the
rectal mucosa. This is a very logical means in making a diagnosis on the
animal. It can be done in a good many cases. I use my finger-nail; reach as
far as I can, and by sawing with the nail edge, I can get a little scrap of mucosa
under my finger-nail. I bring that out and put it in a tube of salt solution;
wash it off, and take it to the laboratory and make a smear. If this is positive,
you have your best test for Johne's disease. I would rather have that than
autopsy results. When you find it at all, it is my experience you find it in
groups. Unfortunately, you cannot diagnose all of these cases in this way,
even the advanced cases, because the lesions have not, in most cases, extended
to the point where you can reach them from the exterior.

Edwards, in India, estimates he could diagnose about twenty-five per cent
of the advanced cases. I think my experience is about in that neighborhood.
It is of value, then, only when you can get positive findings.

As to the allergic tests, the author refers to the use of johnin. About three
years ago, at the Minneapolis meeting of the American Veterinary Medical
Association, we presented results of a comparison of avian tuberculin with
johnin. We have compared these products for a number of years, and we have
found they are essentially alike in their action upon animals. In fact, I know
of no difference in their results. We could get birds infected with avian
tuberculosis to react to johnin. We could sensitize cattle, sheep and guinea
pigs to Johne's bacillus, and they would react to the avian tuberculin. We
could sensitize them to avian tuberculosis, and they would react to johnin.
Following this experience we have been using avian tuberculin almost
entirely—not entirely; we do use a little johnin. The avian tuberculin is
produced somewhat more readily. I have a feeling we can control it somewhat
better than our johnin. In either case, I want to emphasize that (here is
where I disagree with the paper of Dr. Larson, that johnin is safe) it is not
always safe. Experimentally I have shown it has to be watched. I will
say at the same time that avian tuberculin has to be watched when it is given
intravenously. You can't overdose animals. I have tried it. One can take
perfectly normal animals, and I think you can make them react, providing
you give them enough. You have to control your dosage. The only way that
I know of to do this is to test the product on cattle that are known to be
infected and on others that are known not to be infected. That has been my
procedure in making our test products for use in the field.

It appears that some commercial johnin lacks potency. I know that some
commercial johnin has too much potency and that with the dose recommended
you will induce a reaction, particularly in young animals. So I say that one
needs to watch his product and the dosage very carefully. The same thing
applies to avian tuberculin, as well as to johnin.

We have been using the complement-fixation test as a supporting test only.
The trouble with the complement-fixation test is it is not specific. You will
get reactions with any acid-fast sensitization. Tuberculous animals react. Johne's disease animals will react, and probably animals sensitized in other ways.

We are back to the problem of the no-lesion case in cattle. What sensitizes these animals, we do not know. We do find with the complement-fixation test a considerable number of animals react when we cannot connect them with Johne's disease. Our use of the test, then, is largely in checking up on the thermic test, because it has been the experience with those using johnin as well as those using avian tuberculin that animals in a fairly advanced stage of the disease do not react, or may not react. I have seen animals react and be practically killed by the test; but many times they do not. I have had the experience with avian tuberculin, expressed by Dr. Larson, that the animals may show a marked physical reaction but show no thermic reaction at all. They seem to have gone so far that they lack the ability to react typically. We get our best reactions ordinarily in the rather early cases.

The complement-fixation test, in our experience, will always be positive when the test is negative on these animals that have gone too far. Therefore, we usually say that if the animals are suspicious in any way, show any clinical evidence of the disease or are unthrifty, in carrying out the test take those animals even though they do not react to the thermic test. You might say they should be taken anyway; I think that is true. They ought to be taken in any case. But we have a confirming test. We have seen cases in which animals, taken out as clinical specimens, failed to react to the test and have been negative to the complement-fixation test, at autopsy have shown a nail in the stomach. In one case another disease was found which had nothing to do with the test in particular.

In the matter of control, I am inclined to agree with Dr. Larson that as far as we have gone, the results are not particularly encouraging. However, I don't think here is the place to stop. We need more data on the question. That the animal is not so easily infected as in the case of tuberculosis, I am confident. I think we have fed infective material deliberately, with the idea of producing infection to about fifteen or sixteen animals and have always succeeded, with one possible exception, in producing the infection, but in the herd, by having the animals associate with infected animals, we have not found it to spread with the rate we would expect tuberculosis to spread. The rate varies in different herds. I think the degree to which the animals are pushed in milk-production is one factor. Another factor is the diet upon which the animals are fed. A very succulent diet seems to predispose to the spread of the disease.

The authors mentioned a case of a herd in which they got a reasonable number of reactors, and on a subsequent test half of the herd, or more, reacted. I noticed with interest that their first test was done in the spring, and the second test, the one showing the large number, was done in the fall. This more or less coincides with some impressions I have gained; I am not too sure of the point. That is, that bridging the summer, there is apt to be an increase, and I think that may probably be associated with re-infection from pastures.

We have studied the bacillus of Johne's disease, studied its resistance to various disintegrating influences. These studies have not been reported as yet, but we have found that the organism of Johne's disease is more resistant to drying than the tubercle organism. It is more resistant to many other influences than destroy acid-fast organisms. In fact, we have not yet found any influence, except possibly heat (I haven't tested that), which the Johnes organism would not withstand just as long and, in most cases, longer than the tubercle bacillus. It seems to me that there is this question of infected premises. Unlike tuberculosis, the disease probably spreads only from fecal material, and in the pasture the animals have their best opportunity. Is it a case of the pastures remaining infected over a long period of time, possibly longer than tuberculosis, that is causing these re-infections? I don't know, but I merely suggest that. I think we should look into the matter.

It has been of interest to me to note that the avian tubercle organism apparently will remain on premises in a viable condition longer than the mammalian
type. In these comparisons we have found the avian organism next to Johne's bacillus in resistance. It does stand up definitely better than the mammalian types and second only to the organism of Johne's disease. (Applause)

Second Vice-President W. K. Lewis assumed the chair.

CHAIRMAN LEWIS: This paper is open for general discussion.

DR. J. H. RIETZ: Did those animals show any necrotic lesions of the liver?

DR. HAGAN: In those cases, no. I have seen some small necrotic areas of the liver, but there has been no definite relationship between necrosis of fat and necrosis of the liver. Necrosis of fat occurs more predominantly than necrosis of the liver.

DR. C. E. COTTON: Mr. Chairman, in Minnesota, we now have thirteen known infected herds, and five or six of which we are suspicious but not positive.

In 1928, we established a system of undertaking to accredit herds somewhat in line with our tuberculosis-free accredited herds. After succeeding in getting our legislature to provide indemnity, the same as for tuberculosis, we drew up a form of agreement which was accepted by Dr. Mohler, in which the owner agreed that he would put his herd under supervision, and in which he also agreed not to dispose of any animals provided the last test had disclosed reactors, without a permit from our board. We have succeeded in carrying that out, but we are afraid we are not going to continue with this condition.

Dr. Larson stated that their experience was limited mostly to the Channel Islands cattle, the Jersey and the Guernsey. That is not true in Minnesota. In the Guernsey and Jersey herds that we tested, we are satisfied the disease emanated from Wisconsin. Therefore, perhaps his deductions are right. We have it particularly in one wonderful herd of pure-bred black Angus cattle. The owner is insistent on selling his young bulls, particularly. We have it in a large herd of Shorthorns, and the owner is becoming disgusted with the conditions under which he put his herd, under supervision, namely, that he could not sell without a permit. We have now stated to both of those men that they signed the agreement, and we have paid indemnity, and we have agreed to give them a permit to sell these animals on condition that if the last test did disclose reactors, the purchaser should know the history of the animal and the herd when he purchases it, and provided we issue the permit to the purchaser to take the animal into his herd.

Our experience with the test to date is very unsatisfactory, in every herd in which we have made a positive diagnosis. We started first with using johnin which we obtained from Dr. Beach. We have herds in which we would have a reaction. We would slaughter the animal, and gross lesions would be found, acid-fast organisms verifying it, and within three to six weeks we would have a breakdown in one that had not reacted. Then, through the kindness of one of the commercial houses, we were supplied with avian tuberculin. We started last spring we tried to test in the spring and fall. I must say that our results to date are unsatisfactory. We have one herd in which we constantly have had one to three or four reactors on the six-month test since 1928. The man is a good sport. He isn't free of tuberculosis, and he has Bang's disease. He is still loyal.

I am not positive whether we got five or six animals last spring that reacted to the intravenous injection of tuberculin. One of those animals did not react to the complement-fixation test, but a large number of the animals, a relatively large number, that did not react to the thermic test, did react to the complement-fixation test. At that time we did not take the animals that reacted under the complement-fixation test unless they reacted to the avian tuberculin. About six weeks after the test, one animal broke clinically. That animal had reacted to the complement-fixation test but not to the thermic test. We just tested that herd about a month ago, and we had fifteen animals react to the thermic test. None of the animals reacted to the complement-fixation test, with the
exception of one, and we took that animal. The lesions were found and also were verified by the acid-fast findings. But the interesting fact was that some of the animals that had reacted to the complement-fixation test six months ago, but not to the thermic test, did react to the thermic test this time. We have about concluded that we will go farther than Dr. Hagan has proposed. We propose to take animals that react to either the thermic or the complement-fixation test. I am beginning to believe that, provided we make some provision for the animals that have been exposed, we would be justified in undertaking to reach a fair appraisal of these animals, the commercial value, and clean them up and pay for them. (Applause)

President Connaway resumed the chair.

President Connaway: We will take up the program on Poultry Diseases. Dr. H. J. Stafseth will present a paper on “The Effects of Worm Infestation in Poultry, Treatment and Control.” (Applause)

Dr. Stafseth read his paper.

THE EFFECTS, TREATMENT AND PREVENTION OF WORM INFESTATION IN POULTRY

By H. J. Stafseth and W. W. Thompson,
Michigan State College, East Lansing, Michigan

This discussion will deal only with tapeworms and ascaridia, not that we overlook the importance of other intestinal worms, but our main efforts have been applied to problems in connection with the treatment and control of tapeworm and roundworm infestations, because of the great prevalence and economic importance of these parasites.

In the Middle West we encounter from 6 to 8 species of tapeworms in chickens. Turkeys, geese, ducks, pigeons and guinea fowls also have several species of tapeworms. Ascaridia are very prevalent in chickens and may also occur in other classes of domestic fowl.

Effects of Worm Infestation

Symptoms: A very small group of non-conformists maintains that worms do no harm to poultry. However, most poultry pathologists and parasitologists possess field experience and experimental data which show, beyond any doubt, that tapeworms and roundworms are highly pathogenic for birds. The question is often asked: “How many worms does it take to make a bird sick?” To answer such a question is very difficult since the effect of worm infestation does not depend alone upon the number of worms present, but on the age and individual susceptibility of the host, as well. Two or three worms might be more harmful to some birds than would a dozen or more to others. In general it may be said that young birds are most sus-
ceptible and that resistance increases with age. Deficient diet, especially rations lacking the necessary vitamins, is claimed to lower resistance to worm infestation. The following symptoms are quite commonly observed: failure to grow, to feather out, to come into production or to stay in production; emaciation; paleness; dry and shriveled, sometimes cyanotic, combs and wattles; rough plumage; untimely molting; lack of gain in weight or condition, in proportion to amount of feed consumed; lack of appetite; lameness; perhaps even paralysis and blindness; diarrhea, straining, prolapse of cloaca and death. Ackert, of the Kansas Experiment Station, has observed a mortality of 23 per cent. He also found that the death rate was highest during the third week of infestation.

Pathology: On postmortem examination one may find various degrees of enteritis up to the extent of hemorrhage and even sloughing of epithelium. The Raillietina (Davainea) echino-bothrida causes lesions resembling those of tuberculosis in the intestinal walls. All these changes may interfere more or less with digestion and assimilation. If sufficiently severe, the injury produced in the intestines may be of lasting nature and birds so affected may prove unprofitable long after the infestation is over.

Ackert has shown that the large roundworm causes shrinking of the thymus gland and a decrease in the sugar of the blood. Thus it is easily understood why worm-infested birds seem to show increased susceptibility to certain infectious diseases such as roup.

TREATMENT

A few years ago, Dr. W. L. Chandler,1 of the Michigan Agricultural Experiment Station, discovered a method of preparing a colloidal iodin product which he and others have found very effective against roundworms and tapeworms as well. This product has been called “iodine vermicide,” because it not only expels the worms, but it will also kill them. This product was turned over to a reliable chemical manufacturing concern which is now making it according to a definite standard prescribed by Dr. Chandler.

In order to secure more data as to the vermicidal efficiency and lack of toxicity of “iodine vermicide,” the authors proceeded to dose all live birds submitted to our laboratory for examination. These birds were given the prescribed dose of one ounce of pro-
properly diluted, "iodine vermicide" and were examined at various lengths of time following dosing. This work was begun in the early fall of this year and up to the present date we have treated and examined 29 birds that proved to be infested. The results are as follows:

**Bird 1:** Examined 32 hours after dosing. Several tapeworms were passed and none could be found in the intestines.

(A colleague reports that he has found no tapeworm remedy which will remove heads. This work did not take that into consideration any more than to watch for heads in the water in which we collected the worms. We have found a considerable number of heads. It is very difficult to say how many worms do not have heads on them, for the simple reason that for quite a while after the worms are shed, they are deeply stained, and it is very difficult to see any differentiation in the different parts of the worm.

Since that very valuable point was brought out, for the coming year, or perhaps longer, we shall attempt to determine how many heads remain in these birds.)

**Bird 2:** Examined 32 hours after dosing. Two roundworms and three tapeworms were passed and ten dead roundworms were found posterior to the attachment of the ceca. No live worms could be found in this bird.

**Bird 3:** Examined 31 hours following dosing. No worms were passed; one unstained and three deeply stained roundworms were found at the level of the ceca. It should be mentioned that "iodine vermicide" often stains the worms with a brownish color. Occasionally tapeworms may look greenish after being acted upon by colloidal iodin; no worms have been found to be alive after being stained, but they may be killed without being stained.

**Bird 4:** Examined 25 hours after dosing. One tapeworm was passed and no worms found in the intestines.

**Bird 5:** Examined 24 hours after dosing. Six tapeworms passed; none found in the intestines.

**Bird 6:** Examined 18 hours after dosing. One roundworm was passed and 15 deeply stained, dead roundworms were found in the lower part of the intestines.

**Bird 7:** Examined 18 hours after dosing. One roundworm discharged; none in the intestines.

**Bird 8:** Examined 19 hours after dosing. Several tapeworms and one roundworm passed. None in the intestines.

**Bird 9:** Examined 22 hours after dosing. None passed. Twenty live roundworms found in the intestines. On examination it was found that the dose had been delivered into the crop of this bird and not into the gizzard, as is necessary for effective vermicidal and vermifugal action.

**Bird 10:** Examined 20 hours after dosing. Several tapeworms passed. No worms in the intestines.

**Bird 11:** Examined 20 hours after dosing. One roundworm passed. No worms in the intestines.

**Bird 12:** Examined 10 to 15 minutes after dosing. No worms passed; 14 deeply stained roundworms found in the intestines. All were dead.

**Bird 13:** Examined 20 hours after dosing. Four roundworms and one tapeworm passed. None in the intestines.

**Bird 14:** Examined 20 hours after dosing. Numerous tapeworms and one roundworm passed. None in the intestines.

**Bird 15:** Examined 23 hours after dosing. Two tapeworms and one roundworm passed. One young roundworm found in the intestines.

**Bird 16:** Examined 23 hours after dosing. Seven roundworms passed. No worms in the intestines.

**Bird 17:** Examined the day after dosing. Twenty-eight roundworms passed. No worms in the intestines.
Bird 18: Examined one day after dosing. One roundworm passed. One dead roundworm in the intestines.

Bird 19: Examined one day after dosing. Seven roundworms passed. Fifty-eight dead roundworms were found at the level of the ceca.

Bird 20: Examined 23 hours after dosing. One tapeworm passed. One live roundworm found in the intestines. This bird was very difficult to dose as the crop was empty and contracted.

Bird 21: Killed and examined immediately after dosing. There were 75 to 100 tapeworms in the intestines of this bird. Most of these worms were stained and showed no movement whatever when placed in lukewarm water. Some of the worms that were not stained showed expanding and contracting segments. Enough iodine vermicide was then added to stain the water slightly brownish and almost instantaneously all movement on the part of the segments ceased, showing how highly toxic iodin is for tapeworms.

Bird 22: Examined 25 hours after dosing. Three roundworms and several tapeworms passed. None in the intestines.

Bird 23: Examined 10 minutes after dosing. No worms were passed, but five roundworms and a large number of tapeworms, all stained and dead, were found in the intestines.

Bird 24: Examined 25 hours after dosing. An enormous number of tapeworms (Hymenolepis carioca) were passed. None could be found in the intestines.

Bird 25: Examined 10 minutes after dosing. Fifty-six stained, dead roundworms were found in the intestines.

Bird 26: Examined 15 minutes after dosing. A large number of tapeworms were found in the intestines. The last few segments of almost all of these worms were stained and no movement could be detected, suggesting that all these worms were dead.

Bird 27: Examined 47 hours after dosing. About 30 to 40 tapeworms were passed. None were found in the intestines.

Bird 28: Examined 48 hours after dosing. Four roundworms were passed. None were found in the intestines.

Bird 29: Examined 24 hours after dosing. About a dozen tapeworms passed. None were found in the intestines.

Thus the data presented here agree very well with those of Dr. Chandler and his co-workers who were able to obtain 100 per cent efficiency in some critical experiments. It may be well to note that the birds treated and examined by us showed more or less marked effect of the worm infestation. The rather abundant amounts of mucous and membranous exudate found in several of these birds suggest that more iodin may be destroyed in the intestines of such birds than would be destroyed in the intestines of worm-infested birds that had not yet developed marked enteritis. The birds used in Dr. Chandler's experiments were normal in appearance and represented the run of the flock from which they were obtained. This might account for the high degree of efficiency obtained by him.

Observations of results obtained in the field are equally convincing as to the efficiency and harmlessness of this chemical when properly applied. Birds that are used to being handled frequently fail to show even a noticeable reduction in production following treatment and usually a marked improvement in con-
diation is noticed within a very short time following the treatment. This year we have subjected a flock of about 1200 pullets to three treatments with “iodine vermicide” since the birds were three months old. No ill effects have been noticed and at present these birds are in excellent condition.

Last year losses amounting to as much as fifty birds in one month were experienced in a like number of birds on this farm. The ground is exceedingly heavily contaminated with worm eggs and reinestation took place after each one of two treatments applied in the fall and winter. The owner reported that he found large numbers of both tapeworms and roundworms on the dropping-boards following each treatment and, on finding that his pullets were infested at 2½ months of age when raised on what he thought was clean ground, located more than half a mile from any range previously used for poultry, he decided, after talking the matter over with us, to dose the birds at three months of age, at the time of placing them in laying quarters and then again as soon as the fly season would be over. The present condition of this flock and the rate of production indicate that his efforts have not been in vain. Numerous cases of prompt improvement in growth, condition and production following the application of “iodine vermicide” could be cited if time would permit.

We do not expect that one will obtain 100 per cent efficiency in the case of every bird when this remedy is applied in the field. Excessive amount of mucus in the intestines, improper application and mistakes in the dilution of the iodin will all tend to lower the efficiency of the drug. Some of the factors that may interfere with the action of iodin would also hinder other remedies. The application of a worm remedy by means of a catheter or tube which must be passed all the way into the gizzard may seem difficult and laborious at first. However, it must be remembered that the surest way to kill and expel the worms is to get the greatest possible amount of the dose tolerated by the bird in contact with the parasites at once. This can be done by placing “iodine vermicide” in the gizzard, since this organ does not hold fluids, but passes them on to the intestines very promptly. If drugs are given in capsules, prompt delivery into the intestines is unlikely. The senior author has found almost completely intact capsules in the crop and gizzard of chickens at one time twenty-four hours and, at another, two weeks after administration. When “iodine vermicide” is properly administered, the birds
treated will begin to discharge iodin in 10 to 15 minutes following the dosing, showing the prompt passage of this remedy into the intestines. On several occasions we have seen roundworms and tapeworms passed in considerable numbers within one hour following the administration of the dose.

Quite frequently we have given “iodine vermicide” to turkeys affected with blackhead, worm-infested geese and diseased ducks brought to our laboratory for treatment or diagnosis and we have yet to observe any ill effects therefrom.

PREVENTION

In attempting to control roundworms and tapeworms without medicinal treatment, one must take into consideration the mode of spread of these parasites.

In a sense roundworms spread directly from bird to bird, that is, the eggs are discharged with droppings and must then have a chance to incubate for about 15 to 20 or more days, depending upon the climatic conditions. A larva develops within the egg during that time and the young worm is liberated from the egg when it is swallowed by a bird and matures in about two months. The shell of the roundworm egg is thick, making the eggs resistant to heat and cold as well as to the action of most disinfectants. The control of roundworms will therefore depend mainly upon the effective cleaning and disinfection with colloidal iodin of poultry-house floors and dropping-boards. If the ground is heavily contaminated, one may have to keep the birds off the ground for two or three years. Ackert reports that the summer heat in Kansas is sufficient to kill roundworm eggs in soil down to a depth of six inches in unshaded places.

Tapeworms require an intermediary host. The most common tapeworm encountered in Michigan is the *Raillietina (Davainea) cesticillus*. This tapeworm has several intermediary hosts, namely: the house fly, the dung beetle and the ground beetle. The *Davainea proglottina* spreads through the garden slug, the *Raillietina (Davainea) tetragona* through the house fly and a small snail, the *Hymenolepis carioca* through the stable fly and dung beetle, the *Choanotenia infundibilum* through the house fly, the *Amoebotenia sphenoides* through the earth worm, while the intermediary host of the *Raillietina (Davainea) echinobothrida* is unknown. The tapeworms attach themselves to the intestinal mucosa. When the worm has matured it sheds the posterior segments which contain large numbers of eggs. The segments
pass out with the droppings and lie on the ground awaiting a suitable host. When such a host picks up these segments, the eggs hatch, liberating larvae which lie dormant until the intermediary host is swallowed by a primary host, say a chicken, in which they then continue their development. Thus it is evident that in order to control tapeworms, one must control or eliminate, as far as possible, the intermediary hosts.

If tapeworms, which have flies as intermediary hosts, are encountered, one must not leave things, such as milk, meat, carcases of birds or other material which will attract flies, around the poultry plant. It may even be necessary to put fly-screens on the houses and to keep the birds indoors unless one also has screened sun-porches for them.

Tapeworms which spread only through intermediary hosts which live in or on the soil may be controlled by not allowing the birds on the ground at all. Wooden or concrete sun-porches take the place of ordinary yards or runs.

Regular rotation of yards or ranges may help, especially if a large amount of ground is allowed per bird. However, in many places only a limited amount of ground is available and even what is supposed to be clean ground may prove to be contaminated. A careful investigation of local conditions is often necessary for adequate worm control. Garden slugs, for example, live under leafy material that mats down over the soil, or under such things as planks or boards that lie in the yard. Heavy, matted-down growth of alfalfa is said to furnish ideal living places for intermediary hosts for certain tapeworms. Slugs generally come out from under their hiding places only in the morning, when there is dew on the ground. At this time the birds generally find them in large numbers and may of course also pick them up at other times by scratching and turning over the things under which they hide during most of the day. Therefore, keeping the poultry-yards clean and free from boards and heavy leafy material will be an aid in combating tapeworms. It is said that clover may be used to advantage instead of alfalfa as a crop on the range.

Reference


President Connaway: I wish to say in regard to this preparation, "colloidal iodine," we had Dr. Stafseth down at the University of Missouri a few months ago to give some instruction to our veterinarians, in our short course for poultry diseases. The Doctor gave some demonstrations of this,
material. It certainly worked fine on those roundworms. But in following up those birds, we found that it was not quite so effective on the tapeworms.

Quinin does the work in killing some of those blood parasites. For many, many years we didn’t know what its composition was or what it was doing in the body. So a good deal of our work in the past has not been wholly scientific, nor perhaps wholly ethical, from the strict point of view of the veterinary medical profession. But this is a good remedy for roundworms.

I am going to change the order of the program a little bit and call on Dr. E. E. Tyzzer to give his paper on “Criteria and Methods in Coccidiosis Investigation.” (Applause)

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

CRITERIA AND METHODS IN THE INVESTIGATION OF AVIAN COCCIDIOSIS


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While the economic importance of coccidial infection in domestic fowls is quite generally recognized, much of the investigation in this field has yielded only conflicting results and all too little in the way of actual accomplishment. The chief difficulties appear to have been due to the failure to recognize that a number of distinct species of Eimeria occur in poultry, even in a single host species, and also to the failure to employ adequate controls. Thus the coccidial infections encountered in various domesticated birds have been commonly attributed to a single poorly defined species, usually alluded to as “Eimeria avium.” While the usual text-book description of the coccidium life cycle appears to have been understood and widely utilized, certain well-established principles have been frequently ignored.

It is the purpose of this communication to review some of the methods employed by the author in previous work in this field and also to discuss certain criteria which have been found to have application in a more recent investigation carried on in collaboration with H. Theiler and E. E. Jones.* The recognition of the fact that a single avian host may harbor more than one species of Eimeria appears essential to a proper approach to this field of work. In order to learn the reaction of the host to each species of parasite, or indeed to determine to which ones the more serious disease conditions are attributable, it has been found advantageous to work with infections produced experimentally with single species. Since coccidia do not lend themselves to artificial propagation outside the bodies of their respec-

*A full account of this work is in the hands of the publishers and will appear in the American Journal of Hygiene.
tive hosts, the determination of their specific characters makes it necessary to substitute for the test-tube of the bacteriologist a suitable experiment animal. Hence the isolation of a given species is accomplished by the selection of proper material while its propagation is carried on by experimental infection.

Isolation may be accomplished in various ways. On occasion, infections with a single species of Eimeria present themselves, thus doing away with the necessity of artificial isolation. In such cases, sufficient acquaintance with the organism and observations carried out on carefully conducted experimental infections are necessary in order to be sure that one is not dealing with mixed infections.

In some instances the selection of material from a given region of the intestine is all that is necessary to isolate a species. For example, in a mixed infection with *E. acervulina* and *E. tenella*, the fact that the development of the latter is commonly confined to the ceca makes possible the isolation of the former by collecting oocysts from the first portion of the intestinal tract. On the other hand, *E. tenella* may be isolated from such a mixture by taking the cecal mucosa for the source of oocysts after prolonged and thorough washing in running water to remove the *E. acervulina* oocysts that pass into the ceca from the small intestine. By this method we have been successful also in separating *E. necatrix* Johnson from associated *E. acervulina* infection.

By collecting the earliest oocysts to appear in an experimental, mixed infection, it is possible to separate out the species having the shortest period of development. Likewise, selection may be based on differences in the time required by the oocysts of various species to undergo sporulation.

In certain combinations of species, the most feasible method for the isolation of a species may be to obtain single oocysts. One way of accomplishing this is by the dilution method as employed by Miss Jones.* This is done by transferring material containing the mixture of oocysts into a succession of drops of fluid on a thin strip of moistened gelatin, which for convenience is placed on a sterile microscope-slide. When a drop is obtained containing a single oocyst of the type desired, the portion of the gelatin strip including the oocyst in question is then cut out and immediately fed to an uninfected bird. It will be readily understood, however, that it may be a time-consuming task to obtain

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by the dilution method an oocyst of a species which is poorly represented in a given mixture. Another method was employed when *E. maxima* was first encountered in a mixture with *E. acervulina*, in which its oocysts formed only a very small percentage of the total number present. Since the large size of the *E. maxima* oocysts rendered them readily distinguishable, single oocysts were isolated by the Barber micropipette, transferred to a small disc of moistened gelatin which was then lifted by sterile tweezers and placed far back in the pharynx of an uninfected chicken to make sure of its being swallowed.

Should a mixture of two organisms be encountered, such as *E. tenella* and *E. necatrix*, which produce oocysts that are not readily distinguished one from another and that develop in the same portion of the intestinal tract, the most feasible procedure would appear to be to immunize birds against either one of the organisms which may be available in pure culture. Then on feeding the mixture of oocysts to the immunized birds, a pure strain of the other species may be obtained.

In reviewing the criteria that we have considered in recognizing species, attention should be called to the common fallacy of differentiating species on the measurements of oocysts. First of all, the measurement of oocysts furnishes no certain index as to the purity of the material. Slight representation of additional species may have no appreciable effect on the curve plotted and, unless other characters are taken into account, there is no means of knowing whether a curve obtained is typical of any species. There is also considerable evidence indicating the occurrence of size strains within a given species. It has been shown by Miss Jones* that an infection derived from a single oocyst furnishes oocysts that give a distinctly bimodal curve when the measurements are plotted and that this character is maintained throughout successive transfers. She has also shown that the oocysts may be larger in light infections than in heavy ones.

In view of such variation within a species, the consideration of other features in addition to the dimensions of the oocyst appears to be essential for the differentiation of species. For this purpose we have found the following characters useful: the period required for development, *i. e.* the time from the feeding of oocysts to the discharge of oocysts; the sporulation time; the gross topography of the infection; the distribution of organisms in the epithelium, *i. e.* whether scattered or in colonies, super-
ficial or deep, in free surfaces or in glands, et cetera; the gross and microscopic pathology of the infection; the morphology of the developmental forms of the organisms; and finally the absence of cross-immunity. Notwithstanding this rather formidable array of characters, differentiation of the individual species is not difficult once they have been recognized, since certain combinations of characters are practically specific. Thus the occurrence of superficial, whitish, transversely extending, elongate spots composed of oöcysts in the mucosa of the upper portion of the intestine furnishes a reliable indication of *E. acervulina*, while the occurrence, in association with hemorrhage, of rounded whitish spots, occurring in greatest number in the middle portion of the intestine, seen best from the serous surface and composed of numbers of cells containing large schizonts, furnishes a diagnosis of *E. necatrix*.

In addition to the difficulties arising from the confusion of species, the failure to recognize certain fundamental principles in many instances vitiates the results of investigation. In contrast to the experimental bacteriological infections in which no elaborate precautions for the isolation of stock animals are necessary, in experimental studies of coccidial infection, the possible occurrence of adventitious infection must always be taken into account. The ubiquity of coccidial infections, their possible introduction by the attendant, or in food material, or by insects, rats and mice, is apparently often disregarded. The demonstration that the ingestion of a single sporulated oöcyst may result in infection serves to indicate the necessity of carefully planned controls for all crucial experiments in this field. While it seems to have been recognized that coccidial infection tends to be self-limited, the duration of single infections in the absence of any opportunity for reinfection appears not to have been determined heretofore. We have found that various Eimerian infections, even in the absence of any appreciable protective reaction on the part of the host, disappear spontaneously following the completion of the developmental cycle. This type of infection, in contrast to bacterial infections, is thus dependent for its continuance on reinfection through the ingestion of oöcysts. That a certain proportion of sporulated oöcysts may pass through the intestine unhatched is often disregarded, although this fact may be readily demonstrated either by direct examination of fecal discharges or by placing control birds in the same cage with those fed oöcysts.
That the severity of infection is primarily dependent upon dosage is also readily demonstrable; light infections with even the most pathogenic species furnish no symptoms and no more than microscopic lesions. The term "dosage," however, should apply to the number of infective forms which invade the tissues rather than to the number swallowed. Thus it has been found that approximately the same number of organisms fed to birds of one age will furnish a much heavier infection than when fed to birds of another age. It has been found also that greater protection is afforded the host by a heavy infection than by a light one. Among other things to be considered with reference to dosage is the movement of material through the alimentary tract of the bird. Material fed to the chicken commonly makes its appearance in the feces in slightly more than an hour's time. Since no very coarse material is ever found in the ceca, it is apparent that not all material passing through the small intestine enters these tubes, but that there is a sampling of the more finely comminuted material. Thus many of the sporozoites of *E. tenella* hatching in the small intestine fail to enter the ceca, and are lost in the fecal discharges, as may be demonstrated by microscopic examination. Likewise, by far the greater proportion of the merozoites produced in the small intestine by *E. necatrix* pass out in the feces. In fact, merozoites are regularly demonstrable in the discharges even in light infections of this species.

There are certain precautions that should be taken as a matter of routine in experimental coccidial infection, and others that may be taken with special objectives in view. It is a fortunate circumstance that the day-old chicks which may now be purchased at all seasons of the year are usually free from coccidial infection. On arrival, they should be furnished a sterilized equipment consisting of cage, heat unit, food- and water-dishes, and thenceforth kept in a room apart from infected chickens. All mash, grit and litter which they receive thereafter should be made into packages of appropriate size and sterilized in the autoclave as a matter of routine. Water may be taken from the hot-water tap. The attendant should have nothing to do with infected birds, which preferably should be personally cared for by the investigator. The rooms in which either stock or experiment birds are kept should be well screened and free from cockroaches, flies and other insects. Access of mice to cages and food material should be carefully prevented.
Propinquity is another important feature to take into consideration; the activity of chickens in scattering material about makes accidental infection a matter of frequent occurrence, especially when lots of birds are kept in the same room with other lots that are discharging oocysts. The proof of the success of measures to protect experiment birds from accidental infection rests on the freedom of stock from infection as determined by periodic examination of discharges. Accidental infection does not, however, necessarily vitiate one's results, especially if it is immediately recognized. The time of its occurrence may indicate an accidental infection and its morphological characters may make possible its differentiation from the experimental infection.

The assumption that chicks kept on false cage-bottoms of wire mesh will not become reinfected is unwarranted. While this measure may lessen the opportunity for reinfection, nevertheless fecal material adheres to the wire so that it is likely to become mixed with scattered food and later ingested or it may contaminate the feet and be picked off subsequently by the bird. Fecal material is commonly found in food-dishes, thus furnishing ample opportunity for reinfection. Practically the only way to prevent reinfection is to change to successive sterile environments at periods less than the sporulation time of the oocysts, i.e. within each twenty-four hours. The continued absence of infection in normal control birds after their introduction into the cage with the infected ones furnishes evidence as to the efficacy of the above measures.

In the course of our investigations on immunity, the question arose as to whether the birds that were resistant to reinfection were also no longer discharging organisms. While it would appear that no test thus far tried out for the presence of organisms in the fecal discharges is wholly infallible, yet certain procedures carried out at frequent intervals probably furnish a reliable indication. Infection may be disclosed by the direct method of microscopic examination, by which may be discovered not only oocysts, but also merozoites, and it not infrequently happens, at least with some species, that the merozoites may be present when no oocysts are demonstrable. The flotation method of concentration, using strong salt solution, works well for determining the presence of oocysts, but after such treatment the oocysts are often unsuitable for subsequent transmission experiments. By keeping fecal discharges for two or three days in 2.5 per cent potassium dichromate solution and then feeding the material
to normal birds, it is frequently possible to demonstrate the presence of oocysts in material in which they could not be found microscopically. Since by this method the samples fed represent only a fraction of the discharges of the bird tested, it is quite possible that the existence of slight infections may not always be discovered. Even on combining both the microscopic and feeding tests for the presence of infection, it cannot definitely be demonstrated that a bird on a given occasion harbors no infection, for the discharge of organisms is subject to considerable fluctuation. However, in groups of birds such tests made repeatedly furnish an indication of the trends of infections, i.e. whether increasing in intensity or dying out.

Failure to employ adequate precautions to prevent accidental coccidial infections or to recognize them when they occur doubtless accounts for many of the fallacies and ill-founded conclusions that appear from time to time. For example, reports on the transmission of coccidial infection to quite unrelated host species are not uncommon in the literature. A scrutiny of such reports yields no evidence of proper isolation of the test bird or sterilization of its food, while the possibility of the intestinal contents of the donor containing oocysts from other sources than itself appears not to have been considered. Concerning the latter possibility, Krijgsman’s* success in infecting rabbits with *Eimeria stiedae* from the feces of rats that had been fed this organism is noteworthy. Another source of error is the failure to identify accurately the infection that may appear in the recipient in the course of cross-infection experiments. The mere occurrence of coccidial infection is hardly acceptable without definitely identifying it by further morphological and pathological studies. The time of occurrence of infection is of considerable significance and in order to determine this, daily examinations for organisms in the discharges are necessary. Gross pathological features associated with coccidial infection should not be relied on without supporting evidence. For example, extensive fatal hemorrhage into the ceca and small intestine has been noted in turkeys, but we are not justified in regarding this as *E. tenella* infection without demonstrating organisms with the morphological and biological features of this species.

Unwarranted assumptions are frequently encountered in measures proposed for coccidiosis control. Thus the dipping of

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eggs for incubation purposes in antiseptics is advocated without determining whether it is possible for the oocysts to survive on the shell of the egg throughout the period of incubation. The absence of coccidia in most of the day-old stock on the market appears not to have been recognized. Furthermore, it is commonly assumed that coccidial infection, since it is of such serious consequence in poultry, should be wholly eliminated from the flock. The conclusion has been reached, however, in our recent investigations that the exposure of birds to light infection early in life protects them against serious injury from infection later on.

Once the multiplicity of the species of Eimeria infecting poultry is realized and the basic principles of such infections are understood, there is probably no other group of hosts in which coccidiosis may be studied so advantageously. While it is a rather difficult matter to maintain stocks of young mammals free from all such infections, day-old chicks are now available in reasonably large numbers throughout the year and young turkeys, pheasants et cetera may be obtained at certain seasons. The uniform susceptibility of such hosts, the ease with which infection is produced and the regularity of results under laboratory conditions, all lend themselves to accuracy in this field of work. It is reasonable to expect that much may be learned also by the application of exact methods of observation and experiment to the practical problems in coccidiosis.

DISCUSSION

Dr. Chas. Murray: Do you consider that the so-called chronic infection represents a reinfection? Also, what do you consider is the defensive mechanism following infection?

Dr. C. P. Fitch: What is the variation in the period of incubation in the various species, that is the more common species, of coccidia affecting chicks?

Dr. I. D. Wilson: How may asexual generations do you consider these infections may pass through before passing the sexual generation? Also, do you consider that the humidity in the incubator has anything to do with the oocysts living on the eggs during the time the eggs are being incubated? That is, if the humidity is high, would the oocyst be more likely to live through?

Dr. H. E. Moskey: What is your opinion as to the value of drug products in the prevention and treatment of coccidiosis of poultry, particularly the so-called intestinal astringents, such as sulpho-carbolates and catechu?

Dr. J. Traum: Is not the maturation time a good method of differentiating the species?

Dr. H. J. Stafseth: I was very glad to hear what Dr. Tyzzer said about oocysts not living on the eggs. I would like to know how he accounts for the survival of the coccidia on poultry-floors, in soil, and various other conditions, if the incubator is so fatal to the coccidia.

Dr. Tyzzer: With regard to the first question, concerning chronic coccidiosis and the defensive mechanism in immunity, I think that in "chronic coccidiosis" we have a term that is somewhat vague. In the first place, this term seems to apply to the duration of the outbreak in the flock as well as to the clinical course in the individual; at least that is my impression. I think,
however, that in the type of infection which is known as chronic coccidiosis, we do have a long-continued infection which has its basis in re-infection, that is, continuous re-infection from the surroundings. That is my view of it. I haven't any too much practical experience and so must admit that I haven't seen so much chronic infection as many of you gentlemen have.

_Eimeria necatrix_ is very commonly associated with emaciation, with wasting of the muscles and weakness to a degree that the bird is unable to stand. Thus we are convinced that this is the organism that is chiefly concerned in the chronic type of infection.

With regard to the defensive mechanism, we have carried on considerable work along this line. It is possible to build up the defense of chickens by successive infections, giving them at first small amounts of infective material and subsequently increasing the dosage until they are able to resist any amount of such material. We have carried the study further, to see whether the defensive mechanism would continue to be effective in the absence of all infection. We could test this persistence of immunity only over a period of a few weeks, but find that it is maintained for some time in the absence of any lingering infection.

The defensive mechanism itself has no basis in humoral reactions but rather in a cellular one. We have worked out the histology of this reaction. We take a series of solidly immune birds, feed them great numbers of oocysts and then kill individuals at different intervals. We find that the organisms are destroyed in the sporozoite stage. Large numbers of the sporozoites penetrate the cells in the immune bird but the cells, instead of enlarging and taking on a development that is favorable to the growth of the organisms, react unfavorably. The nucleus shrivels up, the cell dies and the organism is thus unable to develop.

The next question was with regard to the developmental period of the different species, that is, the period from the time of feeding the infectious material to the discharge of oocysts. This appears to be quite constant for each species. For example, _E. acervulina_ will discharge oocysts in four days; _E. mitis_ in five days; _E. praecox_ in less than four days (this is the most rapidly developing species known); _E. tenella_ in seven days; _E. necatrix_ in about seven days; and _E. maxima_ in seven days.

Dr. Wilson has asked how many asexual generations are formed before sexual differentiation occurs. There are some species in which one can follow this very easily and other species in which one can not. The first generation is very readily recognized microscopically on account of the globule of material that is carried over from the sporozoite. In _E. tenella_ and _E. necatrix_ the first brood of merozoites can be recognized on account of their very small size. The second-generation merozoites are much larger. In both _E. tenella_ and _E. necatrix_ the sexual forms appear in the third generation. All the organisms present do not differentiate into sexual forms at one time. This is, we will have a certain proportion of them in _E. tenella_ that go over into a third asexual generation, and in _E. necatrix_ there are even more asexual generations but after the third one we can not distinguish them further. That for the present appears to be impossible.

The question in regard to humidity in the incubation of the eggs upon which the oocysts are placed in testing their survival under such conditions appears to be a pertinent one. It might be possible to obtain an atmosphere so moist that the oocysts would survive but this does not appear likely. In our experiments along this line, which were not very extensive, we employed a small Buckeye incubator without additional moisture.

With regard to the value of drug products in the treatment of coccidiosis, we have not attached much importance to this method of attacking the problem. We have not interested ourselves in these questions since it appears to us more important to introduce infection than to keep it out. The great mistake in measures employed to eradicate coccidiosis infection appears to be that they have been too effective. Various clean-up measures are advocated—the use of the fire-gun, the employment of wire platforms, in fact, everything to combat infection—and with what result? I think that Johnson has pointed out the principle that is here concerned. The birds may develop well until they approach maturity but sooner or later infection appears at a time when
INVESTIGATION OF AVIAN COCCIDIOSIS

As our work on *Eimeria necatrix* infection progressed, we were rather surprised to find on administering large doses of infectious material to day-old chicks that they seemed to be coming through much better than older birds. It finally dawned on us that they were more resistant than older birds to this infection. Accordingly, two or three experiments were set up to test out this question of age resistance. One series of birds were tested with *E. tenella* infection and another with *E. necatrix* infection. These birds ranged from about a week old up to two and one-half months of age. In the infection of these two series of chickens the attempt was made to reproduce natural conditions as far as possible. All the birds of various ages were exposed to a given environment. Infective material was mixed with dry mash, care being taken to have it thoroughly incorporated throughout the latter. Water was then added and, after thorough kneading, the moistened mash was fed to those lots of various ages, in the morning after fasting through the night. The chickens were allowed to eat their fill of the infective mash over a period of several hours when they were removed to a sterile environment.

In the *E. tenella* series no marked difference with regard to age resistance was apparent, but in the *E. necatrix* series only a small percentage of the very young birds died while there was one hundred per cent mortality in the older birds. We are thoroughly convinced that the most propitious time for poultry to acquire the latter type of infection is at a very early age. How this may be best accomplished requires further experimentation. It is nevertheless a fact that the exposure of chickens at an early age to *E. necatrix* infection will prevent losses later in life.

As to the question of utilizing the sporulation time of the oocysts in isolating species, it would be quite possible to obtain the promptly sporulating species by picking out the oocysts that sporulate very early.

I do not believe that coccidia survive outside the body very long under ordinary conditions. Dr. Stafseth. We have done a little, bearing on this question. Professor Warner, of the Connecticut Experiment Station, has been carrying on some work along this line. In ordinary soil the oocysts are found to die out with surprising rapidity. Soil taken from a poultry-run within three months after the removal of an infected flock has failed to infect when fed to young chickens. I believe one of the chief sources of infection is to be found in older birds. This brings up the question of carriers. While birds develop protective reactions, coccidial infections commonly tend to persist in them. In one of our experiments we carried *E. necatrix* along for a period of three months by successive reinfection of the same group of birds. The late infections are very light. It seems quite certain that even birds that are temporarily fully protected may, from time to time, possibly at long intervals, become reinfected. Thus older birds are probably an important source of infection. Oocysts may be transported in various ways, on grain bags, shoes, and so forth; in fact, the inadvertent transmission of coccidial infection is rather difficult to prevent except under laboratory conditions. (Applause)

The session adjourned at 12:00 noon.

FRIDAY AFTERNOON, DECEMBER 4, 1931

The sixth and final session convened at 1:15 p. m., President Connaway presiding.

PRESIDENT CONNAWAY: Parasitic diseases constitute a field that has not been given enough attention. At times Dr. Hall has been greatly discouraged over the lack of general interest in this field. When I notified him that he had been appointed the Chairman of this Committee, he wrote back telling me that his impulse was to make a motion that the Committee be discharged. I know that we are not going to discharge this Committee, for year after year there has been an increasing interest all over the country in this special line of work. It would be unfortunate not to discuss these things at every session and work out ways and means for the eradication of some of these parasitic
diseases. They may be a little more difficult than some of the infectious diseases, but I am sure that in tackling the problem in the right way we can do great good.

Dr. H. B. Raffensperger is going to read the report of the Committee on Parasitic Diseases. (Applause)

Dr. Raffensperger read the report.

REPORT OF COMMITTEE ON PARASITIC DISEASES

Dr. Maurice C. Hall, Chairman, Washington, D. C.

Dr. H. M. Martin, Harrisburg, Pa.
Mr. C. L. Johnson, Hartford, Conn.
Dr. H. B. Raffensperger, Moultrie, Ga.
Dr. E. A. Benbrook, Ames, Iowa.

Dr. W. W. Dimock, Lexington, Ky.
Dr. Hubert Schmidt, College Station, Texas
Dr. I. E. Newsom, Fort Collins, Colo.
Dr. B. T. Simms, Corvallis, Ore.

The president of the U. S. Live Stock Sanitary Association formed the Committee on Parasitic Diseases on the basis of representation of the various major areas of the United States, and this report has been drawn up with reference to these areas. First of all, an attempt was made to survey the distribution of the parasites of major importance by areas, and to note what is being done in these areas. These findings are reported first, with comments on the parasites.

PARASITES OF HORSES

Strongyles of the large intestine constitute the most important and dangerous of the horse parasites over the entire United States. They produce nodules in the intestinal wall and aneurisms in the blood-vessels, and either suck blood or attack the intestinal lining and cause extensive injury. Seriously infested animals are unthrifty, less fit as work animals, and subject to colic and intermittent lameness. The larvae appear to be the most resistant of the known nematode larvae and apparently can survive for years in spite of hot, dry sunshine and below-zero temperatures. At present the only control measure applicable on the farm is routine medicinal treatment.

Ascarids are especially troublesome in colts, making them unthrifty and impeding growth. Colts should be put on the safest areas to prevent infection with these worms, and medicinal treatment should be used when indicated.

Bots are commonly present in horses over the entire country. Preventive measures of a practical sort are unknown, but treatment is very effective. Iowa has led the way in a statewide campaign of cooperation among veterinarians, county agents and various official agencies in control of bots, and Illinois is now following this lead. Some other states are planning similar procedures and the indications are that bot campaigns, associated with campaigns against ascarids and strongyles, will become common over much of the United States in the near future to the great benefit of the horse industry.

PARASITES OF CATTLE

Less is known about the parasites of cattle in this country than about the parasites of other domesticated animals. This follows largely from the fact that cattle are very expensive experiment animals and, with limited funds to invest in studies on parasites, the parasites of less expensive animals have been investigated first. Furthermore, the space requirements for cattle are greater per head than for other domesticated animals, except horses, and the limitations of space often hamper investigations of cattle parasites. However, certain parasitic conditions are well known for cattle, and certain information is available for some others.

Piroplasmosis requires no consideration here. It is gradually being eradicated by dipping cattle for the destruction of the cattle-fever tick, and piroplasmosis exists in parts of only four southern states at the present time.

Anaplasmosis came to light a few years ago outside of the cattle-tick area and has since been found to be present in the South, Southwest, Southeast, Middle West, West Coast States and Rocky Mountain States, with only the Eastern States and New England States unrepresented in its area of distribution. Investigations have shown that it is readily conveyed by mechanical
means, as by means of hypodermic syringes, dehorning instruments, lancets and needles, and that it is conveyed in this country by at least three species of ticks, Boophilus annulatus, Dermacentor variabilis and Rhipicephalus sanguineus. The distribution of these ticks coincides with the distribution of anaplasmosis except for the Rocky Mountain States and the Southwest, where it is possible that other species of Dermacentor may be involved. In all probability it will be found to be conveyed by various other ticks, as it is already known to be carried by several genera of ticks in different parts of the world.

It has been reported that anaplasmosis can be conveyed by biting flies, but the published evidence does not indicate that the experiments were adequately checked, as a photo published in a report of this work shows a cow in an open field where the possibility of transfer of anaplasmosis by means of things other than flies cannot be excluded. That biting flies may carry anaplasmosis is a possibility, but more work would have to be done under carefully controlled conditions to establish this. Meanwhile, it is commonly reported that ticks are not found on cases of anaplasmosis as a rule. In this connection it should be kept in mind that ticks can transmit anaplasmosis, engorge within a week and fall off, and anaplasmosis develop three weeks later at a time when the transmitters are no longer present. It is also true that it is very difficult to find seed ticks or nymphs on animals not grossly infected with ticks. However, cattle which develop anaplasmosis should be searched carefully for ticks to throw more light on this point. In this connection it may be noted that educated fingers are probably of more value in the search for small ticks than are eyes. Any ticks found should be accurately identified.

Coccidiosis of cattle was reported from the United States many years ago, but of late it has been receiving much more attention. It is not known to be of importance in New England and in the Southeast and Southwest, but in other sections of the country it is either being more widely recognized or is becoming more generally prevalent and troublesome, and is especially injurious to calves. Satisfactory control measures remain to be developed.

Flukes in cattle have been the cause of losses, most of the known loss being that from condemnation of flukey livers in meat inspection, and part of the loss being from deaths of calves and some unthriftness in animals of various ages. In some places packers deduct the price of livers from cattle from flukey areas, and this deduction may be as high as $2.00 a head. Flukey cattle livers show calcified bile-ducts, and as this calcification is permanent the livers will be condemned as inedible flukey livers any time they are found and regardless of whether flukes are present or have been out of the livers for years. The areas in which liver flukes are present include about 20 states on the West Coast, in the Rocky Mountain States, the Southwest, the South, the Southeast, and the Middle West, the Middle West in this report including certain central and northern states.

It has been somewhat difficult to interest cattle-owners in control measures for liver flukes, for the reason that there are few death losses and usually no striking signs of injury, but when in some places deductions for the value of livers began to be made two or three years ago, following a higher price for liver as a result of its application in treating pernicious anemia, local interest in the subject was aroused. In all probability the practice of deducting the value of flukey livers will become more common, and cattlemen will take steps to control flukes. In general, the emphasis in the control of flukes in cattle has been placed on the destruction of snail hosts by means of copper sulfate and by draining, filling in or fencing off snail-infested areas, rather than on treatment, as treatment is a less simple and inexpensive procedure with cattle than with sheep. The indications are that when economic conditions improve, campaigns to eradicate liver flukes from cattle will follow closely on the campaigns to eradicate flukes from sheep.

Haemonchus contortus, the common sheep stomach worm, is regarded as a serious pest of calves in the East, Middle West, South, and Southeast, but the small stomach worm of cattle, Ostertagia ostertagi, appears to be at least as important in most places, and is much more important on the West Coast.
where *H. contortus* appears to have little foothold. Control measures for these parasites in cattle have had too little attention and little is known about control, especially in regard to *O. ostertagi*.

*Bunostomum phlebotomum*, the cattle hookworm, is present in the East, Southeast, South, and Middle West, and is responsible for severe unthriftness and death among calves. An associated intestinal parasite, *Cooperia punctata*, usually overlooked because of its small size, has been found as the cause of pronounced lesions in the duodenum in calves dying in Louisiana, Maryland and Virginia. No treatment has been found for *Cooperia*, but some of the chlorinated hydrocarbons will produce clinical cure in calves suffering from hookworm disease even when only half of the hookworm infestation is removed.

*Lungworms* are especially injurious to calves and are distributed over the United States from the Atlantic to the Pacific. Nursing treatment appears to be more effective than medicinal treatment. Calves should be put on pastures which do not have a history of previous cases of lungworm infestation on them whenever possible.

*Ticks* of various sorts cause more or less trouble, especially in the South and Southwest. The ear tick can be controlled without dipping, and dipping for ticks has not been resorted to, as a rule, except for fever ticks. Whether it will be necessary or practical to dip for the many two- and three-host ticks which infest cattle remains to be seen.

*Ox warbles* are widespread pests over the entire United States with the exception of a few small areas in which they do not seem to establish themselves. Large-scale studies of these warbles are being carried out in the federal Department of Agriculture with the idea of developing basic information on which to plan control measures of a practical sort. The essential difficulty at the present time is that unless all the cattle over a very wide area are treated for warbles, the benefits are limited, and it is very difficult to get anything approaching widespread cooperation from farmers in most regions.

*Screw-worms* are a serious problem in the Southwest and better control measures for these pests are needed. Fly-trapping is a help, especially if practiced over a wide area. The destruction of carcasses to prevent fly-breeding, and the treatment of all wounds to prevent infection are essentials in control of a satisfactory sort.

**Parasites of Sheep**

*Coccidiosis* of sheep appears to be either more common or more often recognized than formerly. It is widely distributed over the United States and deserves attention to ascertain its importance and to develop control measures for it.

*Taeniasis* appear to be gaining in importance for some reason and are widely regarded as a cause of losses among sheep. Until the life histories of these worms are ascertained, it will not be feasible to ascertain more or less accurately the damage done by them or to formulate satisfactory preventative measures. At present medicinal treatment affords the only control measure.

*Liver flukes* occur in sheep in about 20 states, all areas except the New England and Eastern areas being involved to some extent. The greatest damage appears to be done in the West Coast and Southwest states. For the past three years a control campaign has been waged in California, and the records from slaughter-houses and sheep-owners indicate that liver flukes have been eradicated or practically eradicated from California sheep in the three-year period, a very remarkable record of cooperative accomplishment. The campaign is now being opened in the Pacific Northwest, the Rocky Mountain States, and the Southwest, wherever states show an interest and a desire to cooperate.

The control of liver flukes in sheep is accomplished by the same means as in the control of liver flukes in cattle, i. e. small destruction, and by the additional use of medicinal treatment with carbon tetrachlorid. *The costs are low, the results are dependable, and the procedure is profitable. The federal government has only two men on this work, but will give cooperation, whenever it is possible, to any state ready to go ahead with a control program.*

*Haemonchus contortus*, the common sheep stomach worm, still appears to be the most common and destructive parasite of sheep over most of the United
States. It is becoming more common and troublesome in the Rocky Mountain States as the range sheep business shrinks and the use of irrigated fields for sheep, with the provision of moisture essential for the development of the worm, expands. On the West Coast this worm is very rare and of no known importance.

The control measures for this parasite include light stocking, the rotation of pastures and of different kinds of stock on pastures to the extent that this is feasible, the use of forage crops for sheep, early lambing, the separation of lambs from sheep as early as a date as possible, the raising of lambs on high, dry hillside pastures whenever feasible, and the use of medicinal treatment. Under conditions of moderate stocking stomach worms may be controlled by medicinal treatments once every three weeks over most of the United States, but under conditions of heavy stocking on improved pastures in the South it is necessary to treat every two weeks.

*Ostertagia* spp., the small stomach worms, are more common in many areas than the common sheep stomach worm, and on the West Coast, where *H. contortus* is rare, are very troublesome. Control measures are not so well established as in the case of *H. contortus*, but some of the chlorinated hydrocarbons give good clinical results following the destruction of part of the worms and the lowering of the level of infection.

*Bunostomum trigonocephalum*, the common sheep hookworm, is prevalent over the East, Middle West and South, and is especially troublesome in the South, but is scarce in the Rocky Mountain States and on the West Coast. This worm can be controlled by the same means as the common stomach worm, although there are fewer drugs effective against it, and seems to be much more easily eradicated from a flock.

*Oesophagostomum columbianum*, the sheep nodular worm, was formerly prevalent only in the South, but it has been spreading for years and is established as far north as Maine and as far west as Minnesota. Wherever it goes the intestines of sheep cease to have value as sausage-casings, and it undoubtedly does considerable damage to the sheep. Control measures have not been adequately developed, but certain evidence indicates that the worm is not so persistent in the face of control measures as is the common stomach worm and it seems likely that it could be controlled more easily than the common stomach worm if given more attention.

*Lungworms* are troublesome in sheep over almost the entire country. The thread lungworms have a direct life history and the hair lungworms use land snails as intermediate hosts. Prevention for thread lungworms is a matter of sanitation and the use of safe pastures, but since eating or accidentally swallowing snails is essential in the life history of hair lungworms, it is advisable to see that sheep have plenty of salt, lime and bone meal at all times to ensure against the possibility that mineral deficiencies may lead to a deliberate eating of snails. Infected sheep should be given nursing treatment in safe, dry areas, as no medicinal treatment has yet been established as satisfactory.

*Oestrus ovis*, grub in the head, is prevalent and troublesome over almost the entire country. The most generally recommended control measure is that of tarring the noses of sheep to prevent the fly from depositing larvae in the nostrils; recently a new medicinal treatment for infested sheep has been recommended.

*Lice and sheep ticks* are widely distributed, and sheep ticks are becoming more troublesome in areas where scabies has disappeared and dipping is no longer practiced. The effective control measure for these and similar parasites on sheep or other animals is to dip in suitable dips at appropriate intervals and thus eradicate them. The practice of dipping stock for external parasites should become routine practice on most farms and ranches and if carried out during warm weather there would be much less loss and trouble in cold weather.

**Parasites of Swine**

*Coccidiosis* of swine is receiving attention in the East, Middle West and South, and constitutes a research problem of great interest. Adequate control measures are not yet developed.

*Ascaris suum*, the large roundworm of swine, is present in all sections of the country and is the parasite of greatest known importance in most places. As
the cause of thumps and unthriftiness in young pigs, it is widely recognized as a pest by veterinarians and farmers. Infested animals can be treated satisfactorily by drugs, but the best attack on this parasite is by means of the swine sanitation system. While the total number of farmers using this system is considerable, there are many more who do not use it and have never heard of it and the opportunity for educational work in this field is very great.

Stephanurus dentatus, the swine kidney worm, has long been a parasite of southern swine and is common in the Southeast and Southwest. It is difficult to ascertain the distribution of this parasite in the United States owing to a lack of statistical machinery, but it appears to be spreading slowly beyond its boundaries of 25 years ago. In parts of the South the condemnations of livers, kidneys, etc., because of this parasite, aggregate in value almost 30 cents per animal, and the loss for the United States must run into millions of dollars.

The likelihood that a medicinal treatment for infestations with this worm can be developed is very small, but preventive measures of a very promising sort are being developed. These measures are in the form of a modification of the swine system commonly known as the McLean County system, and they take advantage of the fact that kidney worm larvae passing in the urine are quickly killed by drying. By leaving a strip of bare ground along the edge of a field and placing the hog houses on this bare strip, so that the sow will urinate on the bare ground where the sun can kill the larvae, very promising results are being obtained.

Lungworms appear to be highly important parasites of swine over most of the United States, but less so in New England and the Rocky Mountain States than elsewhere. These worms require earthworms as intermediate hosts, and the sort of earthworms most satisfactory as hosts are those common in dirty hog-lots and not those common in fields and pastures. Hence the swine sanitation system is the most practical control measure, and is the more desirable in view of the lack of a satisfactory medicinal treatment for lungworm infestations.

Trichinosis was very prevalent in human beings a year ago, the number of reported cases exceeding those reported for any previous year. While meat inspection measures and educational propaganda are utilized in the control of this parasite, much that might be done along other lines is not done. Human trichinosis is contracted from eating trichinous pork, and pigs in turn contract trichinosis from eating trichinous pork in the form of dead pigs or uncooked pork scraps or from eating trichinous rats. As a control measure of wide application the swine sanitation system is recommended. This system will exclude the feeding of swill or garbage containing uncooked pork scraps, farmers who will carry it out will not leave the carcasses of swine lying around to be eaten, and rats will continue to frequent hog-pens, corn-cribs and other similar places rather than pastures. Swine sanitation is probably one of our best control measures for diminishing the incidence of trichinosis in swine and man.

Hog lice and sarcoptic mange call for the installation and use of a dipping-tank on the farm. The losses from these parasites are unnecessary and avoidable losses. Control is simple and eradication is usually feasible.

**Parasites of Dogs**

Space does not permit of detailed discussion of dog parasites, but for the sake of human health and comfort, of our live stock to which dogs convey various parasites, and of our dogs themselves, dogs should be kept free from parasites.

**Parasites of Poultry**

Coccidiosis of poultry is a prolific source of loss to the poultry industry over almost the entire country. While there are various control measures of value, the problem of coccidiosis is still a problem in the research stage, both as regards its basic features and its control.

Tapeworms of poultry are receiving constantly increasing attention in all major areas in the United States and are accused of causing larger losses than those of which they formerly were accused. The steady output of research on the life histories of these parasites adds yearly several previously unknown intermediate hosts to the long list of insects, isopods, snails and earthworms
responsible for their transmission. Control measures which will keep chicken droppings away from these hosts are practicable when birds are confined, but not when they are on a range; control measures which will keep these intermediate hosts away from chickens are not entirely practicable under almost any ordinary conditions; and medicinal treatment for some kinds of tapeworms remains unsatisfactory.

*Nematodes* of poultry, including the large roundworm, the cecum worm, the gapeworm, the gizzard worm, the proventricular worm, and the capillarids, are widely distributed and important over the United States. Some of these worms are capable of killing chickens and all of them probably contribute to unthriftiness and help to produce unprofitable birds. Control measures for those with a direct and simple life history are being developed along the lines of sanitation, but, as in the case of the tapeworms, some of these worms utilize intermediate hosts and control is not a simple matter in the case of these worms. Medicinal treatments are effective for the large roundworm and the cecum worm, but we do not have effective treatments for the others.

*Mites and lice,* common over the entire country, are readily controlled by suitable means. There seems to be no reason why control campaigns against these pests could not be successfully carried out on a wide scale.

**Constructive Recommendations**

In order that the livestock industry of the United States may be relieved as rapidly as possible from the burden of loss from parasites, your Committee wishes to point out that the attack on parasites lies along the line of more sound research and along the line of much more general utilization of the available control measures. As regards the parasites of major importance discussed in this report, they may be roughly divided into three groups as follows:

One group has had too little investigation in this country to develop sound and practical control measures. This group includes anaplasmosis, coccidiosis of almost all animals, many of the gastro-intestinal nematodes of cattle and sheep, intestinal tapeworms of cattle and sheep, nodular worms of sheep, kidney worms of swine, and tapeworms and certain nematodes of poultry. The great need in the cases of these parasites is research in order that we may have a sound scientific basis for the development of control measures which cannot be developed in a practical and effective way without more information from investigations.

Another group of parasites has been investigated to the point where effective control measures, sometimes highly effective and sometimes reasonably effective, are available, but these parasites are holding their own or spreading because farm practice has not advanced as rapidly as has our knowledge of control measures. This group includes flukes in sheep and cattle, lungworms in various animals, ticks on various animals, screw-worms, horse strongyles, horse ascarids, bots, common sheep stomach worm, sheep hookworm, lice, sheep ticks, chicken lice and mites, swine ascarids, and the chicken ascarid and cecum worm. What is needed in these cases is action.

The third group includes those parasites for which we have some more or less effective control measures at present, but which still require more research to give us the degree of control we need for the benefit of the livestock industry. This group includes the sheep stomach worm in cattle, the cattle hookworm, ox warbles, some of the small trichostrongyles in sheep, sheep head grubs and trichinosis. From these parasites we can protect our stock to some extent while carrying out research to make our protective measures more effective.

As regards research, your Committee recommends to the members of this Association that they take whatever steps are possible, whenever it is practical to do so, to provide at least one veterinary parasitologist in every state for research on parasites of live stock. One will be inadequate for most states, but more workers can be added later as the need becomes clear. With at least one such worker in each state we might be in a position to map the distribution of our parasites and take measures to check the spread of parasites which now goes on in an insidious fashion with no recognition of what is happening. Meanwhile, the existing research should be encouraged and strengthened. There are a dozen associations and groups interested in one way or another in research in parasitology, and there should be more coordination and coopera-
tion among these groups. Your Committee makes no recommendations for securing formal cooperation of any sort, but it invites attention to these facts: Cooperation depends primarily on a cooperative and friendly spirit among workers, and for the most part such a spirit exists among research workers in this country. Cooperative action is greatly simplified when workers know where to find cooperation of the sort they wish, and there is a dearth of available information as to the existence and location of persons willing to cooperate one way and another on parasite problems. Until we have directories supplying this information, your Committee suggests that requests for information as to persons who will collect parasites, identify parasites, and supply other information be sent to the federal Bureau of Animal Industry, a state experiment station, or the nearest veterinary college.

As regards translating information in regard to control measures into actual practice, the past two or three years have marked an important advance in this matter. Previously, the important campaigns against parasites had been those against scabies, cattle-fever tick, and dourine, all of these being cooperative procedures involving the federal and state governments. All of these were of rather long standing, and no new campaigns had been inaugurated for a number of years. Three years ago the federal Bureau of Animal Industry, in cooperation with sheepmen and various state agencies, began a campaign against sheep liver flukes in California, and within three years that campaign appears to have almost completely eradicated liver flukes from sheep in that state. The campaign has now been extended to other West Coast states and to the Rocky Mountain States. A year ago the Iowa State Veterinary Association, in cooperation with county agents and other officials, began a campaign against bot disease in horses in Iowa and as a result over 100,000 horses were treated for bots. This year Iowa expects to treat 300,000 horses. Illinois is to put on a similar campaign, directed against such horse parasites as bots and ascarids, as a cooperative project of state and federal agencies. Other states are preparing to follow suit in this horse parasite campaign. Finally, a campaign for the wider use of swine sanitation systems is being carried on here and there by various agencies, but has not had the benefit of definite cooperative work and state-wide plans as have the other campaigns.

In other words, new parasite campaigns to supplement the former scabies, cattle-tick and dourine campaigns are now under way and the indications are that in the near future many such campaigns will be inaugurated and will accomplish much more than has been accomplished in the past with mere educational measures. In some cases these campaigns will be headed by federal agencies, in some cases by the veterinarians of a state, and in others probably by state veterinarians, experiment station workers, extension agencies, or stockmen's or poultrymen's associations. Your Committee recommends that members of this Association ascertain the needs of their own states in this connection and take steps to organize parasite control campaigns in cooperation with those interested. This is the best way at this time to translate what we know of parasite control into actual practice and to bring sure relief to a livestock industry which is in distress as a result of present economic conditions.

DR. RAFFENSPERGER: I move that the report of the Committee be adopted.

(Applause)

The motion was regularly seconded.

PRESIDENT CONNAWAY: I want you to take back to Dr. Hall the congratulations of this body that he served this year. We did not let this Committee die. This report shows better than almost anything that has been presented, not only the importance of research but of having research carried on by practical men who will study the habits of that old sow, about her walking up and down that fence. It brings your research into a form that the herdsman can utilize immediately. That is one thing that is very commendable with a great part of the research which is being carried out in this particular field. We must by all means continue this Committee and support it.

The motion to adopt the report was carried.
THE RELATION OF AGGLUTINATION REACTION TO
SALMONELLA PULLORUM INFECTION IN HENS,
AND OBSERVATIONS ON THE DIAGNOSTIC
EFFICIENCY OF TEST METHODS

By HUBERT BUNYEA and WALTER J. HALL

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During the winter of 1930-1931, the writers had opportunity
to apply the stained-antigen, rapid, whole-blood agglutination
test for pullorum disease to more than 1,200 fowls in six small
commercial flocks, with the privilege of purchasing representa-
tive fowls for experimental purposes. It was hoped in this way
to gain further knowledge of the correlation between the aggluti-
nation reaction and the recovery of Salmonella pullorum from the
ovary at autopsy, and also to make observations as to the agree-
ment between the stained-antigen, rapid, whole-blood agglutina-
tion test and the tube agglutination test for pullorum disease in
these experiment fowls. To have attempted to gauge the reliabil-
ity of the stained-antigen test merely by its conformity to
the tube test would not have been conclusive, since the latter
method has not been proved to be uniformly accurate in all
cases. Hence it was considered that inasmuch as pullorum
disease is known to be transmitted primarily by means of the
infection of the hen's ovary with S. pullorum, therefore a demon-
stration of the ovary infection in reactor hens would be a better
criterion in determining the value of any diagnostic test for
pullorum disease. The final criterion is whether the losses from
pullorum disease are controlled.

In all, 206 reactor and non-reactor hens were selected for
experimentation in this connection. Blood samples for compara-
tive tests were collected on the day of the slaughter of the fowls,
and a careful autopsy of each fowl was made, especial attention
being given to the presence of ovary lesions, as well as to a bac-
teriological examination of the ovary, for the presence of S. pullorum.
It has been the experience of the writers that by taking the usual loop cultures of several ova in a hen showing extensive pullorum-disease lesions, *S. pullorum* is sometimes not recovered by this method. Therefore, in view of the probability of overlooking the presence of the organism if cultures were made exclusively by the loop method, it seemed advisable to devise some technic by which the entire ovary should be subjected to cultural examination. The following procedure was adopted:

The hens were killed by severing the jugular vein. Blood was collected in the test-tube for the agglutination test (tube method) and at the same time a stained-antigen, rapid, whole-blood test was made. The fowl was then scalded and thoroughly plucked, and then chilled by washing in cold running water. Before being opened for autopsy, the skin of the breast and abdomen was sterilized by the application of a Bunsen flame. With sterile instruments the carcass was opened and the ovary removed and placed in a sterile mortar, where it was crushed, and then placed in the culture bottle (described below). Large ova were aseptically punctured and placed directly into the culture bottle. In all cases showing typical pullorum-diseased ova, loop cultures also were made.

The medium employed for culturing the ovaries consisted of ordinary beef infusion broth (adjusted to pH 7.2) to which sufficient brilliant green dye (National Aniline and Chemical Company, Incorporated) was added to give a brilliant green content of 1:50,000. This chemical has been shown by Mallmann and Snyder2 to possess the property of inhibiting the growth of colon types of organisms in cultures, and was employed in this connection to reduce to a minimum the possible difficulty which might be occasioned by such forms of contamination.

In order to diminish the possibility of the destructive effect of heat upon this property of brilliant green, the dye was not added directly to the bulk of unsterilized medium, but was aseptically pipetted into the previously sterilized and cooled culture bottles in measured amounts of a freshly made dilution of known strength. It is the practice of this laboratory to make a fresh 1:2500 solution of brilliant green (200 mg. of brilliant green to 500 cc of distilled water) on the day on which the cultures are to be made, and to add 5 cc of this solution to each culture bottle containing 100 cc of the broth. By adding the powdered dye to distilled water which has been previously sterilized by heat, it is not necessary to heat the dye.
The culture bottles used at this laboratory for ovary cultures are half-pint milk or cream bottles, capped with a type of fiber milk cap which protects the lip of the bottle. These caps are damaged by sterilization in an autoclave, but are replaced, after the medium is autoclaved, by fresh caps which have been passed through a 10 per cent formaldehyde solution. The ovary cultures were permitted to incubate for 24 hours, after which subcultures were made upon plain agar slopes. It was necessary in some instances to resort to the use of culture plates to determine conclusively the presence or absence of *S. pullorum*.

The organism was identified in all cases by its characteristic reaction on the following diagnostic media:

- Brom-cresol-purple milk—no change
- Liebig's beef extract dextrose broth—acid with or without gas
- Liebig's beef extract lactose broth—no acid, no gas
- Liebig's beef extract saccharose broth—no acid, no gas
- Liebig's beef extract dulcite broth—no acid

The organisms were also examined in many instances by the agglutination method as well as tinctorially and morphologically.
The blood serum of all fowls slaughtered was tested for pullorum disease by the tube agglutination method, using dilutions of 1:25, 1:50 and 1:100. An agglutination in 1:25 only was regarded as suspicious, while such a reaction in 1:50 or 1:100 was regarded as positive for pullorum disease.

The salient findings which were developed in this investigation are presented diagrammatically in the accompanying charts.

Figure 1, A shows that 143 of the 206 hens used reacted to the tube agglutination test, and of these reactors, 114 hens (80 per cent) were found upon bacteriological examination at autopsy to harbor *S. pullorum* in the ovary.

In figure 1, B it is seen that of 206 hens, 135 reacted to the whole-blood, rapid agglutination test, and of these, 112 hens (83 per cent) were found upon bacteriological examination at autopsy to harbor *S. pullorum* in the ovary.

By a comparison of the bacteriological findings following autopsies of reactors to the tube agglutination test with those of reactors to the whole-blood, rapid agglutination test, it is noted that the tube method found 114 reactors which yielded *S. pullorum*, while the rapid method was successful in detecting 112 of these actually infected reactors, a deviation of 1.75 per cent. In the case of the two fowls involved in this deviation, the reaction to the tube test was partial, and to the rapid test, slight.

It is further noted that in detecting these two additional ovary-infected fowls, the tube test condemned 6 additional non-ovary-infected fowls, which lowered its diagnostic efficiency in detecting ovary-infected fowls to 80 per cent, as against 83 per cent for the whole-blood, rapid agglutination test.

Figure 2, A shows that of 206 fowls tested by both methods, there was an agreement in the reactions in 130 reactor cases and 58 non-reactor cases, making a total of 188 agreements, or 91 per cent agreement between the tube and the rapid whole-blood methods. Of the 18 cases where the two test methods disagreed, 13 were positive to the tube test and negative to the rapid test, while 5 were positive to the rapid test and negative to the tube test. Of the 13 cases diagnosed by the tube method alone, two were found to harbor *S. pullorum* in their ovaries.

Figure 2, B shows that of 114 reactors which harbored *S. pullorum* in their ovaries, 86 reactors (75.4 per cent) had active ovaries, and were therefore potential spreaders of pullorum infection to their offspring at the time when they were slaughtered.
The remaining 28 infected reactors (24.6 per cent) had inactive ovaries at the time of slaughter.

Figure 2, C shows that of the 114 reactors from which *S. pullorum* was isolated from the ovary, 13 cases (11.4 per cent) demonstrated no gross pathological lesion of the ovary, while of the 143 reactors detected by the tube test, 14 cases (10 per cent) failed to demonstrate the presence of any gross pathological lesions of the ovary. On the other hand there were 4 cases (3.5 per cent) in which gross pathological lesions were demonstrated in the ovary, but from which *S. pullorum* was not recovered.

![Bar chart](chart.png)

**Fig. 2.** Charts showing percentage of agreement, reactors yielding organism, and data on lesions.

**SUMMARY**

Two hundred six hens tested by the tube agglutination test and the stained-antigen, rapid, whole-blood agglutination test for pullorum disease showed an agreement of 91 per cent between the two tests.

The tube method showed 143 reactors, of which 114 fowls (80 per cent) at autopsy yielded *S. pullorum* from their ovaries.

The stained-antigen, rapid, whole-blood method showed 135 reactors, of which 112 fowls (83 per cent) at autopsy yielded *S. pullorum* from their ovaries.
Of the reactors whose ovaries were shown to harbor *S. pullorum*, 75.4 per cent had active ovaries, and 24.6 per cent had inactive ovaries at the time of slaughter.

Of the reactors yielding *S. pullorum* in their ovaries, 11.4 per cent showed no gross pathological lesions of the ovary. Of all reactors autopsied, 10 per cent failed to show gross lesions, or the presence of *S. pullorum* in their ovaries. Of all reactors autopsied, 2.7 per cent demonstrated gross pathological lesions but did not yield *S. pullorum* in their ovaries.

**CONCLUSIONS**

In 206 fowls included in this study, the tube agglutination test and the stained-antigen, rapid, whole-blood agglutination test were highly accurate in the detection of hens which harbored *S. pullorum* in their ovaries.

In 75.4 per cent of cases, the *S. pullorum*-infected ovaries were active, hence these fowls were potential disseminators of the disease.

*S. pullorum* infection is present in some apparently normal ovaries of hens.

Reactors whose ovaries do not yield *S. pullorum* may or may not demonstrate pathological lesions of the ovary.

The fifty negative reactors failed to show lesions on postmortem examination or the presence of *S. pullorum* in the ovaries.

**REFERENCES**


**PRESIDENT CONNAWAY:** The next paper is "Studies of the Etiology of Laryngotracheitis (Infectious Bronchitis) of Chickens," by Dr. J. R. Beach. (Applause)

. . . Dr. J. Traum read the paper. . . .

**STUDIES OF THE ETIOLOGY OF LARYNGOTRA-CHEITIS (INFECTIOUS BRONCHITIS) OF CHICKENS**

*By J. R. BEACH, Berkeley, Calif.*

*Division of Veterinary Science, University of California*

Since its first recognition, in 1924, as a distinct disease of poultry, infectious laryngotracheitis or, as it has been more commonly termed, infectious bronchitis, has rapidly assumed a
position of major economic importance to the poultry industry of the United States and Canada. It is not known to have occurred elsewhere in the world.

From 1924 to 1926, studies of the disease were reported by Gwatkin, in Canada; May and Tittsler, in Rhode Island; Eriksen, in Missouri; Hinshaw, in Kansas; and Beach, in California. By these studies the infectious and distinct nature of the disease was established. The causative agent was found to be contained in the exudate which accumulates in the larynx and trachea of infected fowls but its presence in other organs was not demonstrated. Transmission to susceptible fowls was readily accomplished by intralaryngeal or intratracheal inoculation with exudate from the larynx and trachea of infected fowls. Attempts to produce the disease by subcutaneous, intravenous, intramuscular, or intraperitoneal injection of tracheal exudate, however, yielded either entirely negative or questionable results. Efforts by ordinary bacteriological procedures to isolate from diseased fowls any species of bacteria with which the disease could be reproduced were uniformly unsuccessful. Like results from studies of the disease were reported by Kernohan, in 1930. He also reported inability to pass the "virus" through Seitz, Berkefeld "W," Chamberland "F" or Mandler filters. This brief résumé includes all of the important investigations of laryngotracheitis that had been reported at the time the studies of etiology, reported, herein, were undertaken.

For these studies, chickens were infected by means of intratracheal injections with one or another of four strains of the causative agent of the disease. The original infective material consisted of exudate from the trachea of diseased fowls from two farms in New Jersey and two farms in California. It was not used for the experiments until it had been passed at least twice through chickens in which it produced characteristic and uncomplicated symptoms and lesions. The manifestations of disease in the experimentally infected fowls were therefore uniform and the interpretation of the results of the experiments was not confused by the presence of intercurrent disease. The sole source of chickens for the experiments was an inbred strain of Rhode Island Reds that had been neither affected with nor exposed to any infectious disease for several generations. These fowls were uniformly highly susceptible to the disease, notwithstanding the fact that their age at time of use varied from 10 days to 2\(\frac{1}{2}\) years.
The extremely contagious nature of the disease made it unusually difficult to avoid accidental cross-infection among fowls used in the experiments. For this reason, the means that were successfully employed in preventing such cross-infection are worthy of brief description.

All fowls were kept in metal cages which were sterilized by boiling. The caged chickens were kept in isolation units, unconnected with each other, each having its own equipment of utensils, and of overalls, rubber gloves and rubber overshoes. These were invariably worn by anyone who entered a unit for any purpose, and the persons entering were limited to the writer and occasionally his assistant. An isolation unit and its equipment were never used a second time without thorough cleaning and sterilization with very hot water, procedures found through several years of usage to be adequate to prevent the transfer of infection. Chickens inoculated with different types of material were never placed together. Groups of chickens which were inoculated with material of the same type or with graded doses of the same material however, were kept in a single unit. In such instances the data were discarded if the time of the first indications of disease made it possible that later cases resulted from cross-infection from the first cases. In the early experiments a cage containing one or more normal fowls was placed in the same unit with each lot of inoculated chickens to provide a control on the presence of virus in the unit. This precaution was discontinued when it became evident that it was unnecessary.

Bacteriological Studies

The failure, previously mentioned, of a number of investigators to isolate from diseased fowls an organism that could be regarded as the causative agent of laryngotracheitis made it evident that if the disease were due to any bacterial species, it was not one that could be readily seen or cultivated. For this reason, a number of methods for preparing material from diseased fowls for microscopic examination and several types of media (usually ten) for cultivating bacteria were employed. No tube culture was discarded as negative until after incubation for 10 to 20 days and no plate culture until after incubation for 48 hours and examination both with the unaided eye and microscopically. By these procedures examinations were made of the exudate from the larynx and trachea of 61 chickens, of the spleens from 67 chickens, and of the livers from 48 chickens that died of
the disease or that were chloroformed after definite symptoms had developed.

Results of examinations of tracheal exudates: The stained films of tracheal exudate from 24 chickens contained no bacteria, and those from 37 chickens varying numbers of various forms, none of which could be regarded as predominant. No bacteria were seen in dark-field examinations of fresh preparations unless they were also present in stained preparations of the same material. Spirochetes, which Gibbs reported to have been frequently present in the larynx and trachea of chickens with infectious laryngotracheitis, were not observed.

In about half of the cases the bacterial growth in all cultures was so heavy and profuse that pure-culture isolation was not attempted. In view of the exposed location of the exudate and of the findings in many of the films, such results were to be expected.

In 17 instances it was possible to pick discrete, minute colonies and therefrom to secure pure cultures. One of these proved to be a small Gram-positive coccus, one a small Gram-negative rod of the Pasteurella type, and 15 were diphtheroids. These last are probably similar to the organism reported by Graham as present in laryngotracheitis lesions and found by him to possess considerable pathogenicity for chickens.

In 12 instances all media inoculated with tracheal exudate remained sterile. It was rather surprising to find bacteria absent from the tracheal exudate in so many cases.

Results of examinations of spleens and livers: No bacteria were observed in the stained films or in fresh preparations examined by dark-field illumination from any of the spleens and livers. The cultures from 64 spleens and 45 livers were negative. Growths of a diphtheroid type of organism were obtained in the cultures from two spleens and two livers; of a coccus from one spleen; and of a streptococcus from one liver.

Pathogenicity of the strains isolated: Since, as will be shown later, it was found possible to produce laryngotracheitis by inoculation with material that was bacteria-free, the only effort to determine the pathogenicity of the strains isolated was one series of injections into chickens of a saline suspension of a mixture of ten strains. The results were entirely negative.

Causative Agent Present in Spleen and Liver

In attempts to find the causative agent in tissues that are normally free from bacteria and, therefore, more satisfactory for
bacteriological examination than tracheal exudate, and also to throw some light on the distribution of the virus in the body, chickens were injected by the intratracheal method with saline or broth emulsions of spleens and livers of infected fowls. The presence of the causative agent was demonstrated in 18 of 30 spleen emulsions and in 2 of 6 liver emulsions by the appearance of typical symptoms and lesions of laryngotracheitis in the fowls on the third, fourth or fifth day following injection. The adequate control of environmental conditions and the uniformity of results made it certain that the disease that followed the injection of spleen and liver tissue resulted from infective properties of the material injected. Bacteria were not found in any of the tissue emulsions which were infective. The concentration of the causative agent was shown to be considerably less than in tracheal exudate.

The results of these experiments, together with the absence in chickens with laryngotracheitis of lesions in any organ except the respiratory tract, indicate that the presence of the causative agent in the liver and spleen does not indicate any real involvement of those organs, but merely that injury to the blood-vessels of the larynx and trachea of diseased fowls permits the entrance of the causative agent into the blood-stream and its distribution. Further evidence that laryngotracheitis is not accompanied by a general organic or systemic involvement is provided by the fact that no thermal reaction of significance occurred in the experimentally-infected chickens.

**Filtrability of the Causative Agent**

When efforts to find a bacterial cause of laryngotracheitis failed, experiments to determine the presence of a filtrable virus in the virulent tracheal exudate of diseased fowls were undertaken.

**Methods:** In the filtration experiments, Berkefeld “V” and “N” candles and Seitz discs have been used. The Berkefeld candles were given a preliminary test of their ability to retain bacteria by the filtration of a young (6- to 24-hour) broth culture of a chromogenic strain of *B. prodigiosus*. A like test was made at each filtration. In all instances the media inoculated with unfiltered material yielded a profuse growth of *B. prodigiosus*, whereas the media inoculated with filtrates remained sterile.

The comparative porosity of the Berkefeld filters was determined by the water-flow test of Ward and Tang, by which
measurement was made of the amount of water that will flow through them in 5 minutes at 10 cm. negative pressure. Filters that passed an excessive quantity of water were discarded irrespective of whether or not they retained bacteria.

The filtration tests were made with exudate from the trachea of fowls that had been artificially infected with one of four strains of the disease, suspended in infusion broth or other diluent. The unfiltered material and the filtrates were tested by the injection of small quantities into the trachea of susceptible chickens.

Results of filtrations: A summary of 36 filtration experiments, in which all 4 strains of the disease were used, is given in table I. In all but two of the experiments the tracheal exudate was suspended in bouillon; in those two Tyrode's solution was used.

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<td>6 (pads)</td>
<td>New Jersey I</td>
<td>8</td>
<td>4</td>
<td></td>
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<td></td>
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<td>New Jersey II</td>
<td>1</td>
<td>0</td>
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All of the eight Berkefeld V filters gave positive results while only two of the six N filters allowed the etiological agent to pass. These two, by the Ward and Tang test, were as porous as the V type. Of the four filters that gave negative results, one was as porous as the V filters, while the remaining three were less porous. The results indicate that the passage of the disease-producing agent is in some way dependent upon the grade of the filter.

Since all of the V filters gave positive results, some consideration must be given to the six negative experiments. In two of them Tyrode's solution was used to suspend the exudate. As this same exudate, suspended in bouillon and passed through other filters, produced disease, it was concluded that Tyrode's solution is not a suitable diluent. The negative results in the remaining four experiments may be due to adsorption of the
etiological agent on the filters. That there is adsorption was shown by titrations of filtered and unfiltered suspensions.

All of six attempts to pass the virus through Seitz discs gave negative results. The Seitz filters are so much more porous than the Berkefeld candles that the size of their interstices cannot account for their failure to pass the infectious agent. It is probable that some physico-chemical property of the filter pad or of the agent is responsible.

Of the 30 Berkefeld filtrates tested, 19 produced disease, which was typical in every respect except that the incubation period was from one to two days longer than that in control birds. Titration experiments referred to above, with filtered and unfiltered suspensions, show that a large amount of the infectious agent is lost during passage through the Berkefeld candles. It seems probable that the lengthened incubation period in the fowls receiving the filtrate was due to the small amount of the agent present.

The positive results in these filtration experiments are sufficient to establish the fact that the agent that causes laryngotracheitis in chickens is a filtrable virus. Evidence of the filtrable nature of the causative agent of the disease has also been presented by Graham.

**Neutralization Experiments**

Since viruses as a class differ from bacteria in that they are more readily neutralized by immune sera and are more resistant to drying, it was of interest to determine whether the laryngotracheitis virus was typical in these respects. Immune serum was obtained from chickens after recovery from infection with a New Jersey strain of the disease. This was mixed with tracheal exudate from fowls infected with a New Jersey strain and from fowls infected with a California strain of virus. When the proportions were properly adjusted, mixtures of immune serum and tracheal exudate, containing from 10 to 100 times the minimum infective dose of N.J.II or C.V strains of virus, would not produce disease when injected into the tracheas of susceptible chickens.

The finding that the serum of chickens that had recovered from infection with a New Jersey strain of virus was equally effective in neutralizing in vitro the New Jersey and the California strains of virus provides evidence of the etiological identity of the disease known as laryngotracheitis or infectious bronchitis in the two widely separated states.
Resistance to Drying

Although few tests on the resistance of the virus to drying have been made, they show that it withstands conditions that kill most bacteria.

In one experiment, exudate in tubes was kept in a desiccator containing calcium chloride at incubator temperature for 2, 4, 6, 8 and 10 days. The tubes were sealed with wax and stored in a refrigerator for two months, at which time the material was tested and found to produce disease.

In another experiment, exudate kept in a desiccator over calcium chloride at refrigerator temperature for 29 days was found to be active.

Swift's method that preserves bacteria as well as viruses has been to keep on hand adequate supplies of virus and to obviate the necessity of continuous passage through fowls. When the drying has taken place rapidly and the tubes containing dried exudate sealed and kept in the refrigerator, it remained alive for 156 days. No tests have been made on virus stored for a longer period.

Host Specificity of the Disease

The transmission of laryngotracheitis to birds other than chickens was attempted to determine: first, to what extent other species, particularly the wild species and domesticated but free-flying species such as pigeons, might be susceptible and therefore of importance as agencies in the spread of the infection, and, second, if there were some bird host less susceptible than the chicken, by the passage through which the virulence of the causative agent might be so modified that it could be utilized for the immunization of chickens.

In these experiments, 5 sparrows, 1 crow, 3 doves, 1 starling, 9 pigeons and 15 ducks were used. The injections were entirely by the intratracheal method. The virulence of the inoculum was always demonstrated by the inoculation of susceptible control chickens. These experiments resulted in complete failure to transmit the infection to any of the birds except the control chickens.

Attempts have been made to transmit laryngotracheitis to rabbits, guinea pigs and white rats, by intratracheal, intracerebral and intravenous injections, and to one swine by intratracheal injection of tracheal exudate taken from diseased fowls.
The presence of the causal factor in the material injected was demonstrated in all instances by its ability to infect control chickens. None of the animals was found to be susceptible to the disease.

**SUMMARY AND CONCLUSIONS**

1. The causative agent of infectious laryngotracheitis of chickens was found to be present in bacteriologically sterile tracheal exudate, spleens and livers of diseased fowls.

2. The causative agent was present regularly in the tracheal exudate, in the spleens of about 60 per cent, and in the livers of about 30 per cent, of chickens with active laryngotracheitis infection.

3. Suspensions of the spleen and liver were less effective in causing the disease than those made from the tracheal exudate. This finding, together with the absence of pathological changes in the spleens and livers, would seem to indicate that these are not actively involved but that the causative agent is carried to them by way of the blood.

4. The disease, in our experience, could be produced only in chickens. Domesticated ducks and several wild and free-flying species of birds, including sparrows, crows, starlings, doves and pigeons, were found to be refractory, and so too, were rabbits, guinea pigs, white rats, and one pig that was tested.

5. The experiments demonstrate that laryngotracheitis is caused by a filtrable virus that, because of its size or some other property, does not pass readily through the finer filters.

6. It was shown that the sera from fowls that have recovered from an infection with a New Jersey strain of virus will neutralize the same strain and also the one California strain tested.

7. The virus dried over calcium chloride at incubator temperature for 10 days and then stored in the refrigerator for 60 days produced disease. Kept over calcium chloride in the refrigerator for a month, it was still active and, when dried by Swift's method, it remained alive for 5 months.

**REFERENCES**

5 Beach, J. R.: Jour. A. V. M. A., lxvii (1926), n. s. 21 (5), pp. 570-580.
THE OHIO PLAN OF FOWL-POX VACCINATION

By GEO. H. PIERCE, Columbus, Ohio

State Veterinarian

Extensive outbreaks of fowl-pox occurred in Ohio during 1930 and numerous requests came to the Ohio Department of Agriculture for its control.

A plan for the prevention of fowl-pox was approved by the Agricultural Extension Division, Ohio State University; Ohio Experiment Station; College of Veterinary Medicine, Ohio State University, and the Ohio Department of Agriculture and is as follows:

(A copy of "Supplement to Grow Healthy Pullet Project—Emphasizing Vaccination to Control Fowl-Pox," may be obtained by writing Extension Service, Department of Poultry Husbandry, Ohio State University, Columbus, Ohio.)

Plan

Meetings were arranged in 26 counties with the county agents, local veterinarians and in some cases with the local hatcherymen and poultrymen. These meetings were well attended by the veterinarians. It seemed that the poultrymen of Ohio gained the impression that veterinary services for poultry diseases were prohibitive on account of the cost. These meetings were very satisfactory along this line as the veterinarians agreed to vaccinate each bird for $2\frac{1}{2}$ to 3 cents; this included the trip, the vaccination and a return trip to check the "takes."

In most instances the veterinarian lost money on the project, unless the flock was large. However, it brought him in contact with new clients and he also was consulted about various other diseases affecting their livestock. The relationship between the local veterinarians, the county agent, the Agricultural Extension Department of the Ohio State University and the Division of Animal Industry, Ohio Department of Agriculture, was on a friendly basis and each seemed to realize and appreciate the importance and duties of each faction involved. A cooperative spirit existed between these various factions, and we hope to be able to have this cooperation continue.
Information as to the number of birds vaccinated and the data obtained from vaccination have as yet not been secured. The results obtained were very satisfactory and the cooperative plan will be continued more extensively next year.

PRESIDENT CONNWAY: We will have the report of the Committee on Transmissible Poultry Diseases, by Dr. A. F. Schalk. (Applause)

Dr. Schalk read the report. (Applause)

REPORT OF THE COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY

Dr. A. F. Schalk, Chairman, Columbus, Ohio

Dr. Hubert Bunyea, Washington, D. C. Dr. L. M. Roderick, Fargo, N. D.
Dr. E. L. Stubbs, Philadelphia, Pa. Dr. Leo F. Rettger, New Haven, Conn.
Dr. H. J. Stafseth, East Lansing, Mich. Dr. W. R. Hinshaw, Davis, Calif.

Through a corresponding conference of your Committee on Poultry Diseases, a number of topics were suggested for presentation to the members of this Association. Practically all of the subjects suggested are those that have been given intelligent consideration by recent previous committees and to some members they might possibly appear as somewhat “shopworn.” This is undoubtedly true in some instances, but, nevertheless, they are staple “old line” topics, pressing for more enlightenment and solution, and anything we may say regarding them may be considered as “Twice Told Tales,” but this time, we hope, with more emphasis than before. Duplication and repetition are worthy practices in many lines of education and we believe they are quite justifiable in this particular instance.

EDUCATION AND SANITATION

In the absence of more definite, well-established knowledge pertaining to the epizootology, etiology and efficient therapeutic procedure in most poultry diseases, it appears as though, meanwhile, we can perform greatest service by concentrating upon general and special sanitary measures with the hope of prevention of disease. This calls for a broad comprehensive program of education for the poultry-owners. Such a campaign can be made possible only by the diligent and enthusiastic support by practically the entire veterinary profession, including state and federal regulatory officials, practicing and extension veterinarians, laboratory diagnosticians and veterinarians engaged in teaching.

An excellent beginning has been made by some of the foregoing agencies and numerous experimental projects are in progress that will greatly add to our stock of knowledge regarding special hygiene and sanitation, as well as new pathological data that will serve as valuable aids in coping with poultry-disease prevention and control in general. Therefore, it is essential for all concerned to redouble their efforts towards extending a more liberal education to those responsible for the keep of the poultry, that a higher grade of hygiene and sanitation may be attained in the poultry industry.

FOWL PARALYSIS

One member of your Committee writes that the etiology of this disease is certainly in a “chaotic condition.” Another states that the problem is in a “nebulous state.” We most heartily concur in the sentiments of both. Various hypotheses have been advanced as to its cause, chiefly among which may be mentioned: specific bacterial infection, coccidial involvement, tapeworm infestation and nutritional deficiencies. Advocates of each appear to have some substantial evidence at hand to support their contentions.

Is it possible that a disease of such uniform symptomatology and consistent pathologic anatomy can develop from a multiplicity of rather widely differing etiologic agents? Fowl paralysis is occurring in chickens in so many different
areas throughout the world that it can almost be considered a universal
disease. It is rapidly becoming a problem of unusual economic importance
which is urgently calling for solution. Consequently, your Committee deems
it highly advisable for workers in poultry pathology to take cognizance of the
magnitude of this problem and accordingly institute systematic researches on
the subject, that may, at least, throw more definite light on the cause of the
disease, which might ultimately pave the way for its prevention or control.

PULLORUM DISEASE

There is no one single condition in the entire category of poultry diseases
that has been given as much recent special study as that of pullorum disease.
Its extensive distribution, with its attendant vast economic losses, has com-
mmanded the consideration and enlisted the services of a large number of
investigators. Enrolled in this field of research, we find individuals, various
cooperating groups and special associations and conferences. In this way a
majority of the state experiment stations, the U. S. Bureau of Animal Industry
and some departments of the Dominion and provincial governments are
engaged in special studies on some phase of this disease.

Having the facts before us and knowing that this army of men are applying
themselves to the problem with enthusiasm, diligence and faithfulness, it
would not be prudent to embarrass them with additional specific recommenda-
tions at this time. However, instead, we believe that the Association should
extend to them an expression of confidence and encouragement and good faith,
in the programs outlined and preliminary results accomplished. Lastly, we
wish to voice our sincere hopes that the near future will find their labors suc-
cessful, at least to the extent that they will have established certain
standard methods for an efficient detection of this disastrous condition. In
fact, the Conference of Official State and Federal Research Workers in
Animal Diseases of North America has taken very definite action as regards
this problem, and significant progress has been made in the way of establish-
ing standard methods for the diagnosis of this disease.

AVIAN TUBERCULOSIS

Someone recently remarked, in a humorous vein, that there appears to be a
continuous “open season” on committee recommendations and resolutions
pertaining to avian tuberculosis. While there may be considerable truth in
that statement, I do not think that anyone concerned in live stock sanitation
would advocate a very protracted “closed season” on a disease so extensive in
distribution, so economically important and so vitally involved in our national
Tuberculosis Eradication Program.

Perhaps, there has been a sufficient amount of recommending, “resoluting,”
advocating plans, policies and programs by various associations. Possibly
instead of making further recommendations this year, we had better strongly
suggest and urge that more vigorous attempts be made to carry out efficiently
the plans and programs already adopted. There seems to be undue delay in
many places in putting the programs in operation and thus much valuable
time is being lost. The regulatory authorities in some states harboring tuber-
culosi have promulgated and adopted regulations to control and eradicate the
disease. They have made a splendid start and some real progress is being
made. It is earnestly hoped that other states, where the disease is a problem,
will immediately take steps to do their part in the Avian Tuberculosis Eradi-
cation Program.

Your attention is herewith especially called to the Plan for the Eradication
of Tuberculosis from Poultry, adopted and recommended at the seventh annual
meeting of the Mid-Western States Tuberculosis Conference, Saint Paul,
Minnesota, June 12, 1931. You will find this plan incorporated in the report
of the Special Committee on Tuberculosis of the American Veterinary Medical
Association.*

FOWL-POX

No attempt will be made to enter into a lengthy discussion of this disease in
this report as the regular poultry disease program carries a title on the subject,
with special reference to pox vaccination in Ohio.

Suffice it to say that vaccination for this disease, in practically all parts of the country, is reported very satisfactory when carried out with reliable, potent virus, on healthy fowls of proper age, at the right time of the year and in accordance with proper technic. Pigeon-pox vaccine used on chickens has not had sufficient trials in this country to admit of definite conclusions as to its efficiency.

**The Utah Plan of Veterinary Control of Poultry Diseases**

An earnest endeavor was made by your Committee to have some member of the Utah Poultry Producers’ Cooperative Association present a paper covering in full the details of the Utah Plan of Veterinary Control of Poultry Diseases as practiced by their Association. Having failed in this, Mr. Clyde C. Edmonds, secretary and general manager of that organization, was kind enough to outline the high points of their plan which we are submitting here as a part of the report of the Committee, so that the members of our Association may have it for consideration.

The Utah Poultry Producers’ Cooperative Association was organized and began operations in 1923. At that time Utah was practically a virgin state as regards poultry diseases. However, realizing the great probability of invasion of diseases from without, through importation of baby chicks and live poultry, the Association, early in its operations, decided to engage the services of a full-time licensed veterinarian. The duty of the veterinarian was to visit each of the Association’s cooperating poultrymen, and discuss with them problems of sanitation and render such service in the prevention and control of disease as he had at his command.

It soon became quite evident that the problem possessed such enormity and the territory to be covered was so extensive that it was utterly impossible for one veterinarian to give service sufficiently efficient as desired by the Association and required by the cooperators. Consequently, they revised their plans so as to include ten veterinarians. These ten men were engaged in widely separated locations throughout the State, so as to avoid excessive travel costs that would be incurred by sending veterinarians out from the central office at Salt Lake City. By this plan the veterinarians work locally mostly, servicing the flocks in their immediate and adjacent territory, but occasionally are called to neighboring districts when the demand arises.

In some districts the veterinarians are employed full time, while in others only part time is required to service the flocks satisfactorily. Those serving full time are constantly contacting the producers and continuously carrying on a systematic educational campaign. This educational program consists chiefly of stressing the supreme importance of general, high-grade hygiene and sanitation, such as suitable poultry-houses, adequately ventilated; frequent, thorough cleaning of the poultry-house and its equipment and proper disposal of the litter; installing sanitary watering and feeding devices that will reduce contamination to a minimum; advising them as to the proper kinds and quantity of food; instructing them as to the best methods of selecting breeding stock, incubating the eggs and brooding baby chicks; and how to locate building sites and how to construct and maintain sanitary yards and runways for both young and old poultry. In fact their teaching includes everything in the care and management that has a possible bearing on the health of the fowls.

When veterinarians are employed only part time, they usually put in two, three or four days a week. They work under the instructions of the Association, contacting those poultrymen who appear to need their assistance most.

It is understood that each veterinarian will attempt to visit every poultryman within his district at least twice a year. They make it their business to try to visit the poultrymen’s coops in January or February, to check up on their brooder-house conditions and to see that everything is clean and sanitary and in proper condition to receive the baby chicks which will be coming in February, March and April, and then they make it their business, along in August or September, to contact each and every poultryman again, to see that his growing pullets are coming along in good shape and to determine whether or not they need to be wormed, or if any other undesirable condition exists, so they will be in proper shape before they are actually put into the laying-pen.
As specific precautions to avoid spreading disease, the veterinarians always disinfect their rubbers or shoes in some reliable disinfectant before entering a poultryman's premise. They also constantly urge that the producers bar all hucksters, peddlers and trespassers, or compel them to disinfect their footwear before going into the poultry-houses, yards and runways. Also, in so far as possible, they endeavor to have owners keep dogs and cats away from the yards and runways frequented by poultry.

Most cooperators readily comply with the foregoing suggestions and instructions. However, those who do not comply with same are usually easily brought in line by a quarantine system. If the poultryman insists upon maintaining a filthy, insanitary place, he is quarantined by placing a large red and black sign on the front of his coop which reads, "Insanitary Premises, Keep Off." The result is that he usually immediately cleans up as soon as he is placed under such quarantine. All veterinarians employed are deputy state veterinarians, having full power to quarantine. By this arrangement their authority is not questioned.

A modernly equipped pathological laboratory is maintained at headquarters for the benefit of the veterinarians in the field. When in doubt about disease conditions, specimens can be forwarded to the laboratory for a correct diagnosis, which will materially assist him in making recommendations to his client. In addition, a 200-foot poultry-house, properly divided, is contemplated being built in connection with the laboratory at Salt Lake City. Here they propose to carry out experimental work on biological treatment for the prevention and cure of poultry diseases.

The veterinary service is paid for by the Association through the general overhead expenses of the company. Expenses are pro-rated on a per-egg-case basis and partly absorbed in the feed department. In this way the cost pro-rated per case of eggs produced or bags of feed used is so slight and minimal that the producer hardly recognizes it.

This review is an attempt to cover the high points of the Utah Poultry Producers' Cooperative Association plan of veterinary control of poultry diseases, as given your Committee by Mr. Clyde C. Edmonds, secretary and general manager of the Association. He states that the plan is working out very satisfactorily but the Association is ever open for suggestions for improvement of their plan. Should any one desire further detailed information regarding any phase of this plan, same will be gladly furnished by Mr. Edmonds.

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DR. SCHALK: Mr. Chairman, I move the adoption of this report.

The motion was regularly seconded and carried.

PRESIDENT CONNAWAY: We will now have the report of the Committee on Miscellaneous Transmissible Diseases, by Dr. A. W. Miller. (Applause)

Dr. Miller read the report.

REPORT OF THE COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES

Dr. A. W. MILLER, Chairman, Washington, D. C.

Dr. Jacob Traum, Berkeley, Calif. Dr. Edward Records, Reno, Nev.
Dr. M. Jacob, Knoxville, Tenn. Dr. C. C. Hisel, Oklahoma City, Okla.
Dr. H. C. Givens, Richmond, Va. Dr. H. F. Lienhardt, Manhattan, Kans.
Dr. W. A. Hagan, Ithaca, N. Y. Dr. Howard Welch, Bozeman, Mont.

Your Committee on Miscellaneous Transmissible Diseases submits the following report:

ENCEPHALOMYEILITIS OF EQUINES

In July, 1930, there appeared in central California an extensive outbreak of an acute disease of horses and mules. Before its subsidence with the onset of cooler weather, approximately 6,000 animals were involved with a reported mortality of about 50 per cent. In the summer of 1931, the disease again appeared in the same area and in various other parts of California and spread...
to or appeared in parts of Oregon and several counties in western Nevada. In the fall of 1931, the disease again subsided with the onset of cooler weather in the various areas involved.

Frank cases of the disease, severe enough to be diagnosed definitely in the field, were characterized by marked disturbances of the central nervous system with variable complications arising from the animal's incapacity or collapse. While somewhat variable on a basis of locality, stage of the outbreak and weather conditions, the mortality was high. Estimates on the percentage of permanent disability among "recovered" cases vary. In most parts of California it is reported as having been low. In those districts in Nevada where a careful check-up has been made, it has been found to be very high among the reasonably severe cases which did not actually succumb to the disease.

Clinically and epizootically, this outbreak on the Pacific Coast appears to have shown nothing to differentiate it distinctly from the previously reported epizootics of a similar nature which have ravaged the equine population of widely separated areas throughout the United States periodically since at least 1850 and probably before.

In addition to the more spectacular outbreaks which have been variously designated as "cerebrospinal meningitis," "Borna disease," "horse plague," "forage poisoning," "botulism," etc., sporadic cases clinically indistinguishable from those making up these epizootics apparently occur continuously throughout the entire United States.

While previous epizootics of this nature have been subjected to extensive and intensive study and observation along some lines, the results have been in many respects unsatisfactory and inconclusive. No definite information has been developed relative to the identity or dissimilarity of the infective agents or other causative factors in the various epizootics, or their relationship to the constantly occurring sporadic cases.

Neither has any exact information been developed, assuming that a definite infective agent or agents are involved, as to how same is spread rapidly in a wave-like manner over wide areas or from animal to animal within such areas.

In the recent California outbreak the presence of a filter-passing virus in the brains of at least a high percentage of the total cases seems to have been established beyond reasonable question, this virus being transmissible to horses and other animals experimentally, especially the guinea pig, with reasonable regularity under suitable conditions. These findings have been confirmed in the Nevada cases in so far as serial transmission of a virus through guinea pigs is concerned. In one Nevada case the same virus was demonstrated also in a lymph-gland from a fatal case in a horse.

In surveying the recent outbreak on the Pacific Coast, one is struck by the many points of similarity between the problems presented and those of the so-called acute anterior poliomyelitis of the human family. In the latter condition there is a strong trend to the belief that the actual virus involved is more or less ubiquitous and infection at some time of life practically universal; also that the infection is primarily not one of the central nervous system, same being involved only in more susceptible individuals or in the case of unusually enhanced virulence of the infective agent.

Such a theory, if it could be clearly established, would in a large measure clear up some of the most puzzling features of equine encephalomyelitis such as the at-present-obscure method of its distribution, the influence of severe climatic conditions, either heat or cold, and fatigue, or its incidence and the apparent solid immunity of many individual animals.

Assuming that the horse is to continue to have any economic value, a continued, intensive, widespread and well-coordinated study of this problem in all parts of the United States would seem essential.

The existing, too-long-standing condition relative to equine encephalomyelitis is certainly a most unsatisfactory one to the veterinarian or live stock sanitarian. At present we seemingly have nothing definite to offer the horse-owner in the way of advice as to the control of the spread of the disease, artificial immunization, or specific treatment. With the present rapidly-
increasing interest in and knowledge of neurotropic viruses and toxins, both as primary and secondary infective or injurious agents, rapid progress with this problem should be possible through well-directed effort.

**ANAPLASTOMOSIS**

Anaplasmosis is now known to exist in Florida, Louisiana, Texas, Oklahoma, Arizona, Kansas, Missouri, Nevada, California, Georgia, and Mississippi. The disease was definitely diagnosed in the two last-mentioned states during 1930-1931. In 1930, experimental work carried on by the federal Bureau of Animal Industry in Louisiana resulted in showing that the dog tick, *Rhipicephalus sanguineus*, is capable of transmitting anaplasmosis, and this year the common dog or wood tick, *Dermacentor variabilis*, also was demonstrated to be a vector of the affection. The results of cross-immunity tests clearly indicate that the anaplasmosis virus of Kansas is identical with that of Florida and it seems probable that future studies will show that anaplasmosis in the United States is due to a single type of virus. Cattle which had recovered from acute attacks in the late summer of 1927 were shown by inoculation tests to be still carriers of the virus over four years later (October, 1931). Investigators in foreign countries believe that cattle surviving an attack of anaplasmosis probably remain carriers during their entire lives and at the same time are immune from further infection.

Immunization experiments have not as yet shown the way to a successful method of producing immunity without actually infecting the animal and creating a carrier state. No new agents have been found for the specific treatment of the disease. Sodium cacodylate is still used quite extensively in conjunction with symptomatic and supportive treatment.

**HEMORRHAGIC SEPTICEMIA**

The general situation with respect to hemorrhagic septicemia has been fairly good during the current year, no particularly heavy losses having been reported as occurring in any part of the country so far this year.

For the purpose of obtaining additional information on the value of biologics in the control of this disease and to add to the knowledge concerning the factors responsible for this affection, the federal Bureau of Animal Industry, in cooperation with the livestock sanitary officials of a number of states, engaged in the following lines of study:

1. Vaccination of feeder and stocker cattle on the home premises with hemorrhagic septicemia aggressin and bacterin, ten to thirty days before shipment to market or feedlots.
2. Vaccination of feeder and stocker cattle on the home premises with anti-hemorrhagic septicemia serum, one to two days before shipment.
3. Vaccination of feeder and stocker cattle with anti-hemorrhagic serum in the stockyards where they are marketed.
4. Vaccination of young calves on the home premises with hemorrhagic septicemia aggressin.

Appropriate numbers of untreated control animals are provided in each instance.

All animals are identified by placing in the right ear tags bearing the legend, "U. S. Hem. Sept.," and numbered consecutively.

Contact with and inspection of all of the animal entering into the experiment are maintained from the time they are vaccinated, through the centers of marketing to their final destination.

Investigations are made of any sickness that may develop in any of the test animals within thirty days after they reach their final destination. Animals that may die are autopsied and appropriate tissue specimens are forwarded to the Washington office for laboratory examination and study.

**FOOT-AND-MOUTH DISEASE**

The United States has experienced another year of entire freedom from foot-and-mouth disease, the second since the 1929 outbreak in California. With the exception of Australia and New Zealand, the North American Continent is the only large area in the world which is free from this disease.
Norway, Finland, and some of the lesser countries of Europe report its non-existence. The disease has recently appeared in Southern Rhodesia but so far the Union of South Africa has escaped infection.

Numerous outbreaks have occurred in England and the disease has also made its appearance in Scotland, Wales and Northern Ireland. The British authorities have continued their policy of slaughter and have been able to get rid of the disease for periods of several weeks at a time, although unable to prevent reintroduction of the infection.

Enforcement of the regulations of the federal Department of Agriculture designed to prevent the introduction of foot-and-mouth disease through import live stock, animal by-products, feeding materials, etc., was materially strengthened by an act, passed by Congress in 1930, which prohibits the importation of cattle, sheep, other domestic ruminants, or swine from any country in which foot-and-mouth disease or rinderpest exists.

DR. MILLER: Mr. President, I move the adoption of this report.

PRESIDENT CONNAWAY: It has been moved and seconded that this report be adopted. Is there any discussion?

DR. J. TRAUM: I am a member of that Committee. There is one thing I overlooked regarding anaplasmosis that I didn't notice until the report was made. It states that sodium cacodylate is still being used, but there is no comment as to whether it is good, bad or indifferent. I am sorry I didn't see that before. I would have liked to have asked Dr. Boynton to give me permission to quote him that, in the experiments he has carried out, he has found that the sodium cacodylate at least does not cure the carrier stage. It definitely shows that animals treated with sodium cacodylate still are carriers of the virus. I haven't got Dr. Boynton's permission to quote him, but it may appear in the record, and then if he wants to object, he can change it.

PRESIDENT CONNAWAY: I will rule that you have permission to make any corrections that may be necessary to make the record correct. We will include that as a part of this motion.

The motion to adopt the report was carried.

PRESIDENT CONNAWAY: Dr. William Moore will give the report of the Committee on Unification of Laws and Regulations.

Dr. Moore read the report.

REPORT OF THE COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

Dr. William Moore, Chairman, Raleigh, N. C.

Dr. W. F. Crewe, Bismarck, N. D. Dr. N. F. Williams, Fort Worth, Texas
Hon. E. F. Richardson, Boston, Mass. Dr. W. H. Welch, Springfield, Ill.
Dr. J. H. Bux, Little Rock, Ark. Dr. T. E. Munce, Harrisburg, Pa.
Dr. W. H. Lytle, Salem, Ore. Dr. C. G. Lamb, Denver, Colo.

Much has been done during the past decade to prevent the spread of live stock diseases through shipments of animals, by the enactment of laws and regulations governing such movements. Most, if not all, states have such laws or regulations applying to live stock shipped into their respective states. We think it is quite generally conceded by those familiar with the situation that such laws or regulations are legally without effect, this being very definitely decided in the rather recent Oregon case decided by the U. S. Supreme Court and referred to in previous reports of this and other committees.

It seems well to remind you again that state laws and regulations which attempt to regulate the interstate movement of live stock would be declared unconstitutional if passed on by the courts, for the reason that the authority to make such regulations has been delegated by Congress to the federal government. We, therefore, wish again to remind you of the importance of this matter and to urge each member of this Association to assist the Com-
mittee on Special Legislation, created for the purpose of correcting this situa-
tion. The power to quarantine and to regulate shipments of live stock 
within the state rests with the state, the only legal limitation being that such 
regulations shall be reasonable. This was rather fully discussed in the 1925 
report of this Committee. All of this report might be reviewed with interest 
and profit by those engaged in the promulgation and enforcement of live stock 
sanitary laws and regulations. It should be remembered that an ill-advised, 
unnecessary or poorly drawn regulation issued by a state may make it necessary 
for other states to draft regulations for their protection, thus departing from 
uniformity.

No marked progress in the unification of laws and regulations has been 
made in any one year; yet a review of the subject must convince one that 
some progress has been made and that those interested constantly have in 
mind the value of such unification of laws and regulations. The work of the 
Committee on Tuberculosis of this Association is, I think, an outstanding 
example of what can be done towards uniformity, as might also be mentioned 
the work of the Committee on Bang's Disease. However, I think that we 
might reasonably expect more rapid progress in view of our present knowledge 
of animal diseases and the mutual interests involved. We wish again to call 
attention to the very serious problem of controlling shipments made by motor 
truck. This is a problem of some degree with which every state has to con-
tend and, as far as we are aware, no satisfactory solution has been offered. 
It would seem that this is a matter of sufficient importance to warrant the 
appointment of a special committee to study the matter thoroughly and make 
definite recommendations.

Recently representatives of six states met in Baltimore and tentatively 
agreed upon a uniform Bang's disease regulation on imported cattle. Later 
these same representatives, together with representatives of the New England 
states, approved these regulations. A copy of these regulations is submitted 
with this report, as an outline, for your consideration and especially for those 
who contemplate the issuing of regulations for the control of Bang's disease. 
We have had no outbreak in this country of foreign diseases since the 1929 
outbreak of foot-and-mouth disease in California, but during such quiescent 
periods we should prepare for prompt, uniform action when the occasion arises. 
This action should be based on our present knowledge and experience.

We wish again to call attention to recommendations made in previous 
reports of this Committee, especially the reports of 1920 and 1925.

REGULATIONS

FOR THE PREVENTION, CONTROL AND SUPPRESSION OF 
BANG DISEASE

(Bovine Infectious Abortion)

Effective 1931

Section I

Defining Bang Disease

Paragraph 1. Bang disease shall mean the disease wherein any animal is 
infected with *Brucella abortus*, irrespective of the occurrence or absence of 
an abortion.

Paragraph 2. An animal shall be declared infected with Bang disease if it 
has given a positive reaction to the blood test or any other test for Bang 
disease; or if *Brucella abortus* has been found in its body, its secretions or 
discharges; or if it has been treated with a live culture of *Brucella abortus*. 
Any animal which has aborted or shows physical symptoms of Bang disease 
shall be considered infected with said disease until such a time as it is 
proved negative to a recognized test for said disease.

Section II

Entry of Healthy Animals

Paragraph 1. All bovine animals, including calves, except steers or cattle for 
immediate slaughter or beef type cattle for feeding purposes or pure-bred 
cattle temporarily for exhibition purposes or spayed females, for entry into
the state of ................ must have been tested for Bang disease within thirty (30) days or must come from herds certified free from Bang disease by the proper live stock sanitary official of the state of origin, and must be accompanied by a health certificate. Each such health certificate shall show the name and address of the veterinarian who collected the blood for laboratory test, with the name of the approved laboratory, and shall contain a complete statement of the actual results of the test and description for identification of each animal tested, with the name and address of the owner or consignor, also consignee, and must be approved by the proper live stock regulatory official of state of origin.

Section III
Entry of Infected Animals
Paragraph 1. Animals infected with Bang disease as defined in Section I of these regulations shall not be brought into the state of ................ except upon written permit from the proper live stock sanitary official of the state of destination.

Paragraph 2. Animals brought in on such permit shall be subject to quarantine and state regulation immediately upon their entry into said state.

Section IV
How Tests Are to Be Made and Reported
Paragraph 1. All tests shall be made in the name of the original owner and consignor or shipper and approved by the live stock sanitary official within the state of origin.

Paragraph 2. The original report giving the date of test and the name and address of the person or laboratory conducting same, approved by the proper live stock official in the state or foreign country of origin, should be attached to the copy of the tuberculin certification chart and sent to the live stock sanitary official at .................. A duplicate copy of these reports shall be attached to the waybill and accompany the animal or animals in transit.

Section V
How Animals Are to Be Identified
Paragraph 1. Each animal passing a satisfactory test for Bang disease shall be ear-tagged or otherwise satisfactorily marked or identified by registration certificate or tattoo.

Paragraph 2. The same tag, registration number or tattoo used in a tuberculin test for interstate shipment or movement may be utilized as a means of identification.

Section VI
How Animals Are to Be Transported
Paragraph 1. All bovine animals, including calves, except steers or cattle for immediate slaughter, or beef type cattle for feeding purposes, or spayed females, approved to enter .................. under these regulations, shall not be exposed to public stockyards, sales stables or sales yards. Cars, trucks or other conveyances used for the transportation of such cattle must be cleaned and disinfected.

Section VII
Cattle That Are Eligible
Paragraph 1. Any animals found to comply with the requirements as stated in the preceding paragraphs are eligible for shipment or importation direct from point of origin to points within .................; provided, they have also complied with the regulations governing the interstate movement of cattle in relation to tuberculosis and other diseases or other requirements that may now or later be in force and effect.

Paragraph 2. All bovine animals, including calves, except steers or cattle for immediate slaughter, or beef-type cattle for feeding purposes, or pure-bred cattle temporarily for exhibition purposes, or spayed females, if apparently healthy, may be brought into ................ without being previously blood-tested provided they are billed to the public stockyards
at ..................... , where they will be examined and blood-tested under the direction of the Bureau of Animal Industry or diverted for slaughter.

This regulation shall be effective on and after .....................

Note: All bovine animals purchased for additions to herds operating under the Plan for the Prevention, Repression and Elimination of Bang Disease must be added in accordance with the provisions of the Plan.

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Dr. Moore: I move the adoption of this report.

The motion was regularly seconded and carried.

President Conaway: We will have the report of the Special Committee on Legislation, by Dr. W. J. Butler.

Dr. Butler: Mr. Chairman, that report was given to the Executive Committee, and I doubt if there is anything to report to this meeting. It was impossible for the Committee to act during the past year. Our recommendation is that the Committee be continued but that the personnel, and especially the Chairman, be named from a state adjacent to the District of Columbia.

It was regularly moved, seconded and carried that the report be adopted.

President Conaway: We will have the report of the Committee on Tick Eradication, by Dr. N. F. Williams.

Dr. Williams: Mr. Chairman and Members: To follow accustomed roads leads to riches, fame and comfort. Some men are gifted with visions that lead them away from the beaten trails and paths and they sacrifice the things that bring to others the comforts, the riches and the enduring things of life. The pioneer in every undertaking, in every industry, has sacrificed, that those industries and other undertakings might go on. It is said that great men come in groups. That holds true of philosophers. It holds true of the outstanding sculptors, those exponents of art. It holds true of every undertaking and of every profession. That is true of the medical profession.

Somehow, we do not really appreciate that we are living in an age that accentuates that very statement. We are living in an age of modern medicine, made glorious by Pasteur, by Koch, by Theobald Smith, by N. S. Mayo, by Cooper Curtis, by J. W. Connaway, by Mark Francis in Texas, by C. A. Cary of Alabama, and other men of that character.

Those men, contemporary with the time of those two great, outstanding, shining lights, received something from the reflection in their early days, of the greatness of these men for they have certainly been inspired and have inspired the operation that has enabled this country to eradicate the tick and to have the situation so safe that there is no chance for it to escape complete eradication.

What are the things that have come from the association of these men with each other, of their familiarity and association with the age of those other great men, who are greater, perhaps, than they, because they are dead? These men that I am talking about will receive their praise and honors in equal measure when the full survey has been made, and the results of their work have been estimated.

Dr. Kilborne, in 1893, definitely established the fact that the tick was the transmitter of the microorganism that caused Texas fever, that the tick took the disease from the diseased animal and injected it into the well brute. That established the fact of insect-borne disease transmission. That enabled civilization to overcome a 300-year challenge of the microbes and bugs to redeem the Panama Canal. That enabled them to handle yellow fever, malaria, typhus fever, tularemia, Rocky Mountain spotted fever, South American and South African relapsing fevers and other insect-borne diseases.

Besides these men that I have mentioned, Mr. R. J. Kleberg, of Texas, who is in his declining years but still alive, was a very potent factor in this tick-eradication program. Mr. Kleberg's son, a child playing around, baffled by his algebra lessons when Dr. Connaway was there, was recently elected to Congress. Richard M. Kleberg is the strongest man, from a live...
stock sanitary standpoint, who has ever sat in Congress. That boy eradicated
ticks on a portion of the King ranch, a ranch of one million and a quarter
acres. He did the only job of tick eradication on that ranch that didn't have
to be done over. He helped make the vat. He helped mix the dip. He was
associated with a veterinarian and he was a cow-puncher. His father was an
attorney. In obedience to his father's wishes, he studied law at Texas Uni-
versity. He is a finished lawyer, with that background of the animal industry
to draw on.

I would say that the work of these men is not only outstanding from the
accomplishment of tick eradication but it has established the school of eradia-
tion on the North American continent. It has shown that diseases can be
eradicated, and unless you can eradicate a disease, you are losing the fight
for humanity against those diseases. I can vision those men and I envy them
sometimes the pleasure they get when, like first-team football players, they
look from the sidelines at the score they have rolled up, that cannot be over-
come, and watch the younger generation fight it out, knowing that no power
on earth can long delay the completion of the game.

Dr. Williams then read the report of the Committee on Tick
Eradication.

REPORT OF THE COMMITTEE ON TICK
ERADICATION

DR. N. F. WILLIAMS, Chairman, Fort Worth, Texas

Dr. C. A. Cary, Auburn, Ala.  Dr. J. M. Sutton, Atlanta, Ga.
Dr. E. P. Flower, Baton Rouge, La.  Dr. J. V. Knapp, Tallahassee, Fla.
Dr. C. E. O'Neal, Jackson, Miss.

Your Committee on Tick Eradication is pleased to report that the 1931
eradication campaign has resulted in further inroads being made into the
domain of the cattle-fever tick. This year, 16,607 square miles of southern
territory were cleaned up and released from federal quarantine, and a part of
one Louisiana parish, containing 217 square miles, was requarantined by
order of the Secretary of Agriculture, effective December 1, 1931.

This order, which is designated as B. A. I. Order 332, affects the following
areas:

In Arkansas: Cleveland, Columbia, Dallas, Hempstead, Lafayette, Lincoln
and Nevada counties are released from quarantine.

In Florida: Alachua, Flagler, Marion, Putnam, St. Johns and Volusia
counties; the remainder of Duval County; and that part of Lake County
lying north of the boundary line between township 17 south and township
18 south, are released from quarantine.

In Louisiana: That part of Ouachita Parish, east of the Ouachita River,
formerly released, is requarantined.

In Texas: Dimmit, Freestone, Frio and Lee counties; the remainder of
Limestone County; that part of Brazoria County lying west of the Brazos
River; and that part of Fort Bend County lying west of the Brazos River, are
released from quarantine.

The existing quarantine in the territory of Porto Rico is continued.

During the year 18 counties were added to the list of released counties
reported absolutely tick-free, making a total of 801 of the 858 released counties
in which tick eradication has been completed.

The annual statement of the Bureau of Animal Industry recording the
progress made in this work to December 1, 1931, is appended for the records
of the Association. (See page 517.)
REPORT OF THE COMMITTEE ON RESOLUTIONS

DR. VAN ES: Mr. Chairman and Members: The Committee on Resolutions could muster only three men for its meeting, Dr. W. H. Welch, Dr. W. K. Lewis and myself. We have three resolutions to present.

Resolutions, by Dr. L. Van Es.

WHEREAS, A definite terminology has not yet been adopted by federal or state agencies in the national improvement program, and

WHEREAS, The continued use of the word "accredited" by hatcheries for purposes other than defining the health of the flock is both confusing and misleading to a vast majority of the purchasers of "day-old chicks," and

WHEREAS, The advantages of as well as the need for a uniform terminology essential to the protection and most rapid development of the poultry industry are recognized by this Association, therefore, be it

Resolved, That the United States Live Stock Sanitary Association, in convention assembled, reiterates its position with reference to the word "accredited" by urging that its use be restricted to indicate "health alone" and that it be not employed in any other capacity.
DR. VAN ES: Mr. Chairman, I move the adoption of this resolution.

The motion was regularly seconded and carried.

Dr. Van Es read Resolution 2.

RESOLUTION 2

WHEREAS, There appears to be a lack of any prompt, comprehensive and unbiased source of information relative to outbreaks of contagious diseases of live stock, the course of such outbreaks and other matters of interest to official live stock sanitarians, and

WHEREAS, Such a source of information would be of great assistance in official live stock sanitary work and tend to prevent hasty and perhaps unwise action, and

WHEREAS, The United States Bureau of Animal Industry has indicated a willingness to cooperate in collecting and promptly distributing information along these lines to the extent of the means and facilities available, now, therefore, be it

Resolved, That the Chief of the United States Bureau of Animal Industry be requested to consider and, if possible, undertake, with the assistance and cooperation of those interested, the issuance of a weekly/monthly news bulletin covering, in a concise way, current events in live stock sanitation and allied fields throughout the continent of North America and the world in general, this bulletin to be distributed only to official live stock sanitarians in North America and such other persons as the Chief of the United States Bureau of Animal Industry may deem legitimately entitled to receive same, and be it further

Resolved, That a special committee of three be appointed to cooperate with the Chief of the United States Bureau of Animal Industry in establishing this news service if same can be brought about.

DR. VAN ES: Mr. Chairman, I move the adoption of this resolution.

The motion was regularly seconded.

DR. A. W. MILLER: I wonder if we could not influence the people behind this resolution to change that to a monthly report instead of a weekly report. I have had a good deal to do with the issuance of these reports, and I feel, where we have to rely on about forty-eight states for data, the material would not be in promptly enough for us to give any kind of service on a weekly report.

DR. N. S. MAYO: I move an amendment that the word "weekly" be changed to "monthly," except in cases of emergency, when special reports may be issued.

The amendment was regularly seconded.

PRESIDENT CONNAWAY: You have heard the amendment. Is there any further discussion?

The amendment was adopted and then the report as amended.

DR. VAN ES: The third resolution is the one mentioned on the floor the other day, proposed by a number of the state veterinarians of some of the southern and southwestern states, pertaining to hog cholera.

Dr. Van Es read Resolution 3.

RESOLUTION 3

WHEREAS, Hog cholera constitutes an insurmountable problem to the individual states, because of the insufficient regulation of interstate movements of swine, therefore, be it

Resolved, That the United States Live Stock Sanitary Association, in annual meeting assembled at Chicago, December 2 to 4, 1931, do urge the United States Department of Agriculture to enact and enforce regulations that will definitely prohibit the interstate movement of swine for purposes other than immediate slaughter, except such swine as have been properly immunized against hog cholera as suggested by the attached tentative regulation.
Dr. Van Es: There is an appendix to the resolution, a suggested addition to Regulation 6, B. A. I. Order No. 309. We hardly consider it part of the resolution, but I will read it to you to be disposed of at your pleasure.

... Dr. Van Es read the suggested addition. ...

**Suggested Addition to Regulation 6, B. A. I. Order No. 309**

No swine shall be shipped, driven on foot, transported in any manner or received for transportation interstate, unless such swine are accompanied by a certificate and health chart issued by a Bureau veterinarian, a state veterinarian or a graduate veterinarian approved by the live stock sanitary authorities of the state of origin, showing them to be apparently free from any infectious, contagious or communicable disease, and that they have been treated by one of the following methods:

(A) Serum alone method within twenty-one (21) days of date of movement.

(B) Simultaneous inoculation without time restriction.

(C) The swine must be moved in clean and disinfected cars, trucks or other vehicles, and must not be handled through railroad stockyards or chutes.

(D) The swine shall be held in strict quarantine at destination for not less than twenty-one (21) days.

Dr. Van Es: Mr. Chairman, I move the adoption of this resolution.

The motion was regularly seconded.

President Connaway: You have heard the reading of the resolution. Is there any discussion?

Dr. W. J. Butler: As a substitute motion, Mr. Chairman, I move that the resolution be not adopted. A resolution like that is criminal. Are you going to inoculate animals with serum and virus, or serum alone, if they come from a country where hog cholera never has existed? We have areas as big as some states you have in the South and Middle West, where hog cholera has never been known to exist, and where we absolutely prohibit the use of virus.

I move it be not adopted.

Dr. Miller: I would like to have about two minutes on this. I think this would be a most unwise resolution to go out from this Association. I doubt whether the gentlemen who are sponsoring it tried to make any survey of the field and determine just what its enforcement would mean. In many cases farmers take hogs across a state line, twenty or thirty miles, in sections of the United States where there is practically no cholera from year to year. Under this resolution they would have to be treated. Its scope is so broad I would like to take some words that Dr. Schalk has used, some language that Dr. Jacob used the day before yesterday, and some that one or two other members have used, and apply them all to this resolution.

I move it be tabled.

Dr. Mayo: I second the motion.

President Connaway: A motion to table is not debatable.

Dr. Butler: It is just the same thing. I moved it be not adopted. We don't want to kill discussion.

Dr. Miller: I will withdraw my motion.

Dr. Mayo: I will withdraw my support to the motion to table.

President Connaway: I will accept the motion of Dr. Butler.

The motion was regularly seconded.

Dr. Williams: I imagine the laws of all of the states have the same purpose. The law of the state of Texas orders the Live Stock Sanitary Commission to protect the live stock of the state of Texas against communicable and infectious diseases not only within its borders but outside of its borders. It does not say to protect the cattle from scabies or tick fever or from tuberculosis. It comprehends the wide industry of that state. The only obstacle in the way of our following the mandate of our law is the federal department. In the absence of a federal regulation we are without power.

I will say that I appreciate Dr. Butler's stand. In a state that has no hog cholera, I would not inject those hogs if they were going to stay at home. But you are going to send them to us, and we will take the chance. Until...
you can send hogs that are safe, you are going to work a hardship on the swine industry of this country. As veterinarians we have to give an empty answer to the swine industry that is crying for protection. If there is an industry on this continent or in this country that needs help, it is that one, with an infant mortality of 50 per cent, and then beyond that they must be sacrificed to hog cholera.

Gentlemen, I say it is incomprehensible to me that the federal department should try to escape its responsibility in this matter, or how any state regulatory official, who is charged with the protection of the livestock in his state, can sacrifice the swine and save the cattle from tuberculosis.

DR. C. E. COTTON: To my mind this is just another example of why we need this legislation that we are attempting to get in Congress. We have local problems to solve. I can understand why Dr. Butler is not in favor of this, Dr. Williams. He isn't afraid of the ones that are going out. He wants to protect those that are coming in. He does not want them to come in there double-treated.

I want to take this opportunity to request everyone of you to take your coats off and help us get through this congressional legislation. Then each state can promulgate regulations or laws to protect its own interests, and the federal government would certainly sustain them under those conditions.

PRESIDENT CONNAWAY: Is there any further discussion?

DR. MAYO: I move that the resolution be tabled.

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

PRESIDENT CONNAWAY: We will now have the report of the Committee on Tuberculosis, by Dr. C. E. Cotton.

DR. COTTON: Mr. Chairman and Gentlemen: Before taking up the report, I want to take this opportunity to call your attention to the address of Dr. Myers at our 1930 meeting. Dr. Myers is President of the Minnesota Public Health Association and has spent his lifetime in the study of tuberculosis in the human family and particularly in children.

If you will recall, he stated that prior to 1928 he publicly criticized the work that we have been attempting to do in the control of tuberculosis under the area plan. But he was big enough to see his mistake, and he has qualified it, and has qualified it most generously and publicly. He has a book that is now in press on "The Child and the Tuberculosis Problem," It will probably be released in a couple of months. There are three chapters in that book that are devoted to the work that has been done by the live stock sanitary control men of this country. He is now recommending, and they are carrying out, the system of area control of tuberculosis in children by the intradermic test followed up by the x-ray.

I might state that when he opposed this work he felt that it was uneconomic and that the problem could be solved by proper pasteurization. He has found it is not true, and he states that our system is the one system which we must use if we are to get rid of this organism.

Dr. Cotton read the first part of the report of the Committee on Tuberculosis.

(See entire report, as amended and adopted, on page 525.)

DR. COTTON: I move the adoption of that section (part I).

The motion was regularly seconded.

PRESIDENT CONNAWAY: We are reading this section by section and will vote upon it in that manner.

After some discussion of the wording of the report, the motion to adopt was carried.

. . . Dr. Cotton then read the second part of the report.

(See entire report, as amended and adopted, page 525.)

DR. COTTON: I move the adoption of part II.

The motion was regularly seconded.

PRESIDENT CONNAWAY: It has been moved and seconded that this section be adopted. Is there any discussion?

DR. BUTLER: Just as a matter of information, did I understand correctly that the cattle may remain accredited for six years, and then at the expiration of six years, all of the cattle in that area must be retested?
Dr. Cotton: Yes, for a period not exceeding six years.

Dr. Butler: You are eliminating the western states.

Dr. Cotton: This is discretionary. This is an addition to the plans as they are.

Dr. F. H. Brown: Suppose you have a modified area in which there is no infection shown on the initial test. If you let the accreditation on that particular area run six years, then in order to take advantage of this new clause of remodification, you would have to retest all the cattle in that particular area.

Dr. Cotton: Or your could go back and take advantage of the present conditions. It was brought out in the meeting of the Committee that there is a question as to whether we dare leave those herds, even in the counties in which originally the percentage was practically very small and finally nil, because of the fact that we do have instances where some one herd that has been clean in prior tests will suddenly break and show a very large percentage. This was brought out in order to safeguard and also in order not to force the hardship of going on and retesting all of these cattle each three years. We can still continue as we are doing. It is discretionary. This was originated by Wisconsin, because of their present laws. North Dakota and a number of the other states felt they should have to protect themselves with their present laws and the conditions in their state.

Dr. Butler: The wording there is that all the cattle must be retested, if you take this six-year period. I don't think that is quite fair to the western states, and I don't think it is in line with the policy the Committee on Tuberculosis has been pursuing in the past. That is simply my own personal feeling about it.

As Dr. Brown said, we have certain counties where we have never found a case of tuberculosis, but yet, in order to take care of them, in order to accredit them for a period of six years, we have to go back and retest all of them. Under that plan we could not take advantage of the present regulation and test only the bulls, pure-breds and dairy cattle.

It says that in order to get them reaccredited you have to have them all retested. You could not accredit that county as you did in the first place.

Dr. Brown: Yes.

Dr. Butler: If you went to the end of three years and then went to six years, you could not do it, the way that is worded. We could do it at the end of three years or start in today and do it, but if we let it go six years, we can't do it.

Dr. Cotton: Yes, you can. This is only another plan. It doesn't interfere with the original plan, as I understand it.

Dr. W. Wisnicky: In proposing this addition to these regulations, we have not in any way disturbed the previous procedure. This is only an addition, to serve as an alternative, so you may go on the other schedule or come onto this schedule, or maybe there is a way whereby you can hybrid the two together. I have not given that any thought. This is simply an alternative. It was designed for dairy states where infection is of more consequence than it is in the range states, and it was designed to protect the work and the investment that has already been made.

When we made this, we gave due consideration to the point that we did not want to interfere with any other section's procedure. I don't believe, Dr. Butler, that this will interfere with your schedule.

Dr. Butler: I have no doubt about what you mean but that is not what you say. It is perfectly all right with me if that is what you mean, but you say that at the end of six years all cattle have to be tested.

Dr. Miller: I think I must agree with Dr. Butler's interpretation of that language. It seems to me that you must elect which one you will take. You cannot take some easy part of the old plan and then add it onto this six-year plan. If it is the purpose that you can use the six-year plan and do only the testing that Dr. Butler is talking about, it seems to me that language must be modified. I do not believe that is the intention.

Dr. Cotton: It distinctly states: "may remain in the accredited status for a period of not more than six years."
I would like to explain that since this work started Section 25 has been amended three times, to my knowledge. The Committee gave very serious consideration to undertaking to re-edit all of these sections. I do not think there is any question but that in another year it will have to be re-edited, because it has been added to so often. The Committee has been giving this a great deal of thought. This is an adjunct to the other condition. It does not distinctly say they "shall," but "may."

Dr. Edward Records: I think possibly you can clear up Dr. Butler's point. It is hard to judge the sections by themselves. In your opinion, does this conflict with present Section 27? That provides the mechanism for accrediting a range county.

Dr. Cotton: No, it does not have anything to do with range counties. Why would the federal Department of Agriculture have distinct methods for accrediting or reaccrediting? Nor does it conflict with Section 27.

Dr. Records: I think that is the point Dr. Butler has in mind. If they are taken as a whole, they do not conflict.

The question was called for and the motion to adopt was carried.

Dr. Cotton then read the third section of the report.

(See entire report, as amended and adopted, page 525.)

Dr. Cotton: I move the adoption of this section (part III).

The motion was regularly seconded.

Dr. C. G. Lamb: Any feeder cattle, regardless of age, sex or breed, as I understand, that could not qualify under Section 27, relative to coming from modified accredited areas or accredited herds, not accompanied by a tuberculin test chart, would be required to be tested before entering such areas.

Dr. Cotton: Yes.

Dr. Lamb: You gentlemen may have been told, and I trust you may have read, that in the olden times a certain king saw the handwriting on the wall, and he called a certain prophet to interpret that handwriting. You remember what the prophet's answer was, of course. Now I see the handwriting on the wall, and I don't have to call in any prophet to interpret it for me. But I do want to protest, in the name of western range-feeder cattlemen, against the present adoption of such a regulation. It would most seriously handicap feeder-raisers in my state, and I assume in other similarly situated states, at the present time. If this must come, and I think it must, for heaven's sake, let us see if we can't postpone it a little while, until such time as the live stock interests, particularly in range states, get on their feet a little. These range men, and I assume other classes of live stock men as well, are up against a most serious proposition at this time. Practically all of our men are broke. Unless something breaks forth in the immediate future to remedy their condition, they will all be broke or worse than broke, and they will very much appreciate a postponement, at least, of such a regulation.

I entreat that if this regulation is adopted and it should be put into effect (it would be effective immediately, I assume), it would precipitate a most serious condition of affairs in the state that I represent and other similar states.

I shall vote against the adoption of that particular section, but I appreciate the fact that perhaps my vote will be the only one. But I shall have to vote against that in an effort to protect my people from such a catastrophe, as it would be, if it went into effect immediately.

Dr. H. D. Port: Dr. Cotton, did the resolution state when this amendment should go into effect?

Dr. Cotton: This section (part III) does not. The following section (part IV) does. The Committee felt that the date when it should become effective should come in a separate section. The following section does undertake to set the date.

Dr. Port: In addition to what Dr. Lamb has stated, I don't believe our western stockmen are in position to cope with a regulation of that kind at this time. They are just starting to get modified. It is going to take two or three years before this can be brought around, before we can get modified areas sufficient to cope with a regulation of that kind. I certainly feel that our men would be opposed to the adoption of such a regulation at this time.
DR. BROWN: How many modified accredited range areas are there at the present time?

DR. COTTON: Utah is almost accredited, parts of Idaho are accredited; some work has been done in New Mexico under this new plan of testing ten per cent.

DR. E. L. STAM: In behalf of the state of Arizona and the cattlemen of Arizona, I desire to oppose that resolution. We oppose it on these grounds: First, there has never been any evidence presented to show that the cattle of our range states are tuberculous to such an extent that such a regulation is necessary. We feel that in view of the fact that our tuberculosis eradication work has only been within the past few years been getting into full swing, at this time we have not the finances appropriated, and our cattlemen are not in a financial condition to comply with such a regulation. It will be several years before we could possibly have such finances appropriated, due to the fact that the majority of our legislatures will not meet until '33. Further, until such time that the Bureau of Animal Industry can furnish us with postmortem reports showing that approximately 0.5 of 1 per cent of our animals are found to be tuberculous, such a regulation, if put into effect at this time, would mean financial disaster to our stockmen. Therefore we oppose such a resolution.

DR. COTTON: I might state that according to the map, parts of Washington, Oregon, California, Montana, almost all of Utah and part of Idaho, and, as I understand from Dr. Records, part of Nevada, are accredited or in the process of being accredited.

DR. PORT: I am entirely in sympathy with such a resolution but I do think it is just a little early at this time. If Dr. Cotton will hold that map up, you can see our position in this western area. We have a very small percentage of modified area. I think the resolution is absolutely in order, but I think it is a little early to adopt such a resolution at this time. If we could have a year or two more to apply to some of the areas in our state, I would be hearty in sympathy with such a resolution. I think at this time it is a little early to consider the adoption of the resolution.

DR. COTTON: With the consent of my Committee, will you allow me to read the next section? The Committee were of the opinion we should read this recommendation first and then, as another section, if necessary, recommend the date.

DR. WILLIAMS: If you read that, will it be considered in toto then, and acted on, or will we act on part of it, and then act on what you are about to read?

DR. COTTON: Apparently, from the remarks made on the floor, they are in sympathy with the resolution but they want it delayed for a certain period. They don't want to defeat the regulation because they feel, in justice to the states that have spent large amounts of money, it is perhaps proper. Dr. Port, of Wyoming, states we should put it over a year or two.

As Chairman of the Committee I am going to take the liberty of reading this section into paragraph (d): "Your Committee further recommends that these amendments to Section 21 shall become effective on and after July 1, 1932."

DR. WILLIAMS: Mr. President, I am going to offer this amendment: "Except that the provisions of paragraph (b) shall not apply until July 1, 1934, to cattle from areas where the survey indicates that the incidence of bovine tuberculosis does not exceed one per cent."

For Texas I want to state we have tested around our larger cities, and we have accredited five counties in the largest dairy center, and the incidence of tuberculosis is 0.3 of 1 per cent. You can imagine what the condition will be with those range cattle. We are coming clean with you. We will say we haven't tested our range cattle sufficiently to know the extent of tuberculosis. But we can confidently state it will be materially less than it is among our dairy herds. I think this will satisfy the range states. It will satisfy the semi-range states. It should be assurance to the eastern states that they are being protected, and we agree with them in their insurance, but we will ask them not to over-insure at this time.
I offer that as an amendment to this report. That time will give the legis-
latures time to convene. It will give us a chance to get our machinery ready
to certify these cattle the way you men in the other areas want them certified.

DR. COTTON: Who is going to make the survey to determine the one per
cent?

DR. WILLIAMS: We are satisfied to have the federal department do that
from the records of kill.

DR. BUTLER: I second the amendment.

PRESIDENT CONNAY: The question is open for debate on the amendment.

DR. COTTON: Part IV now reads: "The Committee further recommends
that these amendments to Section 21 shall become effective on and after
July 1, 1932."

Dr. Williams’ amendment to that section is: "Except that the provisions
of paragraph (b) (which relates only to feeding cattle) shall not apply until
July 1, 1934, to cattle from areas where the survey indicates that the incidence
of bovine tuberculosis does not exceed one per cent."

DR. WILLIAMS: Are you all clear on this? Paragraph (b) is concerned with
"cattle for feeding purposes not eligible under paragraph (a) may enter the
modified quarantine area, if they are apparently healthy, and are accom-
panied by a health certificate and tuberculin test chart approved by an officer
or agent of the live stock sanitary official in the state of origin."

Of course, that class of cattle is eligible from accredited areas, but we
have not been able to get our machinery going yet, and these other western
states have not had an opportunity to get before their legislatures. In view
of the fact that we do not have much, apparently, if any, tuberculosis in our
range herds, we feel that this will facilitate the operation of the cattle industry.
You can get safe feeders.

DR. STAM: I would like to state for the information of those present that
we are not trying to defeat tuberculosis eradication.

I would like to state also, to those in the East and in the Mississippi Valley,
that they need have no fear that we are trying to unload a bunch of tuberculous
cattle on them. For your information, nine of the fourteen counties of Arizona
are absolutely clean today. We have not gone into our range herds, for the
simple reason that we lack finances. But I personally have tuberculin-tested,
within the past two years, approximately 2,000 of our range cattle without
finding a reactor.

The federal inspector in charge of our district has informed me that the same
conditions exist in the state of New Mexico. We are not afraid of the feeders
that come into our state from New Mexico or Texas. We believe the same
conditions exist there. We know that the imported cattle so seldom show
lesions on the killing-floor, that we are convinced the amount of infection is
far lower in the range states today than in the accredited areas of the East.

When you vote on that resolution, remember this, that all we are asking for
is time, and we will be glad to comply with that regulation. We see the hand-
writing on the wall. We realize that that regulation will be necessary in
time, but all we are asking for is to give us an opportunity not only to comply
with it but to save our live stock industry.

DR. L. M. HURT: You spoke about the killer stuff being killed inside of
ten days. Is that absolute or relative? If they are sold to a killing establish-
ment, would that suffice?

DR. COTTON: Except as extended by permit.

DR. HURT: It will require a lot of red tape.

DR. COTTON: I never knew of any of this work that didn’t require red
tape and constant red tape.

DR. HURT: We can construe them as for immediate slaughter, but they
can put them in the plant and hold them.

DR. COTTON: Men in the eastern and central parts of the country are con-
stantly faced with men in small towns going into another state and buying a
bunch of cattle for feeding purposes. They will get by on this. They will
bring in fifty or sixty. One butcher in a little town would not butcher fifty
animals in ten years. He gets by on the other regulation.
COMMITTEE ON TUBERCULOSIS

President Conaway: If there is no further discussion, we will take a vote on the amendment of Dr. Williams which extends the time. Those who favor the amendment will signify by saying “Aye”; opposed, “No.” It seems to be unanimous.

Now the question comes on the section as amended. Those who favor this will signify by saying “Aye”; opposed, “No.” It is carried.

Dr. Cotton then read the fifth section of the report.

(See entire report, as amended and adopted, below.)

Dr. Cotton: I might state that the Committee is making these suggestions as a result of the live stock interests of Wyoming and Arizona, in conference last night, being of the opinion that if the federal Department of Agriculture or Bureau of Animal Industry could arrange some plan of organization whereby they could report back tuberculous carcasses found on the general kill or general run, they would appreciate that information, in order to establish the fact to the rest of the world how free they are of the disease.

We went further and requested the sanitary authorities of the states to follow up such reports and make the necessary investigations and, if necessary, tests.

I move the adoption of the last two suggestions.

The motion was duly seconded and carried.

Dr. Cotton: I move the adoption of the report of the Committee in toto, as amended.

The motion was duly seconded and carried.

REPORT OF THE COMMITTEE ON TUBERCULOSIS

Charles E. Cotton, Chairman

A. E. Wight, Washington, D. C. George Hilton, Ottawa, Canada
N. F. Williams, Fort Worth, Texas William Moore, Raleigh, N. Car.
A. F. Schalk, Columbus, Ohio J. Traum, Berkeley, Calif.

Part I

Your Committee finds keen interest is being maintained in the question of vaccination against tuberculosis, not only on this continent, but in Europe and elsewhere, and much investigational work has been in progress.

Vaccination by the method of Calmette and Guérin has evoked the greatest interest and concern. It was a topic producing endless discussion at the various international congresses held in Europe a year ago. Many internationally known laboratory workers attended these congresses and their eagerness to ascertain the fullest particulars concerning the claims and criticisms of this method of vaccination was indisputable evidence of the universal interest in this subject.

It was generally agreed, and our work on this continent confirms the opinion, that BCG represents a strain of bovine tubercle bacillus of reduced virulence and pathogenicity.

The question as to whether or not it is a fixed virus has caused the greatest controversy, as many workers have reported that the BCG organism has, in their experimental work, reverted to virulence, and produced disease. It has, however, been shown that the BCG has acquired relatively fixed characters as to its virulence when maintained upon a specific medium (bile-potato medium), and that this relative avirulence may be maintained when BCG is grown upon Sauton’s medium, or glycerinated potato, but as a precautionary measure it may be returned to the bile-potato medium at repeated intervals.

There is evidence that under artificial conditions the virulence of BCG may be enhanced by various cultural means, quite apart from the question of possible contamination of culture.

When cultivated upon Sauton’s medium, or glycerinated potato, many investigators claim it is innocuous to experiment animals on first passage, but others claim that occasionally it may become pathogenic.

The published results of animal experiments to determine the immunizing properties of this vaccine do not confirm the claims made for the degree, duration and value of the immunity conferred by it. It is consequently quite
It is apparent that much work remains to be done before the problem of vaccinal immunity is solved.

It has, however, been shown that vaccination by this method may confer a degree of resistance of brief duration, which is manifested by the absence of lesions, or a more tardy development and progress of the disease arising from natural and experimental infection.

The available evidence further indicates that the degree of resistance diminishes from year to year.

The period of maximum resistance following vaccination, the rate of decrease of resistance, and the results of revaccination have not been determined.

Your Committee desires to draw attention particularly to the fact that it is recognized that there is a possibility of a carrier state appearing in vaccinated animals, and that a tubercle bacillus, which has changed its character through methods of artificial cultivation, it is claimed, may re-acquire its original and dangerous character after a protracted residence in its customary normal environment.

In these circumstances, and in view of the experimental evidence and of the extensive trials of BCG vaccination, your Committee is of the opinion that this method of immunization against bovine tuberculosis must still be considered as in the experimental stage, and in respect to its innocuousness and efficiency open to question.

**PART II**

Your Committee recommends that Section 25, of the Modified Accredited Area Plan adopted December 4, 1930, be amended by adding the following to last paragraph:

"Modified accredited areas in which on a complete area retest the degree of infection found on said retest of all cattle in said areas did not exceed two-tenths (0.2) of one per cent may remain in the accredited status for a period of not more than six years, provided that all cattle in said area will be retested at the expiration of said accreditation period; provided further, that infected herds as are disclosed be handled in accordance with paragraphs (a) and (b) of Section 22."

**PART III**

Your Committee further recommends that Section 21, of the Modified Accredited Area Plan, be amended by striking out Regulation 1, Rules 1 to 5, inclusive, and inserting in lieu thereof the following:

"(a) Cattle identified as coming from other areas designated as Modified Tuberculosis-free Accredited Areas, or coming from herds designated as Tuberculosis-free Accredited Herds, or from herds wherein the entire herd has passed the negative tuberculin test in the process of accreditation under the Accredited Herd Plan or Modified Area Plan, may enter modified quarantine areas without being subjected to an additional tuberculin test prior to entry, providing such cattle are apparently healthy, and accompanied by a health certificate and tuberculin test chart, or other proper identification, approved by the live stock sanitary official or authorized agent of the state of origin.

"(b) Cattle for feeding purposes not eligible under paragraph (a) may enter the modified quarantine area, if they are apparently healthy, and are accompanied by a health certificate and tuberculin test chart approved by an officer or agent of the live stock sanitary official in the state of origin.

"(c) Apparently healthy cattle of strictly slaughter types, and to be used only for immediate slaughter, may enter a modified quarantined area without an examination and tuberculin test. Cattle entering a modified area, under this clause (c), must be slaughtered within ten days after their entry into the modified quarantine area, except when the ten-day period is extended by a special permit from an officer or authorized agent of the live stock sanitary official.

"(d) Pure-bred cattle may enter a modified quarantined area to be kept therein temporarily for exhibition, or to be bred, providing the cattle are accompanied by a health certificate and tuberculin test chart approved by the live stock sanitary official of the state of origin."
ELECTION OF OFFICERS

PART IV
(Amendment)

"Except that the provisions of paragraph (b) shall not apply until July 1, 1934, to cattle from areas where the survey indicates that the incidence of bovine tuberculosis does not exceed one per cent."

PART V

Your Committee suggests that the United States Bureau of Animal Industry extend, as far as practicable, the system of identifying branded or tagged cattle of all types, and also hogs that are found to be tuberculous upon postmortem examination, for the purpose of tracing their origin, and that such information be forwarded immediately to the state live stock sanitary authorities of the state of origin of such animals.

It is also suggested that the live stock sanitary authorities of the various states continue and increase their efforts to locate premises infected with tuberculosis through the tracing of tuberculous cattle and hogs reported as a result of postmortem examination of animals consigned to slaughter.

DR. COTTON: I might state that every member of our Committee signed this report with the exception of Dr. Wilson, who was unable to be in attendance at this meeting. (Applause)

DR. BUTLER: Mr. Chairman, as a member of this Association, and as a representative of one of the western states, I desire to make a motion thanking the Committee on Tuberculosis for the excellent work they have done this time.

The motion was duly seconded and carried.

DR. CARY: Yesterday morning, after making the report, we did not have time to put a motion that we wanted to put. I want to move that the Committee on Meat and Milk Inspection be continued for another year.

The motion was duly seconded and carried.

MR. BROCK: I would like to take this occasion to thank the members of this Association for the consideration they have given me here as a layman from a range state. While we didn't get just exactly what we hoped for in the way we asked for it, I think it was put in such a way that it is going to work out to our mutual benefit. I feel that we all have a much better understanding of each other's problems than we did before.

I again want to say I appreciate the courtesies which you people have extended to me. (Applause)

PRESIDENT CONNAWAY: I wish to state that the gentleman who has spoken is an old Missourian. They always have to be shown. Furthermore, he is going to become a member of this Association and come and help in the eradication of these diseases that are such a burden to the live stock industry of these United States of North America.

This brings us up to a matter which we have overlooked. We have no Committee on Necrology. I am going to appoint, with your consent, Dr. Mayo and Dr. Moore, as a Special Committee on Necrology, to pay proper tribute to the members of this Association who have died in the past year.

Election of Officers

PRESIDENT CONNAWAY: We now come to the election of officers.

I wish to say I neglected, without intention, reporting the Nominating Committee, but I will tell you what I did in regard to that. I decided not to put on this Nominating Committee any man who was eligible to election to office. Therefore, I picked out of ten or fifteen old-timers, who have held office, three. I was limited to three. I wish it had been five, so that I could have appointed one from the North, one from the East, one from the West, one from the South and one from the central part. I appointed one from the East, one from the Northwest and one from the South. This Committee consists of Dr. Van Es, Dr. Cary and Dr. Munce.

If they have a report to make, I shall be glad to entertain it.

DR. CARY: Mr. Chairman, before I make the report I will tell you why I am making it. The other two men were afraid to make it.
A little explanation is probably in order for the reason that we have gone out of the regular course that has been adopted on various occasions previously. There seems to be an emergency for this, and we do it for the benefit of the Association, to back up a state that has had, we consider, the most trouble the past year. If you condemn us for this, we have done it for this purpose.

Therefore, we nominate for President Dr. Peter Malcolm, of Iowa. (Applause)

Dr. Williams: I move the nominations be closed.

The motion was regularly seconded.

President Connaway: I never like to entertain a motion of that kind. I always feel that a body of this kind ought to be free even to oppose Dr. Malcolm. But if it is moved and seconded that the nominations be closed, my hands are tied in the matter. What is your will in this? Is there any discussion, or is it a discussible question? Those in favor of closing the nominations will signify by saying "Aye"; opposed, "No." It is carried.

Now it is in order to elect Dr. Malcolm, since he has been nominated.

Dr. Munce: I move that the rules be suspended and that the Secretary be instructed to cast the ballot for the election of Dr. Malcolm by acclamation.

The motion was duly seconded and carried.

Dr. Cary: Now, Mr. President, I think we had better nominate the three vice-presidents together, so that it won't take so much time.

First Vice-President: Dr. E. T. Faulder, New York
Second Vice-President: Dr. L. M. Hurt, California
Third Vice-President: Dr. H. C. Givens, Virginia

Dr. Mayo: I would like to second the nomination of Dr. Givens particularly, because he was a former student of mine. I don't attribute his success to that but to his own ability and skill.

I move that the By-Laws be suspended and that the Secretary be instructed to cast the vote of the Association for the three vice-presidents whose names were mentioned.

The motion was duly seconded and carried.

Secretary Dyson: I certainly take great pleasure in casting the unanimous vote of this Association for Dr. Malcolm as President, and for the three vice-presidents nominated. (Applause)

President Connaway: Is there any new business to come before the Association? If there is none, we will induct the new officers into their respective positions.

Dr. Dykstra, I think you are stout enough to bring Pete up onto the platform.

The audience applauded as President-elect Malcolm was escorted to the platform.

President-Elect Malcolm: Mr. President and Gentlemen: It is certainly a surprise to me to be elected to this office. I feel it is an honor, and I shall attempt to do the very best I can. If I have more time next year than I have had in the last year, I may be able to handle it in a humble way.

With this condition that arose in Iowa, I don't want you to think for one minute that I did not consider it a duty that I had to perform. There were two reasons why I believed that the laws of the state of Iowa, particularly the tuberculosis law, should be enforced: First, that the veterinary profession, not only of the state of Iowa but of the United States, was in jeopardy. The opposition to the tuberculosis work in Iowa was condemning the veterinary profession. They said that the work that we were doing was not reliable, the tests were not reliable; that the veterinarian was doing it for his bread and butter; that the law was passed for him. That was one reason why I figured it was a duty that I should perform.

The next reason was that the law of the state of Iowa had been tried out in the courts in the State, fairly, honestly and in a friendly manner. The understanding with me and the opposition lawyers was that we would test this law out to see whether it was constitutional or not, to see whether our test was a
reliable test, but it was to be done in a friendly way. They carried it through the district court, which sustained the law and said it was constitutional. They carried it to the Iowa Supreme Court. The Iowa Supreme Court said the law was constitutional, the tests were reliable, and it was a public health measure and a police measure. What was left for the Department of Agriculture and myself to do but enforce it? They even went a step farther. They carried the famous Muscatine County case up to the Supreme Court of the United States, and the latter turned it back saying, "We have no jurisdiction."

With those things before us, we would have been cowards if we had not gone through with the proposition. There is a side to this that you people probably do not know. We had opposition in the famous Cedar County case. It was centered there. We were not only fighting our own citizens, but we had citizens from outside of the state of Iowa coming in and helping them out. True, to enforce the law, we had to call out our militia. We were very fortunate in the state of Iowa in having a Secretary of Agriculture who believed in the eradication of bovine tuberculosis, and backed up by a Governor who wanted to see the law enforced. The Governor and the Attorney-General of the state of Iowa said, "You have a law which the Supreme Court says is constitutional. You must trace that law step by step," and we did. We brought it up to the point where the courts of our State enjoined the opposition from interfering with the test.

We went out and tendered our services and were interfered with, and we got three for contempt of court. The Governor said, "Now we must defend our court," and we did. The result was that we went out into six counties and made the test. Don't think for one minute that any of these counties, with the majority of people in the counties, were not in favor of the test. Cedar County has 2441 cattle-owners, and with only 600 did we have to use force to test their cattle. We drifted into another county with only 206, in a third with 400, which included infected herds. We dropped into another where there were only two, and into the last one, with only six.

The other county, which was Des Moines County, was the only county in the state that area work was not started in. We started in that and, of course, had to complete the test of all cattle. We took out of Des Moines County 425 reactors. We have a report on 248, and 20 per cent of the 248 were tankers.

I want to thank you again for the honor you have bestowed upon me, and I will ask you all to give me your individual support and I will try to do the best I can. (Applause)

PRESIDENT CONNAWAY: Will the vice-presidents come forward?
We will hear from the First Vice-President, Dr. E. T. Faulder. (Applause)

FIRST VICE-PRESIDENT FAULDER: Dr. Connaway, President Malcolm, Members of the Association: I want to thank the Nominating Committee and the members of this Association for their vote of confidence in maintaining me in the office of First Vice-President. I can assure you that I deeply appreciate this honor, and I will continue to work hard to extend the activities of this Association.

Dr. Malcolm, if you want any help from New York State, don't hesitate to call upon me. (Applause)

PRESIDENT CONNAWAY: Second Vice-President, Dr. L. M. Hurt. (Applause)

SECOND VICE-PRESIDENT HURT: Mr. President, this is a surprise to me. I didn't know that I had done anything to deserve this recognition. I will be very much pleased if the Association will allow me to take this as a compliment to the supervisors of Los Angeles County, in having had the nerve to pass regulations years in advance of any compensation funds, for the purpose of tuberculosis eradication.

I wish to assure Dr. Malcolm that we will do all we can that long distance, to help him in every way. (Applause)

PRESIDENT CONNAWAY: Third Vice-President, Dr. H. C. Givens. (Applause)

THIRD VICE-PRESIDENT GIVENS: Mr. President and Gentlemen: The first mystery that concerns me is what this Nominating Committee has against me,
and the second mystery is, What are they after? They want something, I am sure. I might be considered young in disease control work, but I assure you that no man assuming the responsibilities of disease control work will be at it long before he appreciates that the U. S. Live Stock Sanitary Association is his main support.

I therefore shall always be loyal to this Association, and assure you, Mr. President, that any assistance I may give will be gladly extended. (Applause)

President Connaway: We will hear from Dr. Francisco Moguel, one of our new workers. (Applause)

Dr. Moguel: Before this meeting closes, I would like to take the opportunity to give my thanks for the recognition that has been extended to my country and for the attention that has been given to me personally. We hope to be with you every year. You may be sure that my government will try to protect your country from the introduction of diseases. (Applause)

President Connaway: Last but not least, the President of the American Veterinary Medical Association, Dr. R. R. Dykstra. (Applause)

Dr. Dykstra: Gentlemen, I think that the performances of the past have indicated that there is a very close relationship between the work of the United States Live Stock Sanitary Association and of the American Veterinary Medical Association. I feel certain that during the present year an effort will be made to maintain those very close and harmonious relations. (Applause)

President Connaway: Now my valedictory, which is this, and very short: I certainly have enjoyed this meeting more than any I have ever attended, for reasons which are apparent, because I have had the opportunity to sit up here and look over one of the finest audiences I have ever looked at.

I wish to commend this meeting, in particular, for the fine attention they have given to all the speakers. That, too, may have come about from getting the chief disturber from the back seat and putting him up here where he couldn't talk with all of the friends he has made during the past thirty-five years.

I wish to give thanks for the fine work of the committeemen. Without the generous aid, the fine cooperation and help of the Secretary, we would not have had this fine program nor this fine congress of veterinarians from various parts of this country, from Canada and from Mexico, the three which form the United States of North America.

Mr. President, I congratulate you on being elected to this position. You will enjoy it, I am sure, and you will give the service that I know will please this Association. (Applause)

President-elect Malcolm assumed the chair.

President Malcolm: Is there any further business to come before the Association? If not, I will entertain a motion to adjourn.

A motion for adjournment was regularly made and seconded.

The meeting adjourned at 4:30 p.m.
## APPENDIX

### FINANCIAL STATEMENT

O. E. Dyson, Secretary-Treasurer

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### CURRENT ASSETS

- U. S. Treasury Certificates $2,300.00
- U. S. Liberty Bonds 1,500.00
- Cash balance in bank 1,053.43

### LIABILITIES

None.

### STATE MEMBERSHIPS

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Total—32

U. S. Bureau of Animal Industry
Canada Department of Agriculture

*December 1, 1931:*