PROCEEDINGS

Thirtieth Annual Meeting
of the

United States Live Stock Sanitary Association

HOTEL LASALLE, CHICAGO, ILL
December 1-3, 1926
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December 1-3, 1926
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SECRETARY-TREASURER
Dr. O. E. Dyson,
45 Live Stock Exchange Bldg.,
Wichita, Kans.

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Report of the Proceedings
of the
Thirtieth Annual Meeting
of the
United States Live Stock Sanitary Association

Chicago, Illinois, December 1-2-3, 1926

WEDNESDAY MORNING, DECEMBER 1, 1926

The first session of the thirtieth annual meeting of the United States Live Stock Sanitary Association, held at the LaSalle Hotel, Chicago, Illinois, was called to order at 10:30 a.m., by Dr. J. R. Mohler, President.

PRESIDENT MOHLER: Members of the Association and Guests: I want to bid you all welcome to the thirtieth annual meeting of the United States Live Stock Sanitary Association, which is now declared in session.

I am sure it is a great pleasure for me to be with you again this morning and most gratifying that there are so many of you in attendance.

Regretfully it is necessary for me to announce that the Secretary of Agriculture will be unable to be with us this morning, but we are indeed fortunate in having his assistant, who has, at great sacrifice to himself, agreed to stay over in Chicago long enough to be with us this morning. It is with great pleasure that I now present the Assistant Secretary of Agriculture, Mr. Renick W. Dunlap, of Washington, D. C. (Applause)

OPENING ADDRESS

By Hon. Renick W. Dunlap, Washington, D. C.

Assistant Secretary of Agriculture

Mr. President and Gentlemen:

I regret more than you that Secretary Jardine is not able to be present this morning. It may be that I am capable of filling his shoes, but I am very certain I cannot fill his hat.

I haven't any set speech this morning. I was not certain that it would be possible for me to remain for this session, but I discovered late yesterday that it would be, and so I am here this morning, more to say, "How do you do?" look you over and give you a chance to see what the Assistant Secretary looks like, than to make a speech.

I have always been interested in the live stock business, not from the same standpoint that most of you have been and are, but from the standpoint of a producer. I was brought up in
a horse-barn, the cattle-lot and the hog-pen. I think I know something about the production of live stock, but I must, and all we farmers must, depend upon you men scattered over the country to help us control and eradicate the diseases which we find in all classes of live stock.

We hear today a great deal of discussion concerning the plight of the farmer, and there is talk among all classes of people as to just what the federal government may do in order to give some relief.

I think we are all agreed that there is something wrong with agriculture. I think we all recognize that the farmer does not receive for his capital and labor returns commensurate with capital and labor invested in industry, in commerce, in the professions, and even labor. Many remedies have been offered, but in my opinion there is no single remedy which is going to bring about a condition for which we are all hoping.

I know that you men who compose this organization are helping very materially to solve this problem. You are assisting by helping take care of the many diseases with which live stock is affected throughout the nation.

I have made this observation in my own locality, back in the Scioto Valley of Ohio, where my farm is located, that those farmers who market their farm products through live stock are making less complaint about conditions than any other class. I have observed that the farmer who has stuck to live stock throughout the past years, through thick and thin, has done much better than those who have marketed their grain as such. The live stock farmer has been helped very materially in making a success of live stock farming by the assistance you have given him in preventing and curing animal diseases.

I remember very well indeed, when I was a student at the Ohio State University, coming in contact with that grand old man, Dr. Detmers, who was one of the pioneers in bringing about a remedy or a preventive for hog cholera.

I recall one occasion when he called me into his office and said, "I understand you have hog cholera down on your farm in Pickaway County."

I said, "Yes, we have. We have 200 or 300 head of mighty fine hogs that are dying like flies."

"Well," he said, "you are just the fellow I am looking for. I am doing some experimenting in trying to prevent this terrible disease. I have a hog over here in the pen which I think is
immune, and I wish you would allow me to ship this hog down to your farm and turn it in with these diseased animals and see what will happen."

I said, "Certainly, it can do no harm, and I will be very glad indeed to accept the hog."

He said, "If the hog doesn't die, it is yours."

We shipped it down and turned it in with the diseased hogs. It slept with them, ate with them, and the hog lived. Hogs were bringing a pretty good price because of that terrible disease and, as a consequence, I received a right nice little sum of money for that hog.

That interested me very much, and I have watched the progress made in treating hogs to prevent hog cholera from that day until now, and it is certainly gratifying not only to myself as a practical hog-raiser, but to all hog-raisers throughout the United States to know that the veterinary profession, aided by the great Bureau of Animal Industry, has perfected a serum and a virus which will prevent hog cholera. We took care of an outbreak which arose this fall in good order. To be sure, there were a good many thousand, perhaps a million, hogs lost, but how many would have been lost had it not been for this preventive.

Another disease with which I have had some experience is tuberculosis. We have had this disease in our herds and it is a fine thing to know that we can eradicate it through tuberculin tests.

There is one other disease which I am sorry to say we have not conquered quite so well as we have hog cholera and tuberculosis, and it is one which I am sure you are going to conquer sooner or later, and I hope it will be real soon.

Reading over a report of a speech made by your President last year, before breakfast this morning, I believe I am correct when I quote him as having said that there is now a greater loss among the live stock industry from contagious abortion than any other single disease. That disease is the one to which I refer, and I know that with all of you men working on this terrible disease, assisted by the U. S. Department of Agriculture, we are going to conquer it the same as we have conquered these other diseases.

I have also had a little experience in the eradication of the fever tick. I think the Bureau of Animal Industry, through Dr. Mohler, has had quite a little to do with perfecting the dip,
so that, if we will just take the trouble, we can get rid of this pest.

I was located in one of the southern states for better than two years, and personally supervised the dipping of many thousands of cattle, and I find that the cattle which I dipped were greatly benefited. Furthermore, and probably of more importance, by eradicating the fever tick, it is possible for stockraisers in those particular sections of the country to bring in improved live stock and build up the cattle industry; and in the particular section I was in, I will say frankly there was certainly plenty of room for improvement.

I often wonder what would be the condition of the live stock industry in this country if it had not been for the wonderful supervision and the great work done by Dr. Mohler and his staff in eradicating and exterminating foot-and-mouth disease. I know that there have been certain state agencies which have considered handling this situation without the aid of the Bureau of Animal Industry, and if I am not mistaken, they failed to do it, but there has not been any instance I know of where this Bureau, when it has been given control, has not eradicated the disease promptly.

Gentlemen, as you know, it is no easy matter to go in and take charge of a situation such as exists when we have an outbreak of foot-and-mouth disease, and I believe that if the Bureau of Animal Industry had done nothing else during its existence than the stamping out of the last two outbreaks of foot-and-mouth disease, the taxpayers of this country would have been well repaid for the millions of dollars it has spent since the creation of this Bureau. Certainly it has saved the live stock industry of America. I hope the time never will come when diseases of cattle will become as prevalent in the United States as they are in the old country.

I said in the beginning that I was not going to make a speech, and I am afraid if I do not quit right now, I may be accused of having made one; but as I also said in the beginning, I came here more particularly to look you over and to get acquainted.

In closing I want to say to you that the Department of Agriculture—I am sure Secretary Jardine will endorse this statement—is ready and willing at all times to do anything within its power to uphold your hands, to assist in every way in carrying out the programs which you have planned in your various states and which you have planned in a national way.
President Mohler: I am sure we all appreciate the words of not only the Assistant Secretary of Agriculture, but also of a practical livestock raiser. In order to show this appreciation, I am going to ask you all to stand up as our vote of thanks for the speaker's interesting and instructive address.

The audience gave a rising vote of thanks.

President Mohler: It now becomes necessary, according to the by-laws of the Association, for the President to deliver his presidential address.

President Mohler read his address. (Applause)

THE ADDRESS OF THE PRESIDENT

By J. R. Mohler, Washington, D. C.

Members of the Association and Guests:

Live stock sanitary authorities have been confronted constantly by important and often perplexing problems. Their responsibilities began to increase with the rapid development of the live stock industry and the expansion of transportation and marketing facilities. For many years it has been customary for such officials to discuss matters of mutual interest, especially the officials of adjacent states. Frequently groups of states were represented at such meetings. A conference of more than usual significance was held at the U. S. Department of Agriculture on June 19, 1894, to consider the advisability of greater uniformity in state laws regarding infectious and contagious diseases of live stock demanding serious attention. Seventeen delegates were present, representing nine states and the Bureau of Animal Industry. At this meeting an organization was formed under the name of the National Live Stock Sanitary Association, to be composed of state live stock sanitary commissioners and their secretaries, the state veterinarians and any other state or national official having control of the diseases of live stock. It seems that this organization did not survive and again in October, 1897, the live stock sanitary officials of a number of states interested in tick fever met at Fort Worth, Texas, with the view of arriving at some understanding, if possible, in regard to uniform regulations to control the movement of cattle from the quarantined area into, and through, the various states. The results of the deliberations at this meeting were so satisfactory that it was decided to establish a permanent organization and hold such meetings annually. The organization was named The Interstate Association of Livestock Sanitary Boards. In 1909 a constitution and by-laws were adopted and under the constitution the name was changed to the United States Live Stock Sanitary Association.
The problems of tick fever led to the establishment of the Interstate Association of Livestock Sanitary Boards. Its chief aim in the beginning was to bring about uniformity of action by various states in regard to tick fever; but it began early in its existence to extend its scope and usefulness. The first and second meetings were devoted almost entirely to the consideration of tick-fever matters. At the third meeting, held in Chicago, in 1899, bovine tuberculosis became the chief subject for discussion. Hog cholera received special attention at the fourth meeting, held in Louisville, Kentucky, in 1900. Infectious abortion, animal parasites and anthrax were discussed with much interest at the fifth meeting, in Buffalo, in 1901, and scabies was included in the program of the following meeting. The information derived from discussions of these diseases, their nature, prevalence and distribution, had a direct bearing upon one of the purposes of our organization, namely, to suggest and guide the enactment of legislation and the promulgation of regulations toward uniformity and simplicity.

Pearson, Salmon, Dalrymple, Bolser, Austin Peters, Johnson, Dean and, in fact, most of the men who were responsible for the organization and existence of the Interstate Association of Livestock Sanitary Boards and who represented their respective states so creditably in its early deliberations thirty years ago are no longer with us. But the organization which they conceived and founded has moved steadily forward with increasing usefulness and we look forward to these meetings each year with increasing interest. The attendance at the meetings held during the early history of the Association was usually from fifteen to thirty interested persons. Now we have a membership of approximately three hundred, composed of national and state live stock sanitary officials, veterinary practitioners, municipal health authorities, representatives of transportation companies, state agricultural colleges, the live stock and agricultural press, live stock organizations and others who are interested in our problem—and I am glad to see that most of them are here this morning.

The activities of this Association are outstanding among those in behalf of our live stock industry. We have just cause for pride in what has been accomplished and I have great hopes for its future growth and usefulness. I deem it an honor to have been elected to act as your President during the past year—I appreciate the honor personally and in behalf of the live stock interests which I serve in my official capacity.
Only those who have had the responsibility realize how much labor is necessary in making the arrangements for a meeting of this kind. In our organization the duties are divided largely among committees and the success of a meeting depends chiefly upon the work of these committees. In our endeavors to present on this occasion a program of timely subjects which will be interesting and instructive, the committees have worked diligently, there has been a fine spirit of team-work, and I am grateful for their splendid cooperation.

There is one officer to whom I wish to refer especially and that is our Secretary-Treasurer. His duties are varied and exacting and his responsibilities are greater than those of any other officer of the Association. Not only the President, but every member of the organization, owes Doctor Dyson a debt of gratitude for the willing and efficient manner in which he has been performing his duties year after year.

In scanning the various reports of the U. S. Live Stock Sanitary Association it is interesting to note the growth and development of the organization, the trend of veterinary medicine, the developments through research and experimentation, the results attained through the application of new knowledge, and the increasing tendency towards uniformity in state requirements affecting the protection and movement of live stock. While much has been accomplished in these fields, we are yet confronted in this country with many problems of scientific and economic importance.

Time will not permit of a detailed review of the occurrences and conditions, during the past year, which are of interest to this Association, but I will refer briefly to a few of them.

HOG CHOLERA

One of the latest and most outstanding matters of interest was the unusual prevalence of hog cholera during the past three months. This was not an unexpected occurrence. Conditions had been shaping for several years for such an outbreak and it is fortunate, in view of the conditions which prevailed throughout the country, that the disease did not spread more and cause greater losses than it did. There had been a gradual decrease in the disease since 1914 and the outbreaks that occurred were checked by prompt immunization and the application of sanitary measures. A feeling of security grew and spread and in spite of the warnings that cholera is as dangerous and destructive as
ever, hog-growers gradually discontinued immunizing their herds. In many instances they felt that they could not afford the expenditure when there seemed no necessity for it. As a result it is estimated that at least 80 per cent of the entire hog population of the country had not been immunized when, in September, the outbreak began to look serious.

There was suddenly a great demand for serum and serum producers were not in position to supply promptly the quantity needed. As a result of decreasing demands for several years past, some producers had closed their plants, and many of those that continued to operate had reduced production and carried only small reserves. It seems certain that not more than 107,150,000 cubic centimeters of serum were on hand, September 1, 1926, and most of it had not been tested.

Realizing the seriousness of the situation, the Department modified its serum-production requirements to help meet the emergency. The first step was to reduce the test period on serum from twenty-one to fifteen days. This order was followed shortly by a further reduction of the test period to eleven days, with the hope that the emergency might be met without discontinuing entirely the tests for potency and purity. Cholera continued to spread and many farmers unable to procure serum were helpless while they watched their herds die. Reports from the field became so alarming and the representations from authoritative sources so disturbing that it was decided to suspend the tests entirely for a temporary period, as it was believed that serum carrying an element of risk was better than no serum. Of course supervision of the production of serum up to the testing was continued as usual. As a result of the remedial action by the Department, in the neighborhood of 64,167,000 cc of serum, or enough to treat about 1,283,000 hogs each receiving a 50-cc dose, were released three weeks sooner than under normal conditions. The total quantity of serum released in September, 1926, was 89,996,000 cc and for October, 1926, it was 195,018,000 cc, or a gain of 105,022,000 cc. It should be noted that of this quantity 64,167,000 cc were obtained by suspending the test, while 40,855,000 cc were obtained through increased production. As was expected, serum and cold weather have brought the outbreak under control. Many hogs died of the disease in some localities, but the indirect losses through shipping shoats and unfinished hogs to market have probably been as great as the direct losses. This year's experience should bring hog-growers to realize that
cholera is to be dreaded as much as ever and that if they neglect to keep their herds immunized they are liable at any time to suffer heavy losses.

While the individual who loses his hogs through failure to immunize them suffers most, the misfortunes of a large number of negligent individuals affect the community, or state, depending upon the extent of the losses. Therefore, it would seem advisable for all those who are interested in the welfare of the swine industry to urge immunization and all reasonable sanitary precautions to prevent a recurrence of future extensive outbreaks. Research has given the swine industry anti-hog cholera serum, but that does not solve the problem entirely. There must be sufficient demand for the serum to encourage its manufacture in adequate quantities. Quantity production in response to a stable demand in turn tends to bring about economical production and economy of immunization. The producers of serum should carry reasonably large reserve supplies and it would be to the advantage of all concerned if state authorities, especially in the Corn Belt, could arrange to keep on hand a reserve supply, at headquarters, to meet any such emergency as we have just experienced. Before the serum has become too old it could be exchanged, sold, or retested, and the small expense involved would be a very slight premium on the insurance covered. Similarly for the last nine years the B. A. I. has kept a supply of rinderpest serum in storage, which has been replaced with a fresh supply when necessary, in order to combat any outbreak of rinderpest should it appear in this country.

Tuberculosis Eradication

In all live-stock-disease-control work in the United States that has been performed since 1884 the federal government has assisted the various states in conquering outbreaks of an infectious or contagious nature. When the time arrived to wage a relentless campaign against animal tuberculosis, Congress provided funds for the federal government to cooperate with the respective commonwealths in attacking the common foe. I think it safe to say that in all the cooperative campaigns that have been conducted, the forces have never worked with greater harmony and uniformity than in this campaign now being waged. The live stock owners of the country have watched this team-work and the success that has been obtained up to the present time, and are encouraging its continuance. This work is important not
only from an economic standpoint but also because a certain percentage of human tuberculosis, especially among children, is due to infectious products of tuberculous cows.

Time forbids a lengthy discussion of the progress that has been made in this campaign, but when it is realized that over 8,000,000 tuberculin tests were made by the cooperating forces during the fiscal year 1926, a fairly comprehensive idea is gained of the vastness of the work.

The accrediting of individual herds of cattle is not being followed up so closely now as before, as more effort is being put into the area plan of operation.

**STATUS OF AREA WORK**

This plan was not advocated until 1920, notwithstanding the fact that it had been tried out in the District of Columbia as early as 1908 and was found practicable.

The records show that on October 1, 1926, there were 235 counties out of 3,073 counties which had been classified as modified accredited area, because of the fact that the disease exists to less than one-half of one per cent. In addition there were 154 counties which had completed one test of all cattle within their borders and 415 other counties were extensively engaged in area work, making a total of 804 counties, or over one-quarter of the total number of counties in the United States, actively working on eradicating the disease.

Sumarizing the work, the records show that today there are approximately 15,000,000 cattle under state and federal supervision. There are more than 1,500,000 cattle which have been officially accredited and over 11,000,000 cattle that have passed one clean test. If from the 60,000,000 cattle in the country we subtract 7,000,000 calves of the 13,000,000 under one year and also the 7,000,000 steers, we would find that one-third of the remaining cattle are now under supervision. There had been condemned and destroyed for tuberculosis from the inception of the work, in 1917, over 1,000,000 cattle and during the same period more than 29,000,000 tuberculin tests had been applied to cattle. The last Congress gave the Bureau an appropriation of $4,653,000 for tuberculosis or an increase of $1,093,000 over the previous year, and made $750,000 immediately available for indemnities. This increase was due largely to the excellent work of your Committee on Legislation in Washington last February.

The demand at this time on the part of the live stock owners
to place their herds under supervision is greater than ever before
and the prospects of continued progress seem satisfactory.

**Tuberculin**

During the year the biochemical studies of tuberculin, which
have been under way in the laboratories of the Bureau for some
time, have led to a number of interesting observations. Perhaps
the most important of these has been the determination of the
fact that the active material of tuberculin, contrary to the
general belief, is adsorbed by a number of different substances,
such as finely divided charcoal, Fuller’s earth and diatomaceous
earth, commonly called “kieselguhr.” As the Berkefeld filter,
which is so generally used to remove bacteria from tuberculin
and from other biological products, is composed of kieselguhr,
this observation, aside from its scientific interest, may be of
great practical importance, since such a filter no doubt removes
part of the active material from the tuberculin. All of the sub-
stances named above carry a negative electric charge. Finely
divided calcium carbonate, which carries a positive electric
charge, does not seem to adsorb the active material. A pre-
liminary statement of these findings is contained in the December
number of the *Journal of the American Veterinary Medical
Association*.

**Tuberculosis Cures and Immunizing Agents**

It is a function of the Bureau of Animal Industry to keep
itself informed on the claims made from time to time regarding
alleged tuberculosis cures and immunizing agents. Such claims,
with few exceptions, can be dismissed as invalid after a brief
analysis of the evidence on which they are based. Among the
exceptions three are of comparatively recent date. They are
the defatted tubercle bacillus of Dreyer, the sanocrystin or gold-
salt treatment of Mollgaard, and the BCG vaccine of Cal-
mette and Guerin.

Dr. Georges Dreyer, chief of the Department of Pathology of
Oxford University, England, assumed that the specific proteins
of the tubercle bacillus are prevented from leaving its body by
the fatty envelope in which they are enclosed in sufficient
amounts to cause immunity in infected organisms, and, therefore,
that the tubercle bacillus, after the removal of the fatty material,
would be serviceable in the treatment and prevention of tuber-
culosis. The results he obtained in testing his assumption could
not be confirmed by the Bureau. Tubercle bacilli defatted in strict accordance with the method he described failed to cure or prevent tuberculosis in small, experiment animals. In passing, it may be recalled that Dr. Dreyer is only one among truly meritorious investigators whose conclusions on the specific treatment and prevention of tuberculosis have proved untenable.

The Mollgaard, or sanocrysin, or gold-salt treatment requires successive injections of a solution of the gold salt into the veins of the tuberculous subject, followed, if albumin appears in the urine, by injections of a serum obtained from the blood of animals previously injected with killed tubercle bacilli.

As the claims of Mollgaard were based largely on experiments with calves, their validity was tested in an experiment with calves, planned by the Hygienic Laboratory of the U. S. Public Health Service, in which the Bureau, the Rockefeller Institute for Medical Research and the Research Laboratories of the New York City Health Department cooperated.

In the experiment the treatment proved fatally dangerous for artificially infected tuberculous calves. The tubercle bacilli in the bodies of the calves, contrary to the claims that they would be disintegrated, remained visibly unaffected and retained their pathogenic potency. The reactions following the injection of the gold salt into healthy and tuberculous calves were alike. The most favorable conclusion that could be drawn from the experiment and other available data is as follows: If sanocrysin has any value in the treatment of tuberculosis it remains for the future to prove it and to determine how the dangers incident to its use can be eliminated.

It may be added that salts of gold and other heavy metals have long been studied relative to their value in the treatment of tuberculosis, and that, as the Journal of the American Medical Association (Jan. 24, 1925) pointed out in an editorial, sanocrysin is not a newly discovered salt of gold.

The BCG vaccine of Calmette and Guerin is alleged to be an originally virulent strain of the bovine type of the tubercle bacillus, the pathogenic potency of which disappeared under long continued, artificial cultivation on a culture medium containing bile, and which induces a high degree of resistance against tuberculosis in animals whose bodies, prior to vaccination, have not been invaded by virulent tubercle bacilli.

In addition to the use of the vaccine to protect the children of tuberculous families, Doctors Calmette and Guerin are striving
to secure the vaccination of all calves in France as early as possible after they are born, and seem to believe, if they are successful in this, that it will gradually eradicate tuberculosis from the cattle of France.

Children are given the vaccine per mouth, three doses, on alternate days, during the first week to ten days of their lives. The calves receive the vaccine either subcutaneously or intravenously, preferably subcutaneously in the region of the dewlap.

Calmette and Guerin plainly state that the vaccine is not a curative agent for tuberculosis, and that good from it cannot be expected if its use is delayed until after tubercle bacilli have entered the bodies of the children or calves.

The Bureau has been studying the vaccine for some time. The results it has so far obtained indicate that vaccinated calves, on receiving intravenous injections of virulent, bovine tubercle bacilli, are somewhat more resistant, but by no means wholly immune, against tuberculosis than control or unvaccinated calves.

Without at all condemning the BCG vaccine, probably the best thing to do until the many tests to which it is being subjected have supplied data for reliable conclusions, is to follow the lead of the National Tuberculosis Association, which approved a resolution at its annual meeting last October, worded about as follows:

"There is no specific cure for tuberculosis such as antitoxin for diphtheria and no specific preventive such as vaccination against smallpox."

PARATUBERCULOSIS

Most of you are familiar with the disease of cattle known as Johne's disease, paratuberculosis, or infectious bacterial enteritis of cattle, and know something of its characteristics; however, some may not be aware of its insidious character, its increasing prevalence and the need for regulatory measures to cope with the disease as it now exists.

This malady is an infectious diarrhea and when prevalent in a herd of cattle offers a serious handicap, for it not only renders dairy animals unproductive, but the disease is contagious for the other members of the herd, and is moreover fatal to the animals, usually after running a more or less chronic course, despite the best of care that can be bestowed on the victims. The incubation period may be very prolonged, perhaps many months,
so that during this interval other animals coming in contact may pick up the infection from contaminated pastures or fodder. In other words, the disease acts in many ways like intestinal tuberculosis and, on account of this, diagnostic methods have to be applied that are quite analogous to some of those that are carried out for tuberculosis. A biological test known as the johnin test, quite similar to the tuberculin test, is used for making a diagnosis.

The Bureau, while cognizant of the presence of the disease in limited sections of eight or nine states, has failed heretofore in securing funds that could be used in an effective manner to combat the disease. However, I am happy to inform you that Secretary Jardine and the Bureau of the Budget have approved the inclusion of paratuberculosis in the tuberculosis-eradication item. This means that, if the Congress approves, the disease will be attacked along lines similar to the tuberculosis campaign, even to indemnify the owners of condemned and slaughtered cattle.

It is hoped that the sanitary officials of infected states will be able and willing to fight this disease before it has become more widespread, but on account of our inability to increase incubator space the diagnostic agent, johnin, to be used by the various states must be obtained from state experiment stations or biological houses. The present demand for tuberculin for use on cattle is overloading our capacity on account of our limited space and therefore neither avian tuberculin nor johnin can be prepared for our cooperating forces.

**Tick Eradication**

The cooperative efforts, participated in by cattle-owners, state and county officials, and the Bureau of Animal Industry, to exterminate the cattle tick in the infested sections of the South, have now been in progress for twenty years and have resulted in the release of 72 per cent of the original quarantined area.

At the inception of the fight on this disease-carrying parasite in 1906, fifteen southern and southwestern states were in whole or in part under the tick embargo. In this quarantined territory there were 984 counties, with a total area in excess of 725,000 square miles. Of these counties 737 have been released and of these released counties 641 are entirely tick-free.

A review of these figures might give the impression that the feasibility of this project has been so definitely demonstrated that it is now but a simple mathematical problem to estimate
quite accurately when tick eradication in the United States will be an accomplished fact. Unfortunately, this is not the case. There are still a few localities where indifference or active opposition continues, and in two states, Mississippi and Louisiana, there was an actual loss of ground during the past year. It will therefore be apparent that the time required to free the cattle industry of the South completely from this destructive pest will depend largely upon how soon these sections decide that they want to finish the job. It is no longer a question of how to eradicate the cattle tick; the important and controlling phase of this work now is the thorough and conscientious cooperation of the cattle-owners and local officials.

This year, largely through the forceful efforts of your Tick Eradication Committee, the inconsistent provision in the Act of Congress of 1884, which provided that splenetic or Texas fever should not be considered a contagious, infectious or communicable disease and authorized the interstate shipment of ticky cattle for immediate slaughter without dipping, was repealed. This amendment, which undoubtedly will have an important effect in stimulating the completion of this project, was approved June 28, 1926. It provides, however, that until May 1, 1928, cattle infested with or exposed to cattle-fever ticks may be shipped in interstate commerce for immediate slaughter after one dipping in accordance with such regulations as the Secretary of Agriculture may prescribe. After that date cattle must be free from ticks before they will be eligible for interstate shipment for any purpose.

**Foot-and-Mouth Disease**

The recent outbreaks of foot-and-mouth disease in Texas and California have been stamped out and the United States is again entirely free from this intensely infectious malady. The last diseased herd in the former state was destroyed on October 15, 1925. The testing of infected premises was completed in March, 1926, and on April 1 all quarantine restrictions on Texas were revoked. In California, where infection in deer in the Stanislaus National Forest presented a most difficult problem, the last deer showing recent lesions was taken on June 10, 1925. The infected ranges were tested by the grazing of cattle on them during the latter part of 1925 grazing season and of the present season with negative results. All quarantine restrictions were removed from the State on June 10, 1926.
Conditions in nearby countries, however, so far as this disease is concerned, are not so favorable. In Jamaica, where they have been having trouble at intervals for several years, there was a recurrence in June, 1926, after apparent freedom since July, 1925. This outbreak has been confined to a small area and is being vigorously combated by the Jamaican authorities who are using the slaughter method.

A most menacing situation confronts this country in our neighboring republic of Mexico where an outbreak of foot-and-mouth disease was officially confirmed early in May of this year. Two veterinary inspectors were sent from this country to the affected section, upon request of the Mexican authorities, to assist in diagnosing the trouble and in making a survey to determine the extent of the outbreak. The disease has appeared in the states of Tabasco, Yucatan, Campeche and Chiapas. The infected territory is an isolated one with only the most primitive means of communication with other parts of Mexico, except by steamer between gulf-coast ports. The Mexican authorities have been endeavoring to eradicate the disease. They apparently have it under control but new outbreaks still occur occasionally in the infected area.

As soon as it was known that the disease existed in Mexico the Bureau issued an order prohibiting the importation of specified kinds of live stock and materials from that portion of the country lying south and east of the Tehuantepec National Railway and instructed its inspectors at gulf-coast ports to visit incoming vessels from Mexico to insure strict enforcement of this order. A somewhat similar embargo was placed on shipments originating in Jamaica, when the outbreak occurred in that island.

Designed to afford the live stock interests of this country greater protection against foreign animal diseases, the Bureau issued an order, effective July 1, 1926, prohibiting any vessel entering a port of the United States which has on board as ship stores, cattle, sheep, other ruminants or swine originating in a region in which foot-and-mouth disease or rinderpest exists, and another requiring the disinfection of previously used bags and bagging material imported from such countries; also an order, effective January 1, 1927, placing an embargo on fresh and frozen beef, veal, mutton, lamb or pork originating in any region in which either of these diseases exists.
Owing to the close geographical relationship between Mexico and the United States and reciprocal interests in matters of commerce including exchange of live stock and other agricultural products, an outbreak of a dangerous foreign animal disease in one country is a matter of concern to the other. Following an exchange of notes between the two governments concerning the desirability of applying common measures of defense against invasions of such diseases, delegates representing the two countries were appointed to consider this matter.

These delegates met in Washington, in July of this year, and after discussing the subject in all its aspects prepared a joint report of decisions and recommendations for submission to their respective governments. This report is in the form of a treaty which requires ratification by the senates of Mexico and of this country before its provisions will become effective.

Congress in the Second Deficiency Act of March 4, 1925, appropriated $75,000 for the study of foot-and-mouth disease in Europe, which led to the appointment of a commission by the U. S. Department of Agriculture for this purpose. This commission consisted of three members, one of whom was from the Rockefeller Institute for Medical Research, one from the University of California, and the third being a representative of the Bureau.

The Commission left the United States in May, 1925, and returned in July, 1926. France, Germany, England, Denmark, Sweden, Holland, Belgium, Switzerland, Austria, Hungary and Italy were visited where a study was made of the research work being done and the control measures employed in combating this disease. The commission established itself at the Institut d'Hygiène et de Bacteriologie, Strasbourg, France, and later also at the Laboratoire National de Recherches, Alfort, France, where experimental work was done on certain problems of the disease. While the time for experimental work was relatively short, due to the lapse of the appropriation, a considerable amount of valuable information relative to the various phases of foot-and-mouth disease was obtained, and though neither the causative agent of the disease was cultivated nor a specific vaccine discovered, certain contributions extending the outposts of our knowledge of foot-and-mouth disease resulted.

Laboratory studies on the virus have thrown further light on its nature and the conditions favorable to its artificial cultivation, while a study of the action of disinfectants on the virus
brought out some new points of interest. The plurality of foot-and-mouth disease virus as a disputed point was settled by the Commission, in confirmation of the work of Vallée. This has also since been confirmed by the British Foot-and-Mouth Disease Research Committee, and Professor Waldmann, of Reims, Germany, who had previously denied the existence of such plurality.

Comparative studies on vesicular stomatitis and foot-and-mouth disease occupied a large part of the work of the Commission and as a result comparative knowledge of the two diseases has been greatly increased.

Particular information on the infectivity period of infected animals and the spread of the disease has been obtained, while a general study of the epidemiology of the disease in the various European countries has given information that should be of practical value to the United States in dealing with future outbreaks of foot-and-mouth disease.

**Vesicular Stomatitis**

Vesicular stomatitis has been reported from five states during the current year. A factor of great importance in connection with this disease is that its lesions are so much like those of foot-and-mouth disease that it is extremely difficult to differentiate them. A precise and rapid method of distinguishing the one disease from the other is much needed and the discovery of any facts that can be used to improve our present method will be welcomed.

While recent work of the Bureau has added quite a little to our knowledge, it has not as yet, unfortunately, revealed greater differences in the nature and manifestations of the two diseases than were already known. In fact, the reverse is true; because certain supposed differences have been found not to exist.

It has been proved that vesicular stomatitis virus behaves practically the same towards guinea pigs as European investigators, a few years ago, proved foot-and-mouth disease to do. It has also been found, contrary to earlier belief, that the virus of vesicular stomatitis is a filter-passer. It was hoped that the guinea pig and filter would be of some value in helping to distinguish between the two diseases, but we know now that unless minor differences in the behavior of the two viruses towards the guinea pig and filter are discovered, they are of no value for this purpose.
Earlier observations indicated that vesicular stomatitis did not affect the feet of cattle or horses, but recent observations and experiments have shown that the feet of cattle are occasionally affected in naturally acquired disease and may show marked lesions indistinguishable from those of foot-and-mouth disease, and that feet lesions are sometimes produced both in cattle and horses by intravenous injections of the virus. As in foot-and-mouth disease the virus has been demonstrated to be present in the blood in the earlier stages.

The disease is unlike foot-and-mouth disease in that it is usually only mildly contagious, since close contact with infected animals in the early stages of the disease, or with the freshly infected environment of such animals, seems necessary to infect. In a recent outbreak, however, the infection was much more virulent than usual and once introduced rapidly spread through a herd and seemed to be carried from herd to herd by other means than the movement of infected cattle. Small vesicles on the teats of cows have been observed in previous outbreaks, but in the one above mentioned, teat lesions of large size developed in a large proportion of cows in two dairy herds. Milking was rendered extremely difficult if not impossible, and the disease has probably caused permanent, severe damage to udders of many of the cows.

Work now in progress with material collected from the above outbreak and from a former outbreak in a widely different section of the country, indicates that there are at least two distinct strains of virus, neither of which will immunize against the other, though one of them has been proved to give a definite and fairly lasting immunity against itself.

Of animal inoculations so far undertaken, those of horses and mules are the only ones found to be reliable in differentiating vesicular stomatitis from foot-and-mouth disease. Though some European investigators have reported that horses sometimes contract foot-and-mouth disease, no indications of it have been observed in these animals in the several outbreaks of the disease that we have had in this country, though many horses have been exposed by close association with diseased cattle and a number by artificial inoculation. Both horses and mules, however, contract vesicular stomatitis with great regularity of inoculation. The disease becomes manifest by the formation of well-developed vesicles within 48 hours. Therefore, until some better method is found, the inoculation of horses or mules must be our main
dependence in our efforts to distinguish vesicular stomatitis from foot-and-mouth disease.

**Parasites of Live Stock**

For eight years the Bureau has endeavored to secure funds to finance investigations of parasitic diseases of live stock in our southern states, but thus far it has been impossible to secure them. For years we have known that various parasites caused serious losses among southern live stock from time to time, but our knowledge of conditions in the South has been very sketchy and inadequate.

Convinced that this southern work must be done without additional appropriations, we have discontinued several northern projects, which had carried their work to the point of developing measures of proved value in parasite control, and have transferred these projects to the South. One of them is the control of swine parasites, a project which had developed the highly successful system of swine sanitation in McLean County, Illinois. This project has been transferred to Moultrie, Georgia, where it is now being carried out under very good conditions as regards cooperation and the opportunity to consider not only ascarids, the worms receiving attention in McLean County, but also kidney worms and other parasites prevalent in the South. The sheep projects previously conducted at Vienna, Virginia, and Queen City, Missouri, have been closed and experiments begun at McNeill, Mississippi. This work has already given interesting results in demonstrating the grave dangers in overstocking pastures of Bermuda grass, carpet grass and lespedeza. The subject of cattle parasites has received little attention in this country in the past and a new project dealing with this subject has been started on the experiment station at Jeanerette, Louisiana, with funds from the appropriation from that station.

With these three stations investigating parasites of swine, sheep and cattle, respectively, we shall undoubtedly know much more about the prevalence and importance of these parasites and of the possibilities of control in the next few years than we do at present.

**Bovine Infectious Abortion**

Bovine infectious abortion, the economic importance of which must be ranked as nearly if not actually supreme among the infectious diseases of domestic animals, continues to present unsolved problems. Utilization of the knowledge at present
available often enables the prudent stock-owner to maintain an abortion-free herd. Even the eradication of the disease from infected herds is not a hopeless undertaking. Sanitary control measures, based on our present knowledge of the disease, have given satisfactory results. But it must be kept in mind that sanitary control measures, directed against a wide-spread, common and insidious disease, that produces many, apparently unaffected carriers and disseminators of its causative agent, necessarily must be complex and somewhat laborious and expensive, and that they must be continued, uninterrupted and free from mistakes, for long periods of time. Hence, as mistakes are easily made, especially when important tasks must be entrusted largely to laymen, we cannot fail to appreciate that something simpler and less apt to be burdened with disappointments is eminently desirable. For this reason investigations still in progress on specific immunization against bovine infectious abortion should be encouraged.

It may be that some good will come out of tests now being made with culturally attenuated strains of the abortion bacillus, or with the use of strains derived from swine to immunize cattle and strains from cattle to immunize swine. Culturally attenuated abortion germs are easily obtained, and preliminary experiments indicate that abortion germs from cattle and swine, though infectious under natural conditions for the species from which they are derived, are virtually lacking in infectivity for the other species.

Data are gradually accumulating to show that infectious abortion causes probably greater losses than past estimates would lead us to believe, because it now seems that dairy cattle which react with serological abortion tests produce less milk and butter-fat than similar cattle which do not react. From the economic standpoint this is a very important matter in its relationship to the use of living-culture, abortion vaccines, because the injection of such vaccines engenders reactivity to serological tests.

All abortions and breeding troubles among cattle are not due to the germ of bovine infectious abortion. The undeniable part played by deficiencies in the feed of cattle is receiving much attention, but in this connection it is well to remember that it has been proved over and over again that the bacillus of Bang, unaided by other discoverable causes, is the most important factor in bovine abortions.

Increasing attention is being given to the possible significance
of the Bang bacillus for public health, because of the remarkable resemblance between it and the germ of Malta or undulant fever. Relative to this phase of the subject it may be said, though it is a wise policy to avoid the unnecessary exposure of human health to germs pathogenic for any species of animals, it does not seem that the abortion bacillus either is or is apt to become an important health factor if we take into account the enormous number of persons in America and Europe who have been exposed to it without consequent, recognizable sickness, and the large proportion of persons who contract Malta fever from the ingestion of raw milk from infected goats.

Bacillary White Diarrhea

As regards the "billion dollar" poultry industry of the United States, no disease problem is of greater moment than bacillary white diarrhea. This malady, like contagious abortion of cattle, strikes a deadly blow at the very fountain-head of the industry's young life.

The Bureau is by no means indifferent to the menacing character of this disease but, on the contrary, is in full sympathy with the present impulse of the poultrymen to grapple with so destructive a foe. We cannot escape the impression, however, that the action inspired by that impulse, thus far, has to a degree lacked certain qualities that seem essential to lasting results. In some quarters there has been a tendency toward the premature application of ideas yet unproved. It would seem high time that we pause for a deliberate survey of the situation, and a dispassionate inquiry into the feasible ways and means of the most effectual plan of attack.

As the matter now stands, any participation of the Bureau in a comprehensive campaign against bacillary white diarrhea must be limited to an advisory or supervisory capacity. In fact, several prerequisites appear to be imperative before we could hope to function adequately even to that limited extent. One of the conditions referred to is the necessity of a better unified organization of the state agencies cooperating in the plan in question. Complex or conflicting state machinery would unquestionably impede the best interests of joint action on the part of state and federal governments. Therefore the state arm of the movement should be singled down to one official branch, whether that be the livestock sanitary board, state college of agriculture, state veterinarian, or office of marketing, as the case might be.
That branch should be responsible for the application of the agglutination test for bacillary white diarrhea, and its interpretation. Field and laboratory forces and equipment necessary to the plan of flock recognition subject to test would doubtless be dependent upon private or state funds for support, as no appropriations are now available for sustaining this routine work as an activity of the government.

There are probably almost as many versions of the test extant as there are laboratories conducting it, thus establishing a state of chaos out of which some uniformly sound basis of recognition must be developed. Added to this disorder is the fact that many strains of the white diarrhea germ are low or lacking in agglutinative properties, and if used in antigens would be certain to yield confusing results, if not eventually to afford a false sense of security to many owners of dangerously infected flocks.

Our plea, therefore, should be for a standardized test, definitely worked out with known standardized antigens to the accomplishment of definite, dependable results. Qualified veterinarians, interested in poultry diseases and inclined toward serological work, could readily conduct agglutination tests after appropriate instruction and our colleges should be in position to furnish such instruction to graduate veterinarians desiring it. Obviously after acquiring the technic of making these tests for one disease, it may be easily applied to other diseases such as infectious abortion, the control of which, in my opinion, will continue for years to come in the hands of the practitioner working on each animal as a unit. Standardized antigens for these tests should be made available by biological houses or state experiment stations. I have asked your Committee on Poultry Diseases to cultivate this topic further as well as a systematic method of handling avian tuberculosis, and I anticipate with confidence the wisdom of the conclusions to be presented at this meeting.

DISINFECTANTS

There is no question but that disinfection, as carried out at present, is on a largely empirical basis and yet it is known that many disinfectants are quite specific in their action, being capable of destroying one disease-producing organism without having much power against another. Our laboratories have been endeavoring to attack this problem from the standpoint of bactericidal efficiency in relation to chemical constitution and the work has progressed far enough to show that the two things
are very definitely related, at least in certain series of chemical compounds, such as the phenols. It has been possible in the laboratories to prepare substances which have never been made before by chemists and in advance to predict very accurately the bactericidal power which they would possess. These researches have led to the development of certain compounds which have an enormously high bactericidal efficiency. One in particular has been found, when tested under laboratory conditions against *Staphylococcus aureus*, to be 1000 times as powerful as carbolic acid, weight for weight. We look forward with much interest to the development of these researches.

**IMPORTANT SUPREME COURT DECISION**

Last March the United States Supreme Court, in the case of Oregon-Washington R. R. & Navigation Company vs. State of Washington, rendered a decision holding as invalid a state quarantine against the introduction of a serious plant insect, on the ground that by the federal plant quarantine act Congress had itself assumed such authority. Thereupon Congress amended its plant quarantine law so as to authorize the states to establish and enforce quarantines for plant diseases until the federal government should establish similar quarantines. Believing that the courts would render a like decision should the point be raised in a contested case involving a state animal disease quarantine, the Bureau has already recommended that Congress enact at the coming session a similar amendment to our animal quarantine laws. This measure should receive your earnest support and the immediate attention of your Committee on Legislation.

**GENERAL STATEMENTS**

In conclusion I wish to leave with you as the main theme of my address the desirability of laying stress on continuous, persistent, and systematic effort. Much energy is wasted by starting meritorious activities and then, after the first period of enthusiasm, losing interest. This tendency applies to scientific work, administrative work, and even regulatory work. The real test of ability among individuals and in an organization is not so much in conceiving and undertaking work as in preserving the initial enthusiasm until the job is finished. Now that most of the work of the Association is progressing satisfactorily, this is an opportune time to pursue some of the unfinished work and settle some of the more controversial and doubtful points by conclusive study and reports.
I also wish to suggest the advisability of establishing wider and closer contacts with other organizations and studying the point of view of the public. In live stock sanitary work which deals largely with regulations, it is highly desirable to present the problem to the public, especially to persons directly concerned, in such a way as to bring about sympathetic understanding. For instance, to condemn several reactors on a farm is a routine procedure for a veterinary inspector, while it may be an outstanding event in the experience of the farmer whose herd has been tested for the first time. It is therefore highly desirable that the condemnation of live stock be conducted with due consideration for the other person, and in a manner flavored with the Golden Rule.

With the growing tendency toward the study of avian tuberculosis, it seems desirable to establish suitable contacts with officials of poultry associations and superintendents of poultry shows. Such contacts are likely to bear abundant fruit when matters of mutual interest may arise. Furthermore, the influence of the press can scarcely be overestimated, and we should cultivate such contacts for most certainly no scientific organization can be indifferent to the attitude of the lay public.

A noteworthy betterment of conditions for the production of domestic animals has occurred during the past year. There was excellent progress in the eradication and control of important animal diseases. Improvement of live stock by better breeding made further gains. Research and experimentation yielded many important discoveries. Regulatory work also showed general public compliance with the laws and regulations for protecting and otherwise benefiting the live stock industry.

It is a truism that agriculture is the foundation industry of our country. It is essential to our social and political welfare that it be made more profitable. The most important item in increasing agricultural prosperity is profitable production of live stock. The United States Live Stock Sanitary Association is admirably adapted to render great service in improving the condition of live stock producers. We have combined in this organization both the scientific and the practical factors. The closer the alliance and cooperation of these powerful forces the greater will be the influence and usefulness of the organization in helping to better live stock conditions, in increasing our national wealth, in protecting public health and in adding to human comfort and happiness.
PRESIDENT MOHLER: May I now call upon the Secretary-Treasurer for his annual report.

Dr. O. E. Dyson: The report of the Secretary is always embodied in the published proceedings of the meeting. I will therefore confine myself to a report of the Treasurer.

Dr. Dyson read the Treasurer's report.

REPORT OF SECRETARY-TREASURER

1926

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STATE MEMBERSHIPS

Arkansas Iowa Nebraska Pennsylvania
California Kentucky New Hampshire South Dakota
Connecticut Michigan New Jersey Texas
Florida Minnesota North Carolina Vermont
Georgia Mississippi North Dakota Virginia
Indiana Montana Ohio New York

Canada Department of Agriculture
U. S. Bureau of Animal Industry

CURRENT ASSETS—12 $100.00 Liberty Bonds (cost) $1232.90
Cash Balance in Bank 262.14

Total Current Assets $1495.04

LIABILITIES—None.

*In order to segregate the item "Cash on Hand" at the end of the fiscal year from current date of rendering the annual financial report, it was necessary to deduct $25.21 from the item of $275.54 reported as "Cash on Hand" December 2, 1925, leaving in lieu thereof a cash balance of $250.33, the items involved being a prepaid state membership of $25.00 for 1926, and miscellaneous expense of meeting amounting to $3.21.

The meeting adjourned at 11:55 a. m.

WEDNESDAY AFTERNOON, December 1, 1926

The second session was called to order at 2:00 p. m., by President Mohler.

PRESIDENT MOHLER: It now becomes my pleasure to proceed with the literary program of the meeting, and I shall call on Dr. E. B. Forbes to address us on "The Mineral Metabolism of Dairy Cattle and Swine."

Dr. Forbes read his paper. (Applause)
THE MINERAL METABOLISM OF DAIRY CATTLE AND SWINE


Director, Institute of Animal Nutrition
Pennsylvania State College

The Mineral Metabolism of Cattle

The mineral metabolism of the milch cow, in its practical relations, was opened up by a series of studies by the speaker and his associates, at the Ohio Station, which were published during the years 1916, 1917, 1918 and 1921. These experiments are notable as the earliest complete mineral balances with cows on practical rations; and the results comprised 60 balances of sodium, potassium, calcium, magnesium sulphur, phosphorus, chlorin, nitrogen, and in some cases also silicon and arsenic.

In the course of this investigation it became apparent that calcium, on account of the large amount present in the body and in the milk and because of the characteristics of its compounds as to solubility, occupies a dominant or key position in mineral nutrition. It is also obvious that in the long run the metabolism of phosphorus and magnesium must be closely proportional to that of calcium. In the interest of brevity, therefore, I shall confine my remarks entirely to calcium in particular or to the mineral nutrients in general.

Throughout these studies six cows were under experiment at a time, there being four experimental programs, one in each of as many years. The greater part of this work was done while the cows were in the first half of the period of lactation; but in the fourth program of balances the cows were so selected as to cover in a disconnected series of observations the entire cycle of lactation and gestation.

The rations were composed of the best of ordinary feeds. Protein was always present in excess, so that the utilization of minerals could not be limited by protein deficiency. Mineral utilization was studied, as affected by leguminous roughage, as compared with timothy hay, and as affected by mineral supplements added to calcium-rich as compared with calcium-poor rations.

From among the many conclusions the following are selected:

Liberal milk-production, during the first half of the period of
lactation, on normal winter rations, fed in quantities sufficient to maintain live weight and nitrogen equilibrium, invariably caused loss of calcium from the skeleton, in spite of obviously adequate amounts of calcium in the ration.

With large additions of calcium to these normal rations, in the form of steam bone-flour, precipitated bone, calcium carbonate, calcium chloride and calcium lactate, the calcium balances remained negative, that is, calcium was lost from the body, in all cases of abundant milk-production, in spite of calcium intake varying from normal to excessive.

The mineral losses when the roughage was of leguminous nature were, on an average, somewhat less than when timothy hay was fed, but when mineral supplements were added to the normal basal rations the utilization of the added calcium was doubtful and, at the most, slight and inefficient. Inasmuch, therefore, as the basal rations themselves were usually rich in calcium, it is obvious that deficiency of calcium was not the factor responsible for the negative calcium balances.

**Leguminous Roughage Supplies Calcium**

Rations which contain no leguminous roughage, however, are apt to be definitely deficient in the calcium required by liberal milk-production.

From these experiments it is obvious that in the selective improvement of the milch cow we have encountered limitations of capacity to assimilate mineral nutrients, especially calcium, before any such limitations are apparent in their ability to utilize the organic nutrients. But we shall see, later that these limitations are not entirely in capacity to assimilate, but are in part the result of nutritive deficiencies in feeds used.

The mineral constituents of the skeleton were shown to be more readily available for use in milk-production than are the calcium compounds of the ration, and more readily available even than are water-soluble calcium compounds given as supplements to the ration.

Viewing the mineral metabolism of the cow in relation to the reproductive cycle, parturition turns loose a pent-up flood of nutriment which has been stored for the use of the calf. This outpouring of mineral-rich food proceeds in large measure independently of the food supply; that is, if the food is sufficient to maintain the life of the cow she will produce milk even though this involves extensive drafts upon the tissues of the body.
At some point between the middle and the end of the period of lactation, when the impulse to secrete milk has largely spent itself, the milk-production comes to be more definitely related to and dependent on the feed intake, and falls off, in amount, to such extent that retention of calcium becomes possible.

In the meantime the cow has been bred; the demands of the developing calf for mineral nutriment remain comparatively slight; and mineral storage in the cow’s depleted skeleton comes normally to prevail.

It is obvious that a cow should have a dry resting-period of sufficient length, and feed, during this time, in sufficient supply, to permit the entire replacement of the preceding mineral overdraft by the end of the period of gestation. The exact conditions necessary, however, remain to be elucidated.

Perhaps the most important conclusions from this series of studies are the analysis of the cause of negative balances of mineral elements, emphasizing the uncertainty of their meaning, and leading to the conclusion that the significant unit of time in the mineral metabolism of cows is the complete cycle of lactation and gestation, that is, normally, the year.

CAUSES OF NEGATIVE BALANCES

Negative balances may be due (1) to deficiency in the supply of the nutrient; (2) they may be determined by negative balances of other elements or compounds, organic or inorganic, which are necessary to the utilization of the element in question; (3) they may be periodic fluctuations, connected with the reproductive cycle, which would be revealed as such by the accounting for the nutrient in question during the whole of this period, the causes, therefore, lying entirely outside the ration; (4) they may be fluctuations in extensive reserves, especially of the more highly mobile elements, in response to physiological antagonisms, or “oppositeness” of function, in cases where excessive intake is to be disposed of, or where unusually extensive utilization involves abundant transfers; and (5) they may be due to inherited demands for the mobilization of greater amounts of a nutrient than the organism is able to digest or to assimilate, as in milk-production, thus demanding drafts upon the reserves of the body.

Hart, Steenbock and associates, at the Wisconsin Station, have conducted studies which add materially to our under-
standing of the conditions affecting calcium metabolism in the cow.

Storage of calcium during liberal milk-production was demonstrated under the influence of the antirachitic vitamin of alfalfa hay which had been cured under haycock covers; and more liberal calcium storage was observed from green alfalfa than from dry alfalfa hay.

Calcium balances were found to be negative on rations in which the roughage was either timothy hay, or alfalfa hay which had been cured in the windrow for four days, the loss being less with the alfalfa than with the timothy; and the loss with the ration containing timothy being somewhat reduced by the feeding of bone meal.

It was shown in experiments with rats that the vitamin A of alfalfa hay could be destroyed by exposure to sun, dew and rain, in curing; but in experiments on rats, goats and fowls it was found that the antirachitic property, that is the vitamin D, of hay cured in sunlight was higher than in that cured in the dark.

In their latest paper, Hart, Steenbock et al. report finding that direct exposure of cows to sunlight improved the utilization of calcium, and was instrumental in bringing about calcium equilibrium in cows producing as much as 25 to 30 pounds of milk.

H. G. Miller and associates, at the Oregon Station, conducted two series of balance experiments with milking cows, one series early and the other late in the period of lactation. In both series the evidence indicated a slight utilization of the calcium, or a change of calcium balances from negative to positive. The feeding of fresh green kale likewise improved the utilization of calcium.

From these studies, subsequent to my own, it appears that in spite of the usual prevalence of negative calcium balances during liberal milk-production on winter rations, it is possible, under especially favorable conditions, for a heavy-producing cow to maintain a positive calcium balance.

**MINERAL DEFICIENCY AND DISEASE RESISTANCE**

On various occasions I have suggested the possibility that the deficient utilization of minerals by cows may have possible practical bearings in relation to lowered resistance to disease, to the rather common failure of cows to breed after a season of
forced milk-production, to the failure of many cows fed for high production to maintain high yields during consecutive periods of lactation, and to the shrinkage of the milk-flow with advance in the period of lactation; and I hope that these suggestions may finally be justified by leading to research on the points covered, thus offsetting the harm that has been done through their misuse by some feed manufacturers and others who choose to ignore the incompleteness of our present evidence, and to treat these very imperfectly substantiated suggestions of practical bearings as though they were established facts, in order that they may sell mineral feeds to all who can be persuaded to buy, and to sell ground limestone as a component of commercial feeds—therefore at feed prices.

I know very well the guileful answers of this man who so dearly loves to hand out stone in place of bread. One of his favorite defenses is the statement that he puts the rock into the cow's feed at cost—simply as a measure of health insurance, in the farmer's interest; but after he has, as he says, put the stone in at cost, then the feed goes onto the competitive market, where it is sold for what it will bring, regardless of its cost, and in competition with feed containing no rock component.

The real point of the whole matter is that although we do possess a general understanding of the mineral metabolism of the milch cow, this information has been derived, in the main, from short balance experiments; and regarding the annual mineral balances, annual milk-production, reproductive activity, and state of health, as affected by mineral supplements added to first-class, practical rations, we know very little indeed.

**MINERAL SUPPLEMENTS**

Meigs, of the Bureau of Dairying, J. B. Orr and associates, of the Rowett Research Institute, of Aberdeen, Scotland, and Lindsey and Archibald, of Massachusetts, have conducted long-time experiments to determine the value of mineral supplements added to the ration of the milch cow. There was evidence of some slight use of ground limestone in Meigs' work, while the other experiments were quite inconclusive, but in all of these experiments the mineral supplements were added to low-calcium rations which did not represent good dairy practice; so these investigations were not planned in ways to answer our most important problem.

We need to keep in mind the fact that the nature of the back-
ground provided by the basal ration is as important as the supplementary feed in determining apparent results.

For purposes of experimentation I often suggest as a mineral supplement for cows a mixture of four parts of bone meal to one part of salt—the cattle being allowed to run to this at will. Cattle take this readily, but in the light of our present evidence a definite recommendation of this or any other mineral supplement, except common salt, for general use, seems to me unwarranted and, therefore, improper.

Mention should be made in this connection, however, of certain conditions as to feeding, and as to soil and forage composition, which seem unusual to us but are commonplace where they prevail.

Thus, where animals are fed on alfalfa alone, with little or no grain, a deficiency of phosphorus, instead of vitamin D and calcium, may be a disturbing and limiting factor.

Also, in certain regions, for instance in a part of Minnesota east of the Red River Valley, part of Texas, and extensive areas in South Africa and Australia, the composition of the soil is so deficient in phosphorus as to cause a phosphorus deficiency in the forage, and serious disorders, described in all text and reference books on veterinary pathology.

Pastures in intensive farming regions may also be so acid and so poor in calcium and phosphorus that the roughage will be abnormally poor in these elements.

**Bone Meal of Value**

Under these conditions of abnormal forage the feeding of bone meal is of definite value. The question as to whether the forage is abnormal in composition and, therefore, whether advantage may be expected from the feeding of bone meal, may be raised by the behavior of the cattle, but can be settled only by trial, with much greater likelihood that the answer will be negative.

It is highly desirable to have leguminous roughage for cows, especially because of its mineral nutrients. If it is necessary to use graminicious roughage, especially cereal straw, it may perhaps be helpful in avoiding weakness in calves, and premature birth of calves, to allow the cows free access to bone meal.

If goiter is present in calves, or if there is other reason to suspect iodin deficiency in the feed, two grains of sodium or potassium iodid per day, given to the cow during gestation, will be enough.
A convenient way to measure out this iodid is to dissolve one ounce of sodium or potassium iodid in one gallon of water; one teaspoonful will contain approximately two grains. Or mix 320 grains of dry sodium or potassium iodid with each 1000 pounds of grain. For stock on pasture, dry iodid may be mixed with common salt in the proportion of four grains to the pound.

As for the common-salt requirement, cows should receive as much as one to three ounces of salt per day, according to milk yield. Two ounces is enough for any but the very best cows.

The Mineral Metabolism of Swine

The outstanding situation with reference to the mineral metabolism of swine is that created by the mineral and vitamin deficiencies of cereal-grain feeds.

The disorders of nutrition resulting from cereal feeding were formerly considered as effects of simple calcium starvation, but within recent years we have come to understand that the disorders of nutrition of skeletal structure in human beings and other animals stand in the same relation to causative and curative agents, in spite of some differences in the response of the several species to these influences, and that the common type of malnutrition of the bones of growing pigs—swine rickets—is essentially the same as human rickets.

Previous to this present understanding I had carried out extensive mineral-metabolism studies with swine at the Ohio Station, and from these a few of the conclusions will be given.

In a series of 33 complete mineral balances, with growing pigs on practical rations, it was shown that all of the rations composed of seed products alone were inadequate sources of calcium.

The pigs stored from nine to ten times as much calcium from rations containing milk and tankage as from the best ration composed of grain products alone. These results were interpreted as emphasizing the importance of pasture, forage crops and dry roughage, especially of leguminous origin, for these are the cheapest sources of those nutrients which grain foods were shown to lack.

A year later were published results of an extensive feeding and carcass-analysis experiment, comparing the effects of different practical protein supplements fed with corn.

The rations being so compounded as presumably to satisfy protein requirements, the mineral nutrients were in no case
sufficient to support maximum growth of the skeleton; and among the pigs receiving rations composed of seed products only, many had beaded ribs, with enlarged costo-chondral articulations, and peculiar distortions of the bones, obviously having resulted from fractures.

The ash per gram of the bones and the breaking-strength of the bones varied together, as affected by the several rations, in the following order of decreasing magnitude: (1) corn and skim milk, (2) corn and tankage, (3) corn and linseed oil meal, (4) corn alone, (5) corn and wheat middlings, and (6) corn and soy beans.

In 1921 were published reports of six series of experiments of various kinds on the mineral metabolism of swine.

The addition of precipitated calcium carbonate or of pulverized limestone to cereal rations caused marked increase in retention of calcium, magnesium and phosphorus.

The magnesium content of the rations was found to be sufficient, but in some cases of inadequate calcium supply magnesium was lost from the body in spite of superabundant intake.

Rock-phosphate floats was found to be decidedly less efficient than any other phosphate or any calcium carbonate preparation.

On all cereal rations there was calcium equilibrium, or loss, when normally there should have been extensive calcium retention.

**Development Not Influenced by Calcium**

The general development of the pigs on the cereal and other seed rations was not found to be influenced by the administration of calcium phosphate or carbonate preparations, but the skeletons were affected in important degrees, especially as to density, strength, and composition of the ash, though the increase in size of bones was slight.

The carbonate and tricalcic bone phosphate produced dense and strong bones, while rock phosphate produced characteristically weak bones. The effect of rock phosphate to weaken the bones of pigs is apparently through bringing about a decrease in the proportion of carbonate to phosphate in their composition.

Among the several phosphate and carbonate preparations compared, steam bone produced bones characterized by maximum hardness, content of calcium, CO$_2$ and ash, and minimum content of magnesium.
The softest bones, produced under the influence of rock phosphate, were characterized by maximum proportions of magnesium and phosphorus, and minimum proportions of calcium and CO₂.

The mineral substance of bone seems to be a mixture, or a loose combination, of carbonate and phosphate, from which the carbonate can be at least in part selectively withdrawn.

An interesting fundamental observation made was that the alkali reserve—that is, the acid-neutralizing capacity—of the blood is susceptible of modification through the character of the ration. By the addition of calcium carbonate to a cereal ration the alkali reserve of the blood plasma was increased more than 10 per cent. Then by the substitution of precipitated calcium phosphate (dibasic) for the carbonate, the alkali reserve was decreased by about 15 per cent. Practical bearings of this observation have not been demonstrated, but it is quite conceivable that such a fundamental change might come to be important.

One part of common salt to 450 parts of grain was found to permit the storage of both sodium and chlorine.

In relation to rickets in swine I shall trace the development of our recently acquired understanding that the stiffness, lameness, skeletal distortions and posterior paralysis of cereal-fed swine are all results or symptoms of this disease, and are caused by deficiency of skeletal nutrients, especially calcium, and deficiency of vitamin D, or of sunlight.

**Alfalfa Hay Prevents Stiffness in Swine**

As far back as 1916 Hart and McCollum found that alfalfa hay would prevent or cure stiffness in swine.

Three years later Mellanby showed that deficiency of a vitamin is one of the causes of rickets; and in the same year Huldschinsky found that ultraviolet rays were curative of rickets.

Hopkins, in 1920, found that the antirachitic principle is not vitamin A; and two years later McCollum and associates designated this principle vitamin D.

Also, in 1922, Maynard went far toward linking up posterior paralysis of swine with rickets, and cured “stiffness” by feeding carrots and bone meal.

In the next year Maynard and associates reported further progress toward an understanding of the pathology and cure of...
posterior paralysis. In this relation calcium carbonate, bone meal, cod-liver oil and chopped alfalfa hay seemed to have curative or preventive value.

In the same year it was announced from the Wisconsin Station that a ration of white corn and skim milk will cause rickets, and that alfalfa meal fed with white corn and skim milk will prevent rickets.

Hart and Steenbock, in 1924, reported that 20 cc of cod-liver oil per week, added to a ration low in vitamin D but containing the requisite mineral nutrients, will prevent the appearance of rickets in growing pigs.

Also, in 1924, Steenbock and associates and Hess showed that ultraviolet irradiation of the food, and even of the litter in the cages of rats, had an antirachitic effect; and Steenbock, Hart and Jones showed that direct sunlight improves the mineral metabolism and stimulates the growth of pigs. According to these authors grains and milk contain little vitamin D, while fresh, green, plant materials, green roughages cured without excessive weathering, and especially cod-liver oil are rich in this principle.

In harmony with earlier findings Bohstedt and associates also found that a ration of white corn, wheat middlings, linseed oil meal, and blood meal is deficient in both minerals and vitamins, and that feeding 1 per cent cod-liver oil and 2 per cent of precipitated bone with this ration would prevent rickets and paralysis.

**VITAMIN D AND MINERAL METABOLISM**

In 1925 Maynard and associates showed that vitamin D is essential to normal mineral metabolism, even in the presence of abundant mineral nutrients, and presented much information as to the pathology of "stiffness" in swine.

In the present year Bohstedt and associates reported results of extensive feeding experiments on mineral and vitamin requirements of pigs from which we give a few of the conclusions.

A ration of white corn, wheat middlings and linseed oil meal was considered to be low in calcium, iron, and vitamins A and D.

An immediate cause of posterior paralysis was shown to be a fractured vertebra.

Ground limestone was found to be a more effective supplement, as indicated by gain in live weight and development of
bones, than was precipitated calcium carbonate, the authors thought, because of the iron content of the limestone.

Pasture grass, naturally, was found to contribute factors making for rapid gains and good health, but left the ration too poor in mineral nutrients to produce normal strength of bone. Cod-liver oil contributed similar effects—rapid growth, good health, but weak bones; while cod-liver oil and a calcium salt led to rapid growth, good health and strong bones.

Calcium carbonate or ground limestone, fed in a proportion of one part to fifty of the ration, caused a marked rise in blood-serum calcium, a fall in inorganic phosphorus, and also led to extreme difficulty in respiration, the cause of which was not determined.

Ferric oxid, added to the basal ration, and calcium carbonate increased the hemoglobin content of the blood, apparently raising a question as to the sufficiency of the iron content of concentrated rations in general.

Commercial blood meal, on some unexplained account, hurried the pigs into the stiffness and paralysis of rickets, the authors thought, because of nutritive deficiencies and a toxic principle.

Fish meal and tankage were found to be superior sources of mineral nutriment, but to be low in vitamins A and B, and doubtful as to content of vitamin D.

That rations of concentrates may possibly be deficient in iron is also suggested by experiments of McGowan and Crichton.\textsuperscript{32}

**IODIN DEFICIENCY AND GOITER**

The well-known fact that deficiency of iodin in the food and water is the cause of goiter is especially important in relation to swine.

In a study of the iodin content of foods there were made in my laboratory\textsuperscript{44} determinations of iodin in 878 food samples from different parts of the United States. Many detailed conclusions were drawn, but the iodids are so readily soluble that their presence in foods is to a considerable extent accidental, and the study as a whole directed attention to the water rather than to the food as the place to look for evidence of a significant geographic distribution of iodin.

A later study of McClendon and Hathaway\textsuperscript{45} demonstrated a remarkable general coincidence between the incidence of goiter and the low iodin content of the drinking-water of this country.
Except for seacoast regions, nearly all of the United States north of North Carolina, Tennessee, Missouri, Kansas, New Mexico, Arizona and California are characterized by low iodin content of the drinking-water and by high incidence of goiter.

Welch and Smith made the first study of this subject in relation to farm animals, the results being published by Welch in a bulletin of the Montana Station and by Smith, with the cooperation of Welch, in the *Journal of Biological Chemistry*, both in the year 1917.

The conclusions as stated by Welch are the following:

Disturbance of the function of the thyroid gland appears to be the immediate cause of hairlessness in pigs, lambs and calves, and of weakness in colts.

The enlarged thyroid glands are very deficient in iodin, which has been demonstrated to be the essential element for the proper functioning of the gland.

Iodin supplied to the female breeding-stock during gestation is apparently effective as a preventive of goiter in the newborn.

We feel justified in advocating the feeding of iodin to pregnant domestic animals in sections of the Northwest where goiter is prevalent.

Welch and Smith found that the disease is local and often seasonal in occurrence, spring pigs being much more subject to it than others, and that the iodin content of the thyroids of pigs at birth could be more than doubled by feeding potassium iodid to the sow during pregnancy.

The maximum iodin content of the thyroids of pigs was produced by feeding two grains per day of potassium iodid to the sow.

Seidell and Fenger found that there is a seasonal variation in the iodin of the thyroid, apparently associated with the pasturage season. They found that the average iodin content of the dry matter of the thyroids reached a minimum on March 17 (0.133 per cent), and a maximum on September 1 (0.531 per cent).

Evvard has demonstrated that great advantage may result from the feeding of iodid to pigs, as shown by the rate and economy of gain in weight in a region in which goiter or hairlessness in pigs does not occur. In three season's feeding experiments, growing swine showed an advantage, resulting from the feeding of iodid, averaging 9.91 per cent in amount and 10 per cent in economy of gain in weight.

We do not know the minimum iodin requirement of a pregnant sow. This should be determined.

Many mineral substances, the usefulness of which is obscure or doubtful, have been fed to swine. Among these are coal
slack, wood ashes, sulphur, lye, copperas, charcoal and earth. There is some reason to believe that coal slack, earth, wood ashes and lye may assist in relieving hogs from roundworms, though we have much better anthelmintics. Wood ashes and earth contain calcium salts, of which the grain-fed hog is in need. Sulphur is without value for synthetic purposes, but may perhaps react in the intestines to form compounds of antiseptic value. Copperas may perhaps be of use as a source of iron. Charcoal seems to be relished on account of its crisp mechanical character. But in my opinion the liking of hogs for this group of materials is largely an expression of mineral malnutrition and depraved appetite.

**Mineral Substances Fed to Swine**

An important point in relation to the use of mineral supplements by swine is as to the possibility of increasing the rate and economy of gain in weight through the use of mineral nutrients other than common salt.

In the course of an extensive experience in this aspect of the mineral nutrient problem, I did not demonstrate with certainty any such effect. Clearly the metabolism of the skeleton and of the muscular and fatty tissue are characterized by marked independence.

Some other workers, however, apparently demonstrated important interrelationships between mineral and general bodily metabolism, which they were unable later to confirm.

Still others seem to have shown positive effects of minerals, other than common salt, to increase the rate and economy of gain. Thus Grimes and Salmon, at the Alabama Station, observed marked advantage from feeding charcoal, marble dust and salt, with corn and peanut meal.

**Conflicting Results**

In another place Salmon reports similar marked improvement, using the same basal ration, from the supplemental feeding of marble dust, salt, acid phosphate, steam bone meal and tankage, in different combinations.

Similar advantage, especially in the use of mineral supplements with rations composed of corn and soy beans or soybean oil meal, has been reported by Vestal, the Ohio Station, and Evvard, Culbertson and Hammond.

Also, Rice and Mitchell studied the effects of mineral supplements added to well-balanced rations containing tankage.
As usual the bones of the mineral-fed pigs were denser and stronger than the controls but there was little effect on the gain in weight. Sows receiving minerals during pregnancy, however, gained in weight more rapidly than others, and their litters were larger and heavier.

Finally, Morrison and Fargo found no advantage at farrowing time from the feeding of bone meal or ground limestone to gilts during growth on pasture, with a well-balanced ration containing tankage.

We must conclude, therefore, that this problem of effects of mineral supplements on rate and economy of gains cannot be settled in general terms, but that the results depend upon the intimate details of conditions.

The feeding of bone meal to swine, however, is especially to be recommended as a means of increasing the strength of the bones, and as insurance against rickets and related disorders.

REFERENCES

COMMITTEE ON NUTRITIONAL DISEASES

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PRESIDENT MOHLER: Before we join in a discussion of this paper, I shall call on the chairman of the Committee on Nutritional Diseases to give his report. Dr. A. F. Schalk.

Dr. Schalk read his report. . . . (Applause)

REPORT OF COMMITTEE ON NUTRITIONAL DISEASES

Dr. A. F. SCHALK, Chairman, Fargo, N. D.

Mr. A. J. Glover, Fort Atkinson, Wis. Dr. Louis A. Klein, Philadelphia, Pa.
Dr. H. Schmidt, College Station, Tex. Dr. C. M. Haring, Berkeley, Calif.

At the last session of this Association, your Committee on Nutritional Diseases laid before the organization the returns of a questionnaire and a brief analysis thereof, setting forth what the veterinarians and sanitarians of the country considered or believed to be a list of diseases that were or possibly might be of nutritional origin. As might be expected in any branch of knowledge in its formative stages, that list was, in all probability, greatly overdrawn.

Notwithstanding the apparent absurdity of many of the diseases included in the list being of nutritional origin, we believe the survey was of inestimable value. It brought out, in a most vivid manner, the insecure grounds upon which we are treading and the urgent need of a large amount of well-controlled, systematic research along nutritional lines in an endeavor to establish some basic and fundamental knowledge pertaining to nutrition and its probable implication in some of our animal diseases.

If we adhere closely to the literal interpretation of the function of a Committee on Nutritional Diseases, such a committee should confine its report to ease conditions only and refrain from discussing the many factors and principles concerned in the science of nutrition as it applies to health.

However, we believe pursuing such a steadfast policy at this time would be placing the “cart before the horse.” The fact cannot be questioned that the average veterinarian of today, almost regardless of what branch of the profession he is following, is inadequately trained and informed on nutrition. While this may be said of other branches of veterinary science, the incompleteness of our knowledge of nutrition is marked and outstanding. It is the most vulnerable spot in our “professional armor” and is in dire need of immediate repair, or perhaps complete reconstruction.

The veterinarian of the future, emerging from the transitional period through which we are passing, must arrive a much better equipped and qualified man, if he is to measure up to and fulfill his contract with the live stock industry of tomorrow. At the present time he is underinformed upon matters nutritional. With this existing condition in mind, the committee thought it policy to make this report chiefly a review of some of the work that has been done or has been under way during the last few years. The reviews are quite brief, but references to the originals are appended in most instances. We fully realize that a rather complete bibliography of the entire subject would be a most valuable adjunct, but that is quite an undertaking in itself which might be suggested as a worthy work for a future committee.

NUTRITIONAL DISEASES OF CATTLE

Sir Arnold Theiler was probably the first worker who attempted to produce avitaminosis in cattle by feeding vitamin-deficient rations. One of the animals carried a calf to maturity during the experiment, having conceived while the experiment was in progress, but the calf was born blind. More
recently A. K. Anderson\textsuperscript{2} reported on the raising of heifers by the Department of Dairy Husbandry on a vitamin-B-free diet and states that about two weeks after calving the animals developed very striking symptoms. Other details are lacking.

Avitaminotic symptoms in cattle and in their offspring were produced as early as 1907 by the Wisconsin Station and again\textsuperscript{4} in 1919. However, their relationship to deficiency disease was not disclosed until later repetition\textsuperscript{5} of the experiments demonstrated that the addition of cod-liver oil would supply the deficiency.

These studies brought out the information that the wheat plant and its products were deficient in vitamin A and its absence in the ration was responsible for failure in reproduction. In addition to vitamin A and calcium deficiencies being implicated in failures in reproduction, quite recently another nutritional factor—vitamin E—has been discovered by Evans and Bishop, of California,\textsuperscript{6,7} and shown to have some connection with sterility. Deficiency of vitamin E in rats brings about resorption of the implanted ovum and consequent sterility. This may be of far-reaching importance to breeding in our farm live stock.

The chief source of vitamin E is in green materials and the germ cells of seeds, principally wheat and oats. Only recently Dr. Graves and coworkers,\textsuperscript{8} of the Dairy Division of the U. S. Department of Agriculture, have reported some very encouraging results on sterile cattle with vitamin-E experiments. They used daily about two and one-half pounds of oats, which were sprouted for four or five days, as for poultry-feeding. Among other results six virgin heifers and six dairy cows, all of which had failed to conceive after several months of breeding to different sires, were settled within 19 to 48 days after the sprouted-oat feeding began. The Oregon Experiment Station has some similar work under way, at the suggestion of Dr. Graves, which appears confirmatory insofar as the trials have progressed.

It is in another direction, however, that nutritional disturbances in cattle are quite prevalent in some regions and in such cases it is the mineral metabolism that is affected and manifests itself in such symptoms as goiter or hairlessness, bone-chewing, osteoporosis, rickets, licking disease and other less-pronounced lesions of the bones. Unfortunately most of the work on nutritional diseases with respect to the vitamins has been done on laboratory animals, but it is doubtful whether the results obtained can in their entirety be applied to cattle, for not even any one species of laboratory animals in use is subject to all nutritional diseases to the same degree, and hence does not have the same vitamin requirements. Moreover, the nutritional diseases observed in cattle largely depend upon a deficiency of minerals and not only upon a deficiency of vitamins.

The most pronounced and clear-cut effect resulting from disturbance in mineral metabolism is goiter or hairlessness\textsuperscript{9,10,11} in calves, due to a deficiency of iodin, in which the disturbance does not manifest itself as such in the animal receiving the ration deficient in iodin but in the offspring at birth. Since this condition is readily amenable to treatment, by the simple addition of iodin to the ration, apparently none of the known vitamins plays a rôle in bringing about this condition.

The greatest number of spontaneous cases of disturbances in mineral metabolism are ushered in by depraved appetite, disturbances in reproduction and diseases of the skeleton. The true basis of nutritional diseases in cattle, therefore, appears to be a disturbance in the mineral metabolism in which the lack of vitamins plays only a secondary rôle.

Numerous experiments have been performed to determine under what conditions a balance in calcium and phosphorus metabolism can be maintained in lactating cows. Forbes and others\textsuperscript{12,13,14} have found that it is not possible to maintain a lactating cow in calcium and phosphorus equilibrium on dry, winter rations commonly in use. That calcium metabolism and phosphorus metabolism are more or less dependent upon one another has repeatedly been shown and was brought out again by Meigs and others,\textsuperscript{15} who found that calcium assimilation is evidently interfered with when there is more than twice as much calcium in the feed as phosphorus.
Calcium is more often deficient in feed than phosphorus and its assimilation is more often at fault than that of phosphorus. For that reason most of the studies on mineral metabolism have dealt with the assimilation of calcium. Hart, Steenbock and others\(^{15}\) experimented on three lactating and two dry goats. The basal ration plus oat straw gave a negative calcium balance in both classes of animals. When green oats were substituted for oat straw, the calcium loss was decreased but the balance did not become positive. Oat hay made by drying green oats in an attic in diffuse light gave results comparable to green oats and in one animal a positive calcium balance.

To determine the factors operative in these results the basal ration was supplemented successively by orange-juice, 120-240 cc per day; raw cabbage, 1000 gms. per day; or dried cabbage, with no effect on the calcium balance. Cod-liver oil, 5 to 10 cc per day, consistently changed the negative calcium balance to a positive one. These results seem to eliminate vitamin C as a factor influencing calcium assimilation and show that the responsible factor is present in green oats and grasses and in cod-liver oil. The same authors\(^{17}\) could show that calcium is more easily assimilated when lactating cows are fed, in addition to a grain ration and corn silage, green alfalfa containing the same amount of dry matter as ten pounds of dry alfalfa. Cow 1 showed a positive calcium and phosphorus balance in both periods of four weeks each, but the calcium balance was consistently greater during the green-alfalfa period. Cows 2 and 3 showed similar results but did not store as much calcium.

These results are contrary to those of other workers done on this subject and show that a positive calcium balance was maintained on dry feed during lactation and the authors conclude that it depends upon the carrier of calcium as the factor affecting calcium assimilation. The same authors\(^{18}\) could further show, on three lactating cows giving 30 to 45 pounds of milk per day, that they would remain in a negative calcium and phosphorus balance when fed a ration composed of grains and their by-products, corn silage and timothy hay. When alfalfa was substituted for the timothy hay, the negative calcium balance was reduced but did not become positive. Supplementing timothy hay with steamed bone meal daily did not result in establishing a positive calcium and phosphorus balance, but the losses were reduced, compared to the unsupplemented rations.

In 1923 the same authors\(^{19}\) could also show that a lactating cow, supplied with a grain ration and 40 pounds of fresh, green grass, could not be kept in calcium equilibrium, but if a calcium salt was added, the calcium balance became positive. The phosphorus balance was positive at all times, probably due to the adequate amount of phosphorus present in the grain mixture supplied. The authors again point out that the antirachitic vitamin greatly assists calcium assimilation and that direct sunlight may also have something to do with it.

At the Ohio Station\(^{20}\) four cows were placed in a metabolism experiment. Two had been on dry feed and two on green pasture during the previous year. The results were that the latter lost almost double the amount of calcium as the former. The amount of phosphorus retained by the cows that had been on pasture was extremely small, while the amount stored by the cows that had been on dry feed was approximately four grains a day.

Meigs and others\(^{21}\) had similar results. The addition of cod-liver oil did not improve matters. These authors conclude from their extensive observations and those of others that calcium is better assimilated from well-cured timothy hay and alfalfa hay than from bone meal and that calcium is better assimilated from fresh, green material than from hay.

That cattle can develop, grow to maturity and subsist on dry feed and silage alone has been shown by C. C. Hayden, as reported by Forbes\(^{21,22}\). If the antirachitic vitamin is absolutely essential to the assimilation of calcium, for such must occur when the animals grow, it remains to be shown that it escapes destruction during the process of curing in the silo.

Indeed, A. Scheunertz\(^{23}\) has indirectly confirmed the presence of vitamin A in silage by estimating the vitamin-A content of butter under the influence of customary feeding. He found the vitamin-A content lowest during the period of root-feeding and highest during the period of pasturing, while during the period of silage-feeding the value of the vitamin-A content of
the butter lay midway between these extremes. The investigations of F. Kieferle, K. Zeiler and L. Hock also brought out the growth-promoting properties of silage milk as compared with milk from molasses-fed and dry-fed cows.

According to Hart, Steenbock and Elvehjem, the value of the antirachitic vitamin is greater when fed in the form of properly cured alfalfa and green grass than in yellow corn; for these authors state, as the result of their experiment, that lactating cows in negative calcium balance will not be put in positive balance by the addition of yellow corn high in vitamin A and making 60 per cent of the ration.

Reference had already been made by Hart and Steenbock that sunlight may have some bearing upon the calcium assimilation. Following this thought they conducted some experiments along this line. They could show that lactating goats in a negative calcium balance on a ration deficient in antirachitic factor, when irradiated 10 to 20 minutes daily by quartz mercury vapor lamp, at a distance of two feet, would put the animals in a positive calcium balance. Irradiating the hay did not put the goats in a positive calcium balance. Similar experiments testing the effect of sunlight on the assimilation of calcium showed that the effect was very feeble. Hess and Weinstock report that cottonseed oil also acquires antirachitic properties when irradiated. They state that wheat which has been irradiated by ultraviolet light retains its antirachitic potency for weeks and that etiolated yellow wheat, as well as green wheat, can be rendered active in the same way. Hart and Steenbock found the length of time that the antirachitic factor remains active, when mixed with ground grain and stored, to be at least six months.

Turning away from the purely experimental side of the question, we will briefly touch on the recent literature of field cases concerning pica. A phosphorus deficiency in the rations seems to be the outstanding etiological factor in "licking disease," as borne out by the investigations of M. Schlegel, and in osteophagy or "bone chewing," as evidenced by the researches of A. Theiler. The therapeutic experiments conducted by H. Westermann and those by K. Neumann and Reinhardt show that "licking disease" is amenable to calcium treatment.

A. Scheunert and F. W. Kryzwanek, in their studies on "licking disease," tested the alkali reserve of the blood by the Van Slyke method. They could not demonstrate a tapping of the alkali reserve of the blood during the disease. Most experiments conducted so far do not consider the influence of the other chemical elements, especially magnesium, sodium, potassium, chlorin and sulphur, upon the assimilation of calcium. In this connection it is interesting to note that "licking disease" can be brought about, according to Ibele, by an alkali impoverishment of the body, which in turn is caused by an improper balance of alkali and alkali earths in the feed.

The so-called sweet clover poisoning in cattle which is more or less prevalent in some of the north central states and parts of Canada has been thought by some to be of a deficiency nature. In the course of our studies on this disease at the North Dakota Experiment Station, during the last couple of years, this phase of the work has been given considerable attention. Cod-liver oil, lemon-juice, green material, fresh steamed bone meal, yeast and common salt ad. lib. have been used individually and in varying combinations for both the prevention and the cure of the disease. All were found wanting, as no beneficial results, whatever, were obtained. Although these data are limited to about fifteen animals, we believe they are a good indication that this disease is not one of deficiency.

### Nutritional Diseases of Swine

Investigations of the nutritional diseases of swine, made during the last two or three years, have been centered very largely upon the dietary factors concerned with the development of the disease commonly called "stiffness" and its sequel, paralysis. Although much of the information obtained is merely confirmatory of the results of earlier work, some new facts have been discovered, especially with regard to the etiology and pathology of the disease and particularly with reference to the development of paralysis.
The results of the recent experiments confirm the earlier conclusions that a deficiency in calcium salts and vitamin D will lead to the development of disease but the data with reference to vitamin A are conflicting. Orr and Crichton, as a result of experimental feeding tests with pigs, came to the conclusion that the requirements of the pig for vitamin A are so slight that there is little likelihood of fattening pigs suffering from a deficiency of this factor. On the other hand, Bohstedt and his co-workers observed in their experiments irregular growth and poor bone-development when the ration was deficient in vitamin A. The percentage of ash in the bones was reduced and the breaking-strength of the bones was decreased. They also attributed a susceptibility to respiratory diseases shown by pigs on a vitamin-A-deficient ration and the death of several from pneumonia to a lack of this vitamin. A similar experience by Steenbock, Hart and Jones, in feeding pigs on a ration with a low content of vitamin A, led them to the same conclusion. These phenomena indicate not only that vitamin A is an essential dietary factor in the prevention of "stiffness" but also that we may expect to find pneumonia or some other respiratory disease associated with this condition. Indeed, in the case described by Bohstedt and his co-workers, pneumonia developed and caused death in pigs on a rachitic ration before any of the bone lesions associated with "stiffness" had developed.

Failure of "stiffness" to develop in some of the pigs fed experimentally on a ration deficient in the essential dietary factors led to the study of the influence of other possible causes. Pigs were placed in a lot or yard where they could root in the soil and it was observed that they thrived much better than those confined in a paved lot until freezing weather stopped their rooting, although both groups of pigs were fed on a grain ration of low mineral and vitamin content. Another group of pigs on the same ration but having the run of a blue-grass pasture were even more thrifty, making nearly optimal gains in weight. Their bones were poorly calcified, however, and were not strong. Normal bone-development is not necessarily associated with good bodily growth.

These results may explain why rations similar in character to the one used in these experiments, and therefore wanting in essential dietary factors, are frequently fed on farms without the pigs showing symptoms of any injurious effects. Pigs on farms usually have access to soil and green feed, either before or while being fed the deficient grain ration; if before, a nutritional reserve could be built up in the body which would later supplement the deficient ration.

The mineral content of drinking-water does not seem to play a great part in one way or the other. One lot of pigs on a rachitic ration was supplied with distilled water for drinking purposes and another with well-water which was rather high in calcium content (0.0034 to 0.0054 gm. per 100 cc) but no great differences were observed in gains in body weight or in the percentage or breaking-strength of the bones.

The influence of sunlight was also investigated by Bohstedt and his colleagues. Pigs on a ration deficient in calcium salts and vitamins A and D showed a somewhat better calcification of the bones when exposed to direct sunlight in open pens than when kept in pens in a barn. However, the direct sunlight did not act as a protective against all of the deficiencies of the ration, as it did not prevent disease of the bones but only retarded its development.

The question of the influence of direct sunlight was more thoroughly investigated by Steenbock, Hart and Jones. The results of this experiment show that direct sunlight is capable of preventing the development of "stiffness" when vitamin D is deficient in the ration. The animals in the "dark" pens were exposed to the diffuse light of the barn but this did not operate as a protective. Therefore, if the antirachitic effects of the solar radiations are to be obtained, the animals must be exposed to the direct rays of the sun. This must be done without the intervention of ordinary window-glass, as the latter does not permit the effective rays (ultraviolet) to pass through it. The direct rays of the quartz mercury vapor lamp and the open carbon arc are the only effective substitutes known for direct sunlight.
Histological examinations of diseased bone tissue from pigs exhibiting clinical symptoms of "stiffness" disclosed the presence of the alterations characteristic of rickets or osteoporosis, or both, in some sections from some cases, but in the sections from many of the cases the changes observed did not correspond to the alterations peculiar to either of these diseases.37

This would seem to indicate that the syndrome known as "stiffness" is not associated with rickets except in a few cases, but Steenbock, Hart and Jones8 are of the opinion that the histological picture characteristic of rickets is present only when the animal is affected and dies during the period of growth; that growth brings about the production of the characteristic histological picture; and that, therefore, the changes seen in tissues from the more mature animal will naturally differ in appearance.

Our knowledge regarding the substances which may be added, as corrective supplements, to rations deficient in those factors necessary to prevent the development of "stiffness" or paralysis, or to overcome the condition when it is present, has also been increased. In the studies of Bohstock and his colleagues,9 ground limestone was found to be the most effective single substance in correcting the deficiencies of the basal ration which, when fed alone, was attended with the development of "stiffness." Calcium carbonate, of a technical grade, did not prove nearly so satisfactory. Results of feeding tests with the various elements present in these two substances indicate that the difference in effect is probably due to the greater proportion of iron in the ground limestone and to the potassium, indin and sulphur it contains. When cod-liver oil was added with the ground limestone, optimum results were obtained, growth being rapid and uniform, and the pigs showed no signs of ill health. If the cod-liver oil was oxidized, thus destroying the vitamin A but leaving vitamin D, the symptoms of malnutrition developed—rough hair and scurfy skin—and the bones were not so well developed. Therefore, it is assumed that vitamin A may be a factor in preventing the development of bone disease, as well as vitamin D and calcium salts. Fish meal and tankage were found to be good mineral and protein feeds, although deficient in vitamins. Blood meal, on the other hand, when added to the basal ration, accelerated the development of disease of the bones and hastened the appearance of symptoms of "stiffness" and paralysis.

Good physical development was not always accompanied by good bone development. Pigs on the blue-grass pasture in addition to the basal grain ration grew rapidly to a heavy market weight but while their bones were apparently structurally qualified to meet the requirements of the body, they did not have the ash content or the breaking-strength of the bones of pigs receiving ground limestone as a supplement to the basal ration. On the other hand, pigs receiving calcium carbonate or precipitated bone flour in addition to the basal ration developed dense, hard bone but did not grow rapidly and in some instances died before the end of the experiment. When cod-liver oil was added alone, growth was rapid but the bones were too brittle to withstand many of the strains to which they are ordinarily subjected during the life of the animal. Bone development seems to be largely dependent upon the minerals, and growth upon the vitamins, but both must be present in sufficient quantity if development is to be harmonious and comprehensive.

Information regarding the distribution of vitamin D in natural feeding-stuffs is still far from complete. The experience of hog-feeders and the results of experiments with rats and chickens indicate that it is not present in any considerable quantity in the grains. It is plentiful, however, in fresh, green plants. Carefully cured clover and alfalfa hay also contain it in considerable quantity. These roughages are also rich in vitamin A, while alfalfa and clover hay contain a goodly supply of calcium and it is probable that the nutritional requirements of the pig can be met with these substances if the quantity required is not too bulky for the capacity of the animal.38

In addition to the work on vitamin A already mentioned, Orr and Crichton39 made a test to determine the requirements of the pig for vitamin C. From these results the conclusion was drawn that the requirement of the pig for the antiscorbutic vitamin is very low and that it is not likely that pigs will suffer from a deficiency of this dietary factor during the usual fattening period.
The relation of iodin to enlarged thyroids (goiter) in pigs and to the birth of pigs in a hairless or partially hairless state has been further confirmed. Welch,8 in Montana, and Kalkus,9 in Washington, have demonstrated by extensive field trials that the administration of iodin to the pregnant sow will insure the birth of the offspring in normal condition, while sows kept under the same conditions but receiving no iodin will give birth to hairless pigs and pigs with enlarged thyroids.

The minimum quantity of iodin necessary to prevent the disease is not known. A grain of potassium iodid daily is probably more than is required, but no undesirable effects have been reported in swine receiving this dosage. The administration of the drug should cover the period of gestation.

This disease occurs most frequently in animals in the same areas in which simple goiter is more or less common in man, namely upper Michigan, Wisconsin, Minnesota, western North and South Dakota, and sections farther west. It is not known at this time whether the vegetable foods or the water or both are deficient in iodin. McClendon5 is of the opinion that there is a deficiency of iodin in the soil and consequently the plants grown in it are also wanting in this element.

Nutritional Diseases of Poultry

A report on nutritional diseases of poultry was submitted in 1923, by J. R. Beach, at the 27th annual meeting of this association, in which he reviewed the knowledge then existing concerning nutritional roup and leg-weakness, the two deficiency diseases of most importance to the commercial poultryman. Since that time, knowledge concerning the minimum nutritional requirements of fowls and the relation of diet to their diseases has increased through numerous carefully controlled experiments conducted by scientists in nearly all civilized countries of the world. A few of these experiments which have yielded results justifying consideration by live stock sanitarians are summarized in the following report:

VITAMIN A

Definite proof that nutritional roup is caused by a deficiency of vitamin A was first announced in a paper by J. R. Beach,40 before this association, in 1923.

The possibility that a lack of vitamin D might also cause nutritional roup has been controverted by Beach41 and in addition he explained the apparently infrequent occurrence of this disease in the middle western and eastern states because in these states yellow corn in poultry rations is used more extensively than in California. Recently Davis and Beach42 have published the results of carefully controlled experiments showing that all varieties of field-grown greens are good sources of vitamin A for poultry. Certain root crops also were found to be satisfactory substitutes for field-grown greens. In a forthcoming publication Davis and Beach43 will show that the Yellow Giant carrot and Danvers Half Long red carrot are equal in value to the commonly used varieties of green feed as sources of vitamin A for poultry and that salmon oil is as good a source of vitamin A for poultry as the commonly used varieties of greens. They have found that the feeding of one gram per day of these yellow or red carrots is sufficient to prevent nutritional roup in fowls receiving rations deficient in vitamin A. Control fowls not receiving this supplement developed the lesions typical of vitamin-A deficiency in three months or less. The daily administration of one cubic centimeter of cod-liver oil or salmon oil was also a satisfactory supplement. If sprouted barley is used as the entire source of vitamin A for poultry the amount fed should be in excess of twenty per cent of the total ration, according to Beach and Davis, and if alfalfa meal is used the amount should be in excess of ten per cent of the total ration. They also state that mangel beets, yellow or white turnips, or the white Belgian carrot are valueless as sources of vitamin A for poultry.

The discovery that salmon oil is equivalent to cod-liver oil as a source of vitamin A is of economic importance to veterinarians and animal feeders, since salmon oil is at present much cheaper. Delf44 found that sesame and
castor oils are deficient in vitamin A. Seal, whale and blubber oil of the sperm whale were found to contain it in relative abundance.

**Vitamin B**

Although polynieritis of fowls, due to a lack of the water-soluble B factor, is of no economic importance in this country, it would seem appropriate to review here certain recent experiments on fowls which have yielded new knowledge concerning vitamin B. According to McCollum and Simmonds there is a possibility that what we call vitamin B consists of two or more substances. Recently Hauge and Carrick have brought forth evidence, by experiments on fowls, to show that the antineuritic vitamin and the water-soluble, growth-promoting vitamin are not identical although they may occur in the same food. The yeast which these investigators used was poor in the antineuritic substance but rich in water-soluble, growth-promoting substance. They also found corn to be relatively rich in the growth-promoting substance.

Such experiments on fowls are of interest because they yield knowledge applicable to the prevention and cure of diseases in man as well as being a better basis for efficiency in animal feeding. However, they have little practical application in poultry feeding since the dietary essentials now classed under vitamin B are present in abundance in nearly all rations used by poultrymen.

By experiments on pigeons, Collazo and Funk have shown that vitamin B does not act as a catalyst but is a building-stone used up during the metabolic processes of the body.

**Vitamin C**

Plimmer and Rosedale found that antiscorbutics are not required by chickens or else can be synthesised in the fowl's body. This was also demonstrated by Mitchell, Kendall and Card and recently confirmed by Hauge and Carrick. Hart, Steenbock, Lepkovsky and Halpin have observed that a lack of this factor in the food does not appear to be detrimental to poultry in any way. Attempts to demonstrate the presence of this vitamin in eggs have failed, even when the fowls were fed on an antiscorbutic, according to Hauge and Carrick.

**Vitamin D, Ultraviolet Light, Mineral Metabolism and Endocrine Deficiencies**

The problem of controlling leg-weakness and similar diseases, which are due to a deficiency of vitamin D in the food or to a lack of sufficient light, has been solved for the commercial poultryman by the experiments of scientists. Experiments simultaneously undertaken by Hughes, at the Kansas Agricultural Experiment Station, and by Hart, Steenbock, Lepkovsky and Halpin, at the Wisconsin Station, have shown that either cod-liver oil given as one per cent of the mash or an abundance of sunlight or irradiation by ultraviolet light electrically produced will prevent leg-weakness, provided calcium, phosphorus and other minerals are present in the diet in abundance. Davis has shown recently that salmon oil is an efficient preventive of leg-weakness in chicks.

Pathologists are still unable to agree as to the nature of the leg-weakness disease. Pappenheimer and Dunn claim that the bones of affected chicks show no rachitic changes. They found that the administration of the active antirachitic concentrate of the non-saponifiable fraction of cod-liver oil did not prevent the onset of leg-weakness nor modify the character of the bone lesions. On the other hand, the addition of whole cod-liver oil prevented leg-weakness and brought about normal bone structure. The diet which produced typical leg-weakness in chickens was fed to young rats for four weeks and, according to Pappenheimer and Dunn, did not produce rachitic changes in the bones. On the contrary, Hughes and Titus contend that if the term "rickets" can properly be used to designate any disease in a growing organism, characterized by a faulty metabolism of calcium and phosphorus resulting from lack of vitamin D and ultraviolet light, then the experimental data justify diagnosing leg-weakness as rickets.

The sensitiveness of fowls to a deficiency of so-called antirachitic factors makes them useful as test animals.
state that White Leghorn chicks were used to test cows' milk for antirachitic properties. Rickets in chickens was cured by feeding milk from cows exposed daily for from 15 to 30 minutes to ultraviolet light, while other chickens getting milk from cows not receiving this treatment tended to become progressively worse.

It has been shown recently by Heusersand Norris that different brands of cod-liver oil vary significantly in antirachitic potency when this factor is measured by means of chicks. Two samples of American oils tested by the manufacturer for its vitamin content, according to the method now prescribed by the United States Pharmacopoeia, gave results superior to five samples of Norwegian origin.

The results of trials with chicks to determine the antirachitic potency of cod-liver oils are not often uniform. This can be explained from the fact that the yolk of the eggs contains an abundant, but probably variable, amount of this factor, according to Hess. Since the chick absorbs the yolk of the egg just before it comes out of the shell, it, therefore, begins life with a protective dosage of the antirachitic factor.

Several investigators in this and other countries have confirmed the discovery of Steenbock and his associates and of Hess that foods containing lipoidal substances, such as cholesterol or phytosterol, can be endowed with specific antirachitic potency by ultraviolet irradiation. However, Mussel, Hill and Rosenbaum have stated that the irradiation, with a quartz lamp, of fresh corn oil for thirty to sixty minutes only slightly enhanced its antirachitic property and that the irradiation of livermeal, yellow corn or white corn for thirty minutes before grinding did not enhance their antirachitic values to any appreciable degree, as shown by trials on chicks given a ration otherwise complete except for the antirachitic factor.

Hughes, Payne, Titus and Moore have found that the amount of ultraviolet light irradiation which a hen receives is an important factor in determining the antirachitic vitamin content of the eggs which she produces when her feed is low in the antirachitic vitamin. Eggs which have a low antirachitic vitamin content do not have as high a hatchability as eggs having a high antirachitic vitamin content, other factors influencing hatchability being constant.

Recent investigations have pointed to the importance of the endocrine system in the metabolic process. For example, Collip has obtained a powerful extract of the parathyroid by which it is possible to increase the calcium content of the blood to any desired degree, even to the point of fatal tetany.

Riddle claims that one of the functions of the thymus in pigeons is to govern the disposition of the shell and the albumen of the egg. For this hypothetical hormone he proposes the name thymoidin. Such work is of value in correcting the impression that vitamin D and light are the all-important factors in calcium metabolism. Collip, Riddle and others have added to our appreciation of the complexity of the interrelationships of the ductless glands and the even less understood relationship of these glands to metabolism and reproduction.

**Vitamin E**

A food factor necessary for normal reproduction which was provisionally designated as X by its discoverers, Evans and Bishop, has been changed in name to vitamin E by the mutual consent of various investigators who have confirmed the discovery. This substance is present in adequate amounts in the grains and greens which form the rations used by poultry farmers. It is not present in cod-liver oil or in milk in significant quantities. The relation of this vitamin to the normal reproductive function in fowls is not known. The discovery of vitamin E supports the belief that a diet may be sufficiently good to enable a fowl to grow in a perfectly normal manner and yet because of certain deficiencies in the ration be non-productive in eggs.

**Avitaminosis and Specific Infections**

Experience in research on poultry diseases covering a period of twenty-two years at the California Agricultural Experiment Station has failed to reveal any indication that undernutrition or avitaminosis is a contributing
cause to specific infectious diseases such as epithelioma contagiosum. The published data from which McCarrison concludes that deficiency in vitamin B renders fowls more susceptible to epithelioma contagiosum is not convincing to the writer. It would seem possible that the fowls would have become infected just as easily on an adequate diet. McCarrison's observations that B. suipester, B. pyocyaneus and other organisms invade the circulating blood of pigeons affected with advanced avitaminosis agrees with what pathologists would expect, but the invasion of injured tissues by organisms normally present in the intestinal canal is quite different from the development of an infection like epithelioma contagiosum, which is virulent for fowls regardless of their state of nutrition.

**Resistance to Fowl Cholera As Affected by Over-feeding**

Beach has reported outbreaks of fowl cholera in both chickens and ducks in which over-feeding was apparently an important contributing cause of susceptibility to *Bacterium avisepticum*. On four outbreaks at various times in a large flock of ducks the deaths ceased promptly following a reduction in the amount of meat in the ration. He also reports many flocks in which severe losses occurred in pullets during the height of the laying season. *Bacterium avisepticum* was repeatedly isolated from the heart, liver or ovary of these fowls. Ruptured yolk was usually present in the birds autopsied. The outbreaks of the disease were promptly checked by reducing the meat ration. This was accomplished mainly by adding coarse bran to the mash. Several attempts to increase the amount of meat in the ration were followed by increased losses. The virulence of the *Bacterium avisepticum* isolated from fowls with ruptured yolk was low, as indicated by the fact that the disease could not be transmitted to other fowls by feeding the organs of dead birds or by injecting the cultures subcutaneously. It was not determined whether *Bacterium avisepticum* was responsible for rupture of the yolks or the rupture of itself was sufficient to make the fowl susceptible to organisms of low virulence present, perhaps, in the intestinal tract. Unpublished observations by Beach indicate that infection with *Bacterium sanguinarius* may also be associated with ruptured yolk in pullets.

Your chairman is very glad to state that this is a composite report of the entire committee. Dr. Schmidt has contributed largely to nutritional diseases of cattle, Dr. Klein to those of swine and Dr. Haring to poultry. Mr. A. J. Glover has rendered valuable aid and assistance in the way of suggestions for carrying out the report.

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PRESIDENT MOHLE: Gentlemen, this subject of nutritional diseases, as you know, is a very important one; in fact, it is becoming more important every day, and I would like very much to have a full discussion. In case you do not want to discuss it, you may ask questions of either Doctor Schalk or Professor Forbes.

Dr. Howe: I feel strongly that nutrition and pathology must go together and that the nutrition man must have the aid of the pathologist and I hope the man working in nutrition can also assist the pathologist.

PRESIDENT MOHLE: Any further discussion? If not, we will proceed with the topic of Tick Eradication. The first paper on this subject is by Dr. J. H. Bux, of Little Rock, Arkansas, "The Effect of Inadequate Federal Regulations in the Interstate Movement of Cattle from the Quarantine Area."

Dr. J. H. Bux read his paper. . . . (Applause)

THE EFFECT OF INADEQUATE FEDERAL REGULATIONS IN THE INTERSTATE MOVEMENT OF CATTLE FROM THE QUARANTINE AREA

By J. H. Bux, State Veterinarian, Little Rock, Arkansas

It should not be inferred from the title of this paper that there is an intimated delinquency on the part of the federal regulatory officials in the promulgation of regulations governing the interstate movement of cattle from the tick-infested areas. The only glaring inadequacy of federal authority apparent to the writer in the movement of cattle from tick-infested areas interstate is due to the antiquated federal statute of 1884 which does not recognize Texas fever as being infectious, contagious or communicable, and which authorizes the movement interstate of tick-infested cattle for immediate slaughter. It was not known at the time of the passage of the act referred to that Texas fever is transmitted by the Margaropus annulatus. This section has been repealed, effective in 1928, but I sincerely believe efforts...
will be made to postpone further. I am not questioning the motives of anyone, nor censuring any persons for attention to what they believe to be their best interests, but I believe it should be considered at this time.

The movement interstate of animals from tick-quarantined areas for immediate slaughter has been, is and will continue to be the greatest deterrent to tick eradication. Cattlemen would not produce infested cattle if they knew they could not ship them. They would produce tick-free cattle. Satisfactory production of tick-free cattle means embracing systematic, cattle-tick eradication. This is corroborated by the promptness with which measures were undertaken for eradicating foot-and-mouth disease from the United States recently, after rigid embargoes were imposed by various surrounding states.

Inasmuch as movement of tick-infested cattle suppresses sentiment for cattle-tick eradication, it is a factor in the continuation of the annual loss due to death, loss of flesh and diminution of milk-flow annually in the present inactive, tick-infested areas. Inquiries by federal and state employes among cattle-owners of Montgomery County, Ark., in November, 1926, disclose that approximately one-third, or 1600, of the total number, or 4800 calves dropped alive, die annually of Texas fever. Assuming an expected value of mature animals at $10.00 each gives a total loss of $16,000.00. Taking this as the average for each county, the loss for the 246 tick-infested counties in the United States gives a total of $3,936,000.00. It should be remembered that these actual losses are supplemented by greater losses due to the permanent stunting of the many animals that contract the fever but do not die.

**Clean Territory Often Reinfested**

The movement of tick-infested cattle in the past has always resulted in reinfestation of clean territory and it always will, because despite all care that may be exercised, this infestation is bound to occur with subsequent attendant losses, and difficulty and expense of eradication. This is not so apparent to some of you who are a considerable distance removed from cattle-tick-infested areas and who represent sections in which climatic and other conditions are adverse to the permanent establishment of infestation of fever ticks. Emergencies arise such as the necessity of unloading cattle in free areas to evade
the 28-hour law, train wrecks, etc., that may at any time result in infestation of clean area.

Permission of movement of ticky cattle from inactive, quarantined areas results in prolongation of cattle-tick eradication, with attendant expenses amounting to thousands and perhaps millions of dollars annually for maintenance of federal and state inspectors, specially equipped pens, and other equipment for handling quarantined cattle. This entire burden is finally borne by the live stock industry. It can be eliminated by the eradication of the cattle-fever tick. It certainly would appear that it would be the business-like thing to eliminate this overhead toll as soon as possible.

**Undesirability of Present Plan**

The undesirability of the continuation of movements of ticky cattle from quarantined areas has been called to the attention of this body repeatedly in former years, with the disclosure that all the officials of the cattle-tick-infested states except one believe that the movement of ticky animals interstate should be discontinued. The proceedings of this Association for the year 1918 disclose that the report of the Committee on Tick Eradication recommended that this Association pass and present to the Secretary of Agriculture a resolution prohibiting by law the interstate movement of tick-infested cattle. Again, in 1920, the same committee reports that its Secretary, Dr. Cary, sent a questionnaire to state veterinarians, federal inspectors engaged in tick eradication, and to other federal and state officials the following question: "Is it best for the live stock industry of the South to stop the interstate movement of ticky cattle or of cattle quarantined on account of ticks?" A summary of the answers shows that all (with the exception of those from Texas) were strongly in favor of stopping the interstate movement of ticky cattle for any purpose. The expressions were more or less emphatic. Some were, "Now"; others, "At once"; and others, "Immediately." Florida officials seemed to believe it advisable and best for the work of tick eradication and the cattle industry in Florida. Texas officials appear to want more time, especially for southern Texas. The report of the Committee in 1920 also discloses that a second question was asked as to whether the U. S. Department of Agriculture should do this at once. In this, one state appears as the only opposer. Most of the states below the original quarantine line
and a few above have endeavored to prohibit or regulate the movement of tick-infested animals. Some have wholly eliminated it within their borders, others in part, still others have regulated or eliminated it within their borders only to be compelled to permit cattle to pass through such states from other states. This has resulted in a great conflict or non-uniformity of regulations between the various states and between the various states and the federal department. Where state regulations are not so strict as federal, it is difficult for the state officials to enforce their regulations and overcome local opposing influence, as it must be conceded that federal regulations have more dignity and standing than those issued by the states. Unfortunately and deplorably the officials of the states that are in the best position to assist the officials in the infested states have taken little or no action in stopping the movement of tick-infested cattle.

Many of the cattlemen in the present inactive, tick-infested areas of Arkansas believe that tick eradication is being stayed by the movement of ticky cattle. This is corroborated by the statement of over one hundred county officials, judges of various courts, and stock-owners that tick-infested animals should not be permitted to move under any conditions for any purpose.

Many Excuses For Inactivity

The movement of ticky cattle is justified in the minds of its supporters because of the alleged hardships it will inflict on the cattle industry of quarantined areas, and the favorite excuse offered is that these areas should be given more time. This will continue to be a favorite argument. Most, if not all, of the inactive, infested counties have had an opportunity to embrace cattle-tick eradication and many of them continued it for varying periods of time. Lack of funds, inefficiency of federal, state and county officials, and impossibility of accomplishing the task are all freely offered as excuses. Many counties that failed in cattle-tick eradication did so not because of lack of funds but because of lack of proper administration of the work. It is believed that any district can provide the necessary revenue if it really becomes convinced that it needs to do so. You are reminded that the actual cost of cattle-tick eradication will be insignificant as compared with the cost of tolerating the ticks.

Relative to the inefficiency of inspectors, when the citizenship of a county really becomes convinced that tick eradication can
be accomplished and then resolves to do it, a flock of inspectors could not prevent eradication if they actually directed their efforts towards doing so. Physical impossibilities are cited, such as large, mountainous or swampy sections. Investigation discloses that ticks have been eradicated from large forest reserves and large swampy sections successfully. It will also be stated that prohibition of movement of ticky cattle would inflict a great damage on the infested areas for the reason that they would be unable to move their cattle or handicapped in doing so. This is not true, as cattle are permitted to pass out of a county upon certificate to any point for any purpose as tick-free cattle, within thirty days after systematic cattle-tick eradication is inaugurated. Therefore, all a county would have to do, if the movement of ticky cattle were prohibited, would be to inaugurate systematic cattle-tick eradication.

SELFISH INTERESTS RETARD PROGRESS

The observation of the writer is that the supporters of the continuation of the movement of tick-infested cattle are largely confined to certain dealers, traders, commission men, and representatives of transportation companies. The cattle-growers, with the probable exception of large ranchmen, are penalized because buyers use the quarantine as an argument and a means of depressing prices beyond what the true situation justifies. It is believed that the discontinuance of the movement of tick-infested cattle will not detract from the revenue of dealers, commission merchants and transportation companies, but will enhance it because there will be more cattle of better quality for commerce and without the attendant expense of segregation because of ticks.

In conclusion, the effect of inadequate federal authority in regulating or prohibiting the movement of ticky cattle is highly adverse to the cattle industry of the entire United States and its allied interests and the greatest stimulant that can come to cattle-tick eradication at this time is a proper modification of the said statute to eliminate movement of ticky cattle interstate for immediate slaughter.

PRESIDENT MOHLER: Continuing this symposium on Tick Eradication, I shall call on Dr. Hartwell Robbins to discuss "The Scope of State Cooperation Necessary for Effective Tick Eradication."

... Dr. Robbins presented his paper. ...
THE SCOPE OF STATE COOPERATION NECESSARY FOR EFFECTIVE TICK ERADICATION

By HARTWELL ROBBINS, Jackson, Miss.

U. S. B. A. I. Inspector-in-Charge, Tick Eradication

I will first post a quarantine map, so that those not familiar with tick eradication may see by the sections in red, the quarantined area of the United States. On December first this area will, I believe, be modified in a few of the states, but the general outline will be the same, with the exception of slight changes in Florida, Texas, Virginia, Arkansas and Louisiana.

The cattle in this area are infested with cattle ticks for the reason that their owners have not seen fit to eradicate the ticks. The question naturally arises: When will tick eradication be completed in this red area? Whenever the owners of tick-infested cattle are determined to dip their cattle systematically. There are various things that will bring this about. First, we should have an adequate law for each state, and second, a strictly maintained quarantine. Without tick eradication, these ticks will not stay quarantined in this area. The cattle will be moved in violation of law and will scatter ticks north of this red area.

An adequate state law should first outline just what the county and state authorities and the cattle-owners must do. The state should furnish the inspectors. The county may or may not furnish the dip and the vats. Some states do not require the county to furnish anything. Florida and South Carolina are two states in which state and federal governments bear all the expense, but in most states the state furnishes inspectors and the county furnishes the vats and the chemicals to dip the cattle. It is advisable to have a law that will outline penalties for the cattle-owner who fails to dip. This should be in the form of seizure of the cattle or fine within the code.

In working a county the veterinarian or agent responsible for the work should be absolutely in charge of the county, and the local men who are paid by the county or state must be under his direction so that they can be displaced at any time their work is not satisfactory. We have experienced considerable trouble in most states where the owners have named the local inspectors. This may be satisfactory provided the inspectors will carry out the instruction of the Bureau men. On the other
MAP 1. The black sections indicate the area quarantined on account of splenetic, southern, or Texas fever of cattle, effective December 1, 1926.
hand, if they will not carry out the instructions, failure will eventually overtake us.

The amount which the state should appropriate varies. Some states, owing to the cattle population, will require more money than states which have a small cattle population. I think the state law should be written by those who are to enforce it, as they are in the best position to put all the requirements in the law that are necessary to complete tick eradication.

While the scope of cooperation may vary, each of the cooperating parties should understand their part in it and accept their responsibility. In most instances of failure, it is due to the fact that the inspectors and the cattle-owners do not function 100 per cent, that is, the cattle-owners do not dip all the cattle every fourteen days and the inspectors do not find and report them when they are not dipped.

This law should have two provisions, seizure of cattle if they are not dipped, and prosecution of owners who fail to dip. The secret of tick eradication is simply dipping all the cattle every fourteen days. Anything short of this will cause ticks to be held over from year to year and perhaps never result in tick eradication.

There are counties in this red area which have been dipping cattle for fourteen or fifteen years and still have ticks. They dip cattle, but dipping cattle is not tick eradication. I believe Webster defines the word "eradicate"—"to pull out by the roots and do away with." To eradicate ticks is to dip all cattle every fourteen days.

When Dr. Bahnsen assigned me this subject, I thought the scope should be 100 per cent in every respect and it should be carried through in every phase of the work. I think the officials should always deal with the man in charge of the work in a county. A cattle-owner who does not wish to dip his cattle always wishes to get the regulations modified. He wants the state official to say one thing—"It is all right. You need not dip your cattle." He is hunting that modification. They try to influence the legislature to modify their rules and regulations in regard to dipping their tick-infested cattle. Their whole aim is to modify. They always want the law modified to the breaking-point where tick eradication cannot be completed. You cannot compromise with the dipping of cattle except after the animals are dipped and go through the vat.
I do think the state officials, in writing cattle-owners in the quarantined area, should always supply the Bureau's office and also the Bureau veterinarian in charge of the county with a copy of the letter, so we will all know what is going on in the counties of the quarantined area.

PRESIDENT MOHLER: We are very fortunate in having with us this afternoon a visitor from the great state of Texas who has been the secretary of the Texas Cattle Raisers' Association for a long term of years. I take great pleasure in introducing Mr. E. B. Spiller, of Fort Worth, Texas, whose subject is "The Attitude and Interest of the Texas Cattlemen in Tick Eradication." . . . Mr. Spiller read his paper. . . . (Applause)

THE TEXAS CATTLEMEN'S VIEWPOINT OF AND INTEREST IN TICK ERADICATION

By E. B. SPILLER, Fort Worth, Texas

Secretary, Texas and Southwestern Cattle Raisers Association

To tell you of the viewpoint and interest in tick eradication of the Texas cattlemen, it is necessary to cite some of the history of the work in Texas and the activity of the Texas cattlemen in connection with it. The facts which I will state to you I feel will explain both their attitude and interest.

The policy of the Texas cattlemen on any subject, as a rule, is that which is expressed by the organized cattle interests of the State. The Texas and Southwestern Cattle Raisers Association has always been the representative of the cattle industry of Texas and the mouthpiece of the industry. Therefore, in telling you of the cattlemen's interest in tick eradication it is well to refer first to the activities of the Texas and Southwestern Cattle Raisers Association. The matter of tick eradication was first presented to the Association through the agents of the Bureau of Animal Industry in addresses before the convention of the Association. These addresses, of course, were of an educational nature. During 1906 and the years following, agents of the Bureau of Animal Industry held conferences with the Executive Committee of the Association. The outcome of this was that the officers and many members of the Executive Committee were convinced of the importance, necessity and value of tick eradication, and while taking no very aggressive or active steps at that time as a body, the officers and many of the members encouraged the work.

Up to 1910 little progress in tick eradication had been made in Texas. The function of the Texas Live Stock Sanitary Com-
mission had, up to that time, consisted largely of policing what was known as the Texas Fever Quarantine Line. During that year, on account of what appeared to be a failure to prevent properly the movement of ticky cattle across the quarantine line, a serious situation affecting the commerce with other states was brought about and called to the attention of the Association. That situation brought the Association's attention more forcibly to the necessity for more activity in tick eradication work.

A representative of the Association was sent to meet with the U. S. Live Stock Sanitary Association at its meeting in December, 1910, for the purpose of assuring the other states that the organized cattle interests of Texas would become quite active in live stock sanitary matters, and see to it that the Texas authorities pursued a policy which would warrant the other states in continuing the commerce in cattle with Texas. A representative of the Association at that time learned of the work which was being done in tick eradication in other states, and of the appropriations which were being made by the state legislatures for the work, and also gathered considerable information as to the methods of carrying on the work. At that time a very meager appropriation was available for the live stock sanitary authorities of Texas. In 1910 the Cattle Raisers Association of Texas augmented the appropriation then in existence by paying the salaries of additional employees of the Live Stock Sanitary Commission, in order that its work might be prosecuted more effectively.

The information gained by the Association up to 1911 showed the lack of necessary legislation to prosecute tick eradication work properly. Also, in order for the work to be carried on, it was found that considerably more funds were needed by the Live Stock Sanitary Commission. Therefore, in 1911, the Association took an active interest in having adequate legislation passed by the session of the legislature that year, and was successful in convincing the Legislature of the necessity for considerably increased appropriations. At later sessions of the Legislature it became necessary to make further changes in the live stock sanitary laws. At every session of the Legislature the representatives of the Association were quite active in their efforts to secure the passage of laws which would strengthen the power of the live stock sanitary authorities to carry on the tick eradication work.
The state-wide tick-eradication law came before the Legislature in 1917. The representatives of the Association were quite active in their efforts to get the law through the Legislature. The original bill which was introduced was considerably amended, but it passed during that session of the Legislature. From that time until 1924 tick eradication work was carried on in a more or less successful manner. One of the candidates for Governor in 1924 openly advocated the discontinuance of tick eradication work. I take it that every person here knows that this candidate for Governor had a male representative who has since taken an active part in the administration of affairs in Texas. This made quite an appeal to some people in eastern Texas and a few in other sections. This candidate was elected.

However, there was another very important issue in the campaign and the anti-tick-eradication platform was not responsible for election. Notwithstanding the election of the Governor who had pledged opposition to tick eradication, the Texas and Southwestern Cattle Raisers Association took a definite stand for systematic tick eradication and a compulsory tick-eradication law. At the session of Legislature in 1925 a new livestock sanitary law was passed. It provided for compulsory tick eradication, although differing in other respects from the former law. This activity on the part of the Association expresses, more fully than anything else I could tell you, the policy of the Association on tick eradication, and is convincing that the organized cattle interests are strongly in favor of tick eradication, and intensely interested in having the work carried on.

The Association has assisted in the campaign of education necessary to get the cooperation of stockmen and farmers in tick eradication work. However, the educational work which the Association has done has really been negligible. In the state of Texas the educational campaign was carried on by the federal and state authorities, and to them is due the major portion of the credit for the results gained by such campaign. The general feeling in Texas toward tick eradication, as expressed by one very prominent cowman, is that it is regarded as "an intelligent public policy." There are some cattlemen who have made little progress in cleaning up their ranges. The majority of these men express themselves as being desirous of ridding their ranges of ticks. Failure to clean up their ranges is due in a large
measure to the fact that a considerable number of those who have not cleaned up their ranges are located in that section of the State which is included in the third zone provided for in the law enacted in Texas in 1917. Active work began in their territories about the time the depression in the cattle business set in.

**Cattlemen Confronted By Financial Difficulties**

The serious conditions which have confronted the cattlemen since that time have been quite a retarding influence on tick eradication, due to the fact that many cattlemen since then have been quite busily engaged in trying to look after their interests in such a way as to avoid bankruptcy. No doubt the cleaning-up of their ranges would be helpful in avoiding this condition, yet such a situation is not conducive to promoting tick eradication work, or other progressive policies.

As an instance of the feeling of the cattlemen of Texas generally, your attention is directed to a meeting which was held in San Antonio, in December, 1924. This meeting was called by the representative of the Governor-elect, who had advocated the discontinuance of tick eradication. The meeting was attended by stockmen from all sections of the State. While the outcome of this meeting was quite unsatisfactory to a considerable number of those who had been interested and actively engaged in tick eradication work, the meeting did go on record as recommending that a compulsory tick-eradication law be kept on the statute books. I have shown already that the Legislature of 1925 did make a change in the law, as provided in this recommendation, but did not repeal the compulsory tick-eradication law.

The State appropriation for tick eradication has been increased from year to year. Previous to 1925 the country expended considerable funds on tick eradication. Therefore, I have no available figures as to the amount expended by Texas. The Board of Control has approved for the year ending August, 1928, an appropriation of $425,000.00, and $300,000.00 for year ending August, 1929. This is for tick eradication work alone. Additional appropriations for other expenses of the Live Stock Sanitary Commission have been made.

**Large Area Released From Quarantine**

In view of the well-known fact that cattle free of ticks are much more valuable than ticky cattle, and as Texas is the largest
cattle-producing state, and it has been shown so conclusively that by the proper effort cattle can be freed of ticks, it would seem that Texas should have accomplished more in tick eradication work than any other state. The records show that since 1906 there have been cleaned up in Texas and released from quarantine, effective this month, 110,119 square miles. This includes 111 entire counties and portions of two counties. That is a considerable territory, when it is considered that it is 40,000 square miles more than the entire area of our sister state of Oklahoma, and 57,000 square miles more than the entire state of Arkansas. The records show that the area in which systematic tick eradication work was carried on in Texas on November 1, 1926, was 28,550 square miles. There will be held under federal quarantine on January 1, 1927, in Texas, 82,143 square miles.

Included in the area which will be held under quarantine on January 1, 1927, is that section of eastern Texas in which it would appear that tick eradication work will not make very rapid progress. A considerable section of that territory is cut-over land belonging to lumber companies. A large portion of it is open-range country. Some of the cattle in those counties are owned by the lumber companies. To them, of course, the cattle business is an incidental business. A large portion of the men in that section of the State, other than the lumber companies, who own cattle are not dependent on the cattle business for existence, but are simply engaged in it to utilize their lands which are not bringing them revenue from other sources. In many instances it is an incidental business engaged in by a man who is simply trying it out to take advantage of the open, free range. Men so engaged in the cattle business in that section are not intensely interested in the improvement of the breeds of cattle, or other improvements which are being made by progressive cattlemen engaged in the cattle business, or the production of live stock as their principal or entire business.

Conditions In The Range Country

It might appear to some that the great range country of Texas would make more rapid progress in tick eradication than would be made in the farming sections of some of the southeastern states where very commendable progress has been made. In Texas, tick eradication work has been carried on both in the range country and in the farming sections, and it has been our
experience that unless some local conditions arise to retard progress the work can be more easily handled in the farming sections than in the range country. In the farming sections as a rule the methods of eradication provide for the dipping of cattle at community vats. Live stock in those sections is owned in small bunches. On regular dipping-dates such live stock is brought by the owner, some member of his family or some employe to the dipping-vat and his work is over. With the ranchmen it is a more difficult and more expensive problem. It is necessary that the ranchman build his vats. When actual work begins it is necessary that he dip his cattle at the intervals prescribed by the regulations. In order to do this properly it is necessary that he increase his number of employes, his equipment in the way of horses and other necessaries. On some of the large ranches tick eradication work was very expensive. In some instances it was necessary that a whole outfit be working ever day during the year, or during the dipping season, in order to dip the cattle at prescribed intervals.

In some instances it was necessary to detail a state or federal agent to such a ranch, and his entire time and attention was required on that particular ranch. It is now twenty years since tick eradication work began. A score of years in the life of a man seems a long time, yet it passes in matchless flight. Those who have been actively engaged in tick eradication work can, in my judgment, look back over twenty years of achievement. When it is considered from all angles I feel that much has been accomplished. I am not making reference to the state of Texas alone now, but have reference to all of that portion of the United States which has been freed of ticks since the work started. I do not know that any figures have been compiled or that it is practical to compile them, but all of us know that millions of dollars have been added to the value of the live stock of our country by tick eradication. At times I have, and I know many others interested in the work have, been discouraged on account of what appeared to be lack of progress, due in many instances to some local condition, but considered in the aggregate we are warranted in feeling that a great work has been accomplished. I have not made comparisons with other states but hope that the state of Texas, when the situation is considered from all angles, has kept pace with other states. I am hopeful that in my rambling remarks I have shown to you that there is not a lack of interest on the part of the Texas cattlemen.
REPORT ON TICK ERADICATION

PRESIDENT MOHLER: I feel sure we all appreciate the report presented to us this afternoon by Mr. Spiller and I want to thank Mr. Spiller personally and in behalf of the Association for the time and trouble he has gone to in coming this long distance to make this address. We now call on Chairman Bahnsen, for the report of the Committee on Tick Eradication.

DR. PETER F. BAHNSEN: I want to endorse heartily the paper by Dr. Bux. It covered tick eradication, as I see it, emphatically, except that he made apology for someone who might resent the difficulty about moving cattle because it paid him. Possibly under his conception of government rules, the owner has a right to do that, but it shows a mighty poor spirit. A man who will sacrifice the interest of the community in order to gain a few dollars for himself is not much of a citizen.

We believe the time has come when tick eradication should be completed. There was a time when many details had to be worked out and we had to go slowly in order to know what to do and when to do it, but that time has long since passed and it is absolutely unnecessary to delay tick eradication because a few individuals manage to get a few dollars out of the other fellow's troubles or difficulties.

Any county, any community, any individual can clean up his ticks in one year if they know they can't move the cattle under any condition for any purpose until they are clean. They know just exactly how to do it, and there is not any earthly use to fool with them.

Dr. Bahnsen then read the report of the Committee on Tick Eradication. . . . (Applause)

REPORT OF COMMITTEE ON TICK ERADICATION

DR. P. F. BAHNSEN, Chairman, Atlanta, Ga.

Dr. J. H. Bux, Little Rock, Ark. Dr. W. M. MacKellar, Washington, D.C.
Dr. C. A. Cary, Auburn, Ala. Dr. E. P. Flower, Baton Rouge, La.
Dr. W. K. Lewis, Columbia, S. C. Dr. J. V. Knapp, Tallahassee, Fla.
Dr. R. V. Rafnel, Jackson, Miss. Dr. N. F. Williams, Fort Worth, Tex.
Dr. J. G. Ferneyhough, Richmond, Va. Mr. J. A. Whitehurst, Oklahoma City, Okla.

The occurrence of outstanding interest and importance in this project was the action by Congress repealing the special provision in Section 6 of the 1884 law, which exempted splenetic or Texas fever from the restrictions applied to all other infectious or contagious diseases and in effect specifically permitted the shipment of tick-infested cattle in interstate commerce for immediate slaughter. This repealing act, commonly referred to as the Crisp Bill, having been introduced by Congressman Crisp, of Georgia, at the request of the chairman of your Tick Eradication Committee, does not immediately prohibit the interstate shipment of tick-infested cattle, but carries a provision that until May 1, 1928, cattle infested with or exposed to cattle-fever ticks may be shipped in interstate commerce after one dipping, in accordance with such regulations as the Secretary of Agriculture may prescribe. On and after May 1, 1928, only tick-free cattle will be permitted in interstate commerce for any purpose.

Conditions resulting from the past year's activities make the following changes in the federal quarantine area advisable, and these changes in the quarantined area have been ordered by the Secretary of Agriculture, in B. A. I. Order 300, effective December 1, 1926:

In Arkansas, Logan, Perry, Scott, and Yell counties, the remainder of Conway County, and a portion of Desha County are released from quarantine.

In Florida, the remainder of Franklin County is released from quarantine.

In Louisiana, Richland Parish and those portions of Caldwell and Red River parishes, formerly released, are requarantined.

In Texas, Caldwell, DeWitt, Gonzales, Gaudalupe, Maverick and Val Verde counties, and the remainder of Lamar County are released from quarantine. Limestone County, formerly released, is requarantined.

In Virginia, Isle of Wight and Nansemond counties and the remainder of Surry County are released from quarantine.
The existing quarantine of areas in the states of Alabama, Mississippi, Oklahoma and South Carolina, and the territory of Porto Rico is continued.

The results obtained, from the inception of this work in 1906 to date, are briefly summarized in the accompanying table.

**Table I—Statement of results—tick eradication, July 1, 1926, to December 1, 1926. United States Department of Agriculture, Bureau of Animal Industry, Washington, D. C.**

<table>
<thead>
<tr>
<th>Counties Quarantined</th>
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<th>Released Counties Tick-Free on Nov. 1, 1926</th>
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*Inactive: Nov. 1, 1926, to Nov. 1, 1924.*

**President Mohler:** This topic of tick eradication is now open for general discussion. I wish to extend to everyone the privilege of the floor.

**Dr. R. A. Ramsay:** Mr. President, I may say that I enjoy being here today and being with many of my old friends of the West and Northwest, with whom I used to associate when we were dipping cattle to eradicate scabies. We had a terrible job to get the people to dip cattle twice in those days. If they dipped once, they wanted to stop.

One day in my office in Fargo, in 1905, we received a kind of preliminary statement on tick eradication, which emanated from Washington and stated that in order to eradicate cattle ticks, it would be necessary to dip the cattle about once every two weeks for approximately a year. I remember one of the boys who read that threw up his hands and said, "Good Lord, there is no such animal as dipping cattle every two weeks for a whole year. We can't get them to dip twice in a year. How are you going to get them rounded up to dip every two weeks for an entire year?"

But it has been done. It is being done now, and I think the people of the North should take off their hats to the people of the South for their accomplishment in this piece of work. It is really a constructive piece of work that we all ought to be proud of. The southern people have taken hold of and are making a success of something we thought was impossible. The people up north looked at it as an impossibility, but the cattle are being dipped every two weeks. The result is that out of the 900 some-odd counties, 641 counties are now absolutely free from ticks. That is quite an accomplishment.

One of the speakers mentioned politics. I would like to talk a little about that. The whole matter of tick eradication as we have gone along is strewn with corpses and carcasses of a political nature. I have known a good many politicians, good friends of ours, friends of tick eradication, fine men, honest gentlemen, who saw tick eradication as it was and said, "Why, it is easy."
They read the life history of the tick and said, "Keep it from reproducing itself and you stop the ticks, kill the ticks off. What you don't poison, you starve to death. You have a double-barrel gun." It looked easy.

I remember one mighty good congressman from the South, and the thing was so apparent to him that he hung his election on it. He went out and campaigned in his state for the United States Senate on the question of tick eradication and the upbuilding it was going to do for the farmer and for the cattle industry of that state. He was just about fifteen years ahead of his time and they defeated him. Other people could not see it just his way. It takes time to get up to this point, to realize just what tick eradication is.

I might relate similar instances of county judges, sheriffs and prosecuting attorneys, and even to governors, who have experienced success or defeat on the position taken by them on the subject of eradicating cattle ticks.

All through the South the question of tick eradication is injected into nearly every platform on the question of tick eradication and they must face that and we must face it. Politics and ticks were so associated that a man could not be elected unless he was on the right side. Sometimes he got on too soon and sometimes too late, and it meant office or no office.

When we consider what has been accomplished in the face of all obstacles and how tick eradication has still carried on, we must admit that it is a worthwhile project.

Mr. Spiller very well brought out, in his remarks, the mixing of this project with politics. It is unfortunate that a project like this—worthy, constructive work—should have to be mixed with politics to the extent it has been, but I guess it is that way and will continue.

In closing I want you to appreciate what has been done and is being done in the South, and you would appreciate it if you could see them gathering cattle out of the swamps and dipping them every two weeks.

I might add that we are getting up a motion picture which shows the southern cattle yesterday and today. We have in that picture a scene showing a dense swamp as a background, with dogs bringing the animals out, and holding them there until they have been dipped. That is something that they do not know anything about in the North.

One state required dogs in order to facilitate this work and get it done. They could not get the people to supply dogs, so the state bought fifty dogs at one time and put them into a corral, with a man in charge of them. When it was necessary to dip cattle they would take out six or eight or ten of these dogs in a big crate in a Ford truck and turn them loose, and they would gather the cattle. That is just an illustration to show some of the obstacles that tick eradication does surmount, not only in overcoming politics, but in getting the cattle out and killing ticks either by arsenic or starvation. (Applause)

Dr. C. A. Cary: There is one phase of this question that really involves the North as much as the South and it shows what they can do. But before I talk on that, I want to tell you a story of the late Governor Taylor, of Tennessee. He was noted for pardoning convicts. One day an old negro woman came up to him to get her husband out of the penitentiary and Governor Taylor asked her how Sam got into the penitentiary.

"Well," she said, "he stole meat."

Governor Taylor asked what kind of a man Sam was.

She said, "Governor, Sam is just no count for anything, in the penitentiary or out of it."

"Then why do you want him out?"

She said, "We are out of meat." (Laughter)

Why is it that some people in the North injure tick eradication in the South? To illustrate that I will give you an example of a packer who is now down in Mississippi trying to get cheap cattle out of that state. He wants to get something for nothing.

We have some feeders in the West and North—I am not criticizing exactly, because I am a Corn Belt boy—who want feeder cattle and they want to get the cattle out for individual interest. If you will eliminate that and your congressmen in Washington will not try to legislate laws in order to try to help them out, we will get rid of the ticks. We want you northern fellows to tell your congressmen to let the ticky cattle alone until they are clean.
If we could just lock up the quarantine area and not let a solitary cow out of there, every county would get into this work because they could not sell their products until they were clean. It would be very simple and could be done in a few years and we would have it wiped off the map, but just as long as you want to get something for nothing, so long there will be means and ways by which you can get a dipping-station requiring one dipping to get those cattle out and make something out of it.

**PRESIDENT MOHLER:** Is there any further discussion?

I would like to tell a little story, which is true, about how one chief of the Bureau was chosen as a result of his belief in the possibility of tick eradication.

Back in 1905, Dr. Salmon resigned and Dr. Melvin was the acting chief of the Bureau for a number of months. The position had been offered to Dr. Pearson, and others were being considered at about the time the southern Commissioners of Agriculture met in Richmond, Virginia. I was invited to discuss measures for the eradication of ticks. Our old Secretary, James Wilson, was present at the conference. After I had finished, Secretary Wilson came up to the platform and wanted to know if Dr. Melvin agreed with my views on the subject of tick eradication. I told him frankly that Dr. Melvin had been West for four or five years on account of his health and I had never discussed it with Dr. Melvin. He said, “I wish you would wire to Washington and have him come down here right away.”

I wired and in three hours he was at the Murphy Hotel, in Richmond, and the three of us had dinner there. During the course of this meal the Secretary asked me to tell Dr. Melvin of the points I had made at this conference and he then asked Dr. Melvin if he concurred and if he was in sympathy with that proposition. Naturally Dr. Melvin was very much in sympathy with the recommendations and Secretary Wilson told him right then and there that he would make him Chief of the Bureau of Animal Industry as soon as he got back to Washington. That is one reason, along with others, that Dr. Melvin became Chief of the Bureau without further delay.

I would like to have some more discussion of this topic before we adjourn. If any of you have anything on your mind, now is the time to present it. If not, we will stand adjourned until tomorrow morning at nine o’clock. The first paper will be by Dr. Fretz, and if nobody but Fretz and I are here, we will discuss it together because we are good friends. We will have to start promptly in order to complete the program on time.

... The meeting adjourned at 4:50 p.m. ...

**ADJOURNMENT.**

**THURSDAY MORNING, December 2, 1926**

The third session convened at nine o’clock, President Mohler presiding.

**PRESIDENT MOHLER:** The morning’s program will consist entirely of research problems connected with our tuberculosis campaign, and the first speaker will be Dr. W. J. Fretz, inspector-in-charge at St. Paul, Minnesota, who will address us on the subject of “Intradermic Tuberculin Reactions.” (Applause)

... Dr. Fretz read his paper...  

**INTRADERMIC TUBERCULIN REACTIONS**

*By W. J. Fretz, St. Paul, Minn.*

*U. S. B. A. I. Inspector-in-Charge, Tuberculosis Eradication*

The intradermic tuberculin test has justified its adoption by this body, on December 6, 1920, by virtue of the fact that it now can be held definitely that bovine tuberculosis will be eliminated by the intensive application of this test to the cattle of this country.
In other words, the proponents of this test of ten years ago are to be congratulated on their keen vision and sound judgment in advancing their belief that the intradermic method dominated all other tests in solving the most gigantic problem this body has ever been called upon to solve.

In looking back ten years it will be recalled to mind, first, that many expressed as impossible the testing of a state with a cattle population of one to three million. Second, that if ways and means could be devised to test all of the cattle in a state it would be impossible to obtain the necessary appropriations for indemnity and, third, the stock-owners would not cooperate on a large scale when confronted with the possibility of losing valuable cattle which required years of effort and the expenditure of money to acquire.

These fallacies of ten years ago, with the passing of time, have gone down like a house of cards before the onrush of progress. It seems appropriate to pause here and pay a tribute, first, to the discoverer of tuberculin; second, to the veterinarian who first conceived the idea of using it as a diagnostic agent in detecting tuberculosis in live stock, and to the present-day veterinarian who occupies the most advanced position on the firing-line in this great battle being waged against tuberculosis of live stock; third, to the laymen who, in many instances, without the hope of fee or reward, have given freely of their time and energy in educating the less informed as to the importance of eliminating this disease from their herds, and to their untiring efforts in obtaining funds for carrying on the work and, fourth, to the most important factor, the stockman, for his supreme confidence in tuberculin and in the men who are applying it.

**Questions Remain Unanswered**

It will do no harm to bring to mind again the fact that we know only how tuberculin is made and are unable to demonstrate the elements which cause a thermic, an intradermic or an ophthalmic reaction. We cannot answer the question as to why, in the application of the thermic test, the temperatures of reactions will range from 103.8° F. in some instances to 108° in others. Nor can we explain why intradermic deviations range from very small dimensions to extremely large reactions, or why there is a slight, well-marked or extensive reaction to the application of ophthalmic tuberculin. We can only observe and
For circumscribed swellings, "pea" size (diameter 3/16") shall be used as the basic standard. Larger swellings shall be reported as P2, P3, P4, P5, etc., the figures 2, 3, 4 and 5 referring to twice, thrice, four and five times the size (diameter) of a pea.
record these actions and for this reason we should ever be on
the alert to take advantage of information gained that will
raise the standard of efficiency, not only of the intradermic
test but any other means we have at hand.

Since the intradermic test has become the major test in our
work every effort should be made to carry it to a higher plane
of efficiency, if possible, and to that end I believe that the present
code does not convey the required information.

There are two important factors in conducting an intradermic
test: first, the injection of tuberculin and, second, the recording
of the degrees of deviation which follow.

In the first instance the veterinarian is called upon to make
a most delicate operation of placing tuberculin at the proper
point under very adverse conditions. Secondly, he is called
upon to make the proper reading on the border-line deviation
between reactors and suspicious animals. The present code
does not convey a word-picture of the deviations disclosed
and, in my judgment, a word-picture of the deviations should
be recorded.

Permit me to draw your attention to the present "P" or
circumscribed-swelling code. Does the word "size" refer to
area or diameter? If it refers to area then a P8 in this instance
would not be quite so large as a P4 in diameter (as shown in
fig. 1). I find, in consulting the men, that they take the inter-
pretation of diameter, and fig. 1 runs from one diameter of
\( \frac{1}{16} \)" to eight diameters of \( \frac{1}{16} \)". Under either interpretation
of "area" or "diameter" no provision is made in the code for
reporting additional units in thickness of \( \frac{1}{16} \)" (as illustrated in
fig. 2). Permit me also to draw your attention to the thick
code. For diffused swellings "thick 2X" shall be used as the
basic standard and signifies a diffuse swelling in which the
injected caudal fold is twice as thick as the normal fold. Larger
swellings shall be recorded as "thick 3X," "thick 4X," etc.

**INTERPRETATIONS VARY**

It is apparent that it was intended by the authors that the
entire fold must be involved. Otherwise, if less than the entire
fold was involved, it would have immediately brought to their
minds the fact that they were describing a circumscribed swell-
ing of say 6, 7 or 8 diameters within the field involved. How-
ever, this interpretation is not universally applied in this manner
in the field, as a large number of veterinarians are reporting this
For diffused swellings "thick 2X" shall be used as the basic standard and signifies a diffuse swelling in which the injected caudal fold is twice as thick as the normal fold. Larger swellings shall be recorded as "thick 3X," "thick 4X," etc.
code as illustrated in fig. 3. Here you have a “thick 2X,” which is seven diameters long and \( \frac{3}{16} \)" thick, on a fold five inches long. This is the type of swelling many men are reporting as a “Th 2X,” while the “Th 3X” and “Th 4X” of the same diameters are being marked “P.”

Fig. 4 merely represents approximately three-fourths of the folds involved; fig. 5 the involvement of the entire fold to a thickness of \( \frac{3}{16} " \). The experience of myself and many field men is that we have very few true diffused swellings involving the entire fold, as compared with those that are circumscribed within this area and are subject to measurement of thickness and length.

It seems sound, in reporting deviations resulting from the intradermic test, to provide a combination of the two essential features of the old code, namely: thickness and length. This is illustrated in figures 2 and 6, which are cross-sections of deviations as presented for reading on the skin.

Fig. 6 represents the proposed code, in which thickness and length of the old code are combined. You will note that you have three letters involved in fig. 6: P, M and S. The letter “X” will be referred to in reading the proposed code.

You will note that P1 in fig. 2 and M1-1 in fig. 6 are not \( \frac{3}{16} " \) thick. In fact, P1 has a dimension of \( \frac{3}{16} " \) in thickness or height, and \( \frac{3}{16} " \) in diameter or length. In fig. 6, M1-1 has been increased to \( \frac{3}{8} " \) in height and \( \frac{3}{4} " \) in length. You will note that the first three diameters, in fig. 6, are stepped up arbitrarily on the basis of \( \frac{3}{8} " \) and the rest on the basis of \( \frac{3}{4} " \), while in fig. 2 the lengths of the old code are stepped up on the basis of \( \frac{3}{16} " \).

**Proposed Intradermic Code**

1. Animals showing no reactions shall be recorded at each observation as “W” (negative).

2. Animals showing any deviation from normal shall be recorded with the following code letters: first, “P”; second, “M”; third, “S” and fourth, “X,” the letters P, M and X representing reactors, and S, suspicious. These code letters (with the exception of X) are to be coupled with two numerals, the first numeral representing thickness, using \( \frac{3}{16} " \) inch as the basic standard of more or less deviation; and the second numeral representing length, using the more familiar terms of \( \frac{1}{4}, \frac{3}{8}, \frac{1}{2}, \frac{3}{4}, 1, 1\frac{1}{4} \) and \( 1\frac{1}{2} " \) inch for measuring these dimensions.
### INTRADERMIC TUBERCULIN REACTIONS

**Fig. 6. Proposed code**

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Defining and Recording the Code

"P" reactors followed by the two required code numerals are defined as representing a basic standard of \( \frac{3}{16} \) units in thickness, and \( \frac{3}{8} \) or more in length, and shall be coded in the following manner: P1-2 (basic), P1-3, P1-4, P1-5, P1-6, etc.

"M" reactors followed by two required code numerals are defined as representing a basic standard of \( \frac{7}{32} \) in thickness, and a basic length of not less than \( \frac{1}{4} \) in length; and shall be coded in the following manner: M1-1 (basic), M1-2, M1-3, M1-4, M1-5, M1-6, etc.

"S" suspicious animals are defined as showing less deviation in thickness than "M" reactions, and shall be recorded on the basis of less thickness than "M" reactors, using the adopted numerals for reporting deviation in length in the following manner: S1-1, S1-2, S1-3, S1-4, S1-5, S1-6, S1-7, etc.

The code letter "X" shall be used in recording reactions showing greater deviations in dimensions than the "P" code.

Animals showing clinical evidence of tuberculosis shall be condemned upon physical examination and recorded "Clinic."

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It does not appear material to fix exact units of length of intradermic deviations on the basis of \( \frac{3}{16} \), as many of them are not truly circular in form, but, in reading the reactions and discussing the reactions with the field men, the conclusion is reached that the thickness of the area involved, expressed from a basic standard above and below, is all important. However, the use of \( \frac{7}{32} \) as a basic thickness in the old code appears sound. If \( \frac{1}{4} \) is used, the deviation will be too great.
In recommending the addition of the "M" code I am going to call to mind a parallel condition encountered in the use of the thermic test. You will recall that in the first instance a deviation of two-tenths of a degree condemned an animal. That is to say, a temperature of 103.8° F., with or without a two-degree rise in temperature, could be classed as suspicious, while an animal with a temperature of 104° should be classed as a reactor, with less than the prescribed two-degree rise. The provision for condemnation in the first instance was: "If the animal be aged, in poor condition or in a tuberculous herd, it may be, under these circumstances, classified as a reactor."

While there was no provision in the subcutaneous code for expressing reactors with less than the standard degree of temperature reaction prescribed, yet there was a provision for condemning animals that did not approximate the standard under certain conditions that might exist in the herd.

It also provided for a mental picture of the deviations disclosed in suspicious animals. There is no question as to the soundness of these conditions in the thermic code, and I feel justified in making the statement that there seems to be no valid reason why they should not be applied to the intradermic code.

The "P" code, therefore, represents (expressed subcutaneously) reactions comparable to 104° plus, and the "M" code the qualification of condemning animals that do not approximate this standard, and the "S" code gives a record of dimension of what the inspector is leaving as "suspicious" in the herd. The letter "X" is for the purpose of designating dimensions beyond the proposed code.

Under these standards of comparison we can then agree that the "P" code needs no further explanation and that the "M" code must justify its existence by results that should be based on whether or not the field men can differentiate between $\frac{1}{16}$" and $\frac{1}{8}$" in thickness. My answer to this is unqualifiedly, "Yes," and my evidence is based on the repeated calling of my attention, by field men, to this perceptible difference. The line of demarcation between the "M" code and the "S" code is in inverse relation, that is to say, less marked in the arc, but here again I am confident, from my observations and those of field men, that a clear distinction can be made between a very slight thickness of $\frac{1}{16}$" as against $\frac{1}{8}$" (or $\frac{1}{8}$") as provided by the "M" code.
From my observations and those of the field men, there is another important parallel which may be drawn between the subcutaneous and intradermic reactions, namely: It is a well-known fact that the lower temperature reactions in the subcutaneous test, from 103.8° on up to 105°, revealed a larger percentage of generalized cases than did the 105° plus. The same observation, insofar as our experience goes, can be connected with the smaller swellings of the old code up to four diameters, but the code did not give a picture of less deviation than \( \frac{3}{16} \)", which we have demonstrated, beyond a doubt, reveal generalized cases.

There is still a third parallel that can be drawn between the subcutaneous and intradermic tests that has another significance. By the repeated use of thermic tuberculin the reactions did not run so high as on the initial test. Our observations lead us to believe that this holds true in the reactions disclosed between the first and second retests of infected herds with the use of intradermic tuberculin. That is, on the second test the swellings will not be so large in comparative units as the first test.

In view of the fact that the use of intradermic tuberculin has become the major test, and in view of the accuracy under the old code, which gave an optional (or rather a personal) interpretation to the results recorded, it seems sound basically to call for two dimensions, the first being the important one and the second somewhat arbitrary or relative up to some predetermined point.

**TWO OBJECTIVES SOUGHT FOR**

If a code of this kind is adopted and the first 300 reactors on initial test are gauged, 200 on the first retest of infected herds, and 100 on the second retest of infected herds, two very vital things will be accomplished:

1. We will obtain statistical efficiency on the intradermic test, by which standards of comparison may be established.
2. By calling for the actual measurements for statistical purposes the present field men will become well schooled in the sense of proportion.

These two conditions may be illustrated best by a hypothetical case. We will assume that it has been found that P1-5 gives an efficiency in lesions of 96 per cent; and that M1-5 gives 86 per cent. I take the position that the code M1-5 would be justified, even though only this percentage were found to be correct,
because of its relatively high efficiency. But, if an inspector is compelled to mark in units of full \( \frac{3}{8} \)", as provided in the old code, and assuming in this hypothetical case that 50 were P1-5, and 50 were MI-5, then we would have an average efficiency of only 91 per cent. In other words, we would have reduced the efficiency of one and raised the efficiency of the other, which is not a sound method of arriving at efficiency percentages.

In stating this hypothetical case and making the statement that 86 per cent of lesions are justifiable under certain conditions, I fully agree with the authorities that the animals showing no visible lesions are harboring the organism in their bodies.

**Three Important Factors**

By the adoption of the proposed code, success can be measured in terms of accurate statistical data. There are three all-important factors in measuring this success in the larger aspect of eliminating tuberculosis from cattle:

1. The technic in applying the intradermic test.
2. The elimination of all diseased animals on a given test.
3. Suspicious animals left in the herd.

In my judgment, uniform technic (insofar as that is possible) is the most important factor. While it is possible to lay down general directions to be followed, the resulting deviations of different operators will not be the same. Two illustrations will suffice to demonstrate the necessity of a more specific code:

First, I have in mind two operators on my force using gauge syringes with needles the same length and a uniform dosage of two minims, and to all appearances introducing the tuberculin in the same manner, but they cannot produce the same general character of swellings. One operator produces the more sharply circumscribed swellings of \( \frac{3}{8} \)" in thickness, up to four diameters in length, and the other less thickness over the same field of diameters in length. The lesions disclosed by both operators run parallel and the re-checking of their results by changing herds reveals the fact that both are successful in eliminating tuberculosis from the herds.

Second, this illustration has to do with dosage. In recommending to an operator to reduce his dosage to two minims I find that invariably he will try less than two minims temporarily, which will result in less pronounced deviations at the 72-hour and more positive reactions at the 120-hour observations.
DIRECTIONS FOR INJECTING TUBERCULIN

In view of the fact that skin texture is of varying thickness, we stress the following general directions in Minnesota for introducing tuberculin:

1. Restrain the animal.
2. Wipe the needle with a small piece of cotton saturated with alcohol before using it on the next animal.
3. Wipe the seat of injection with the same piece of saturated cotton and discard it.
4. Then, with the needle parallel to the skin, puncture to the true corium and inject two minims of tuberculin.

The above directions appear simple but the placing of tuberculin is a difficult matter that should be stressed on every occasion and calls for expertness of the highest degree on the part of the operator, as it is the starting-point from which we should strive to record the deviations resulting in the hands of individuals or collectively.

Due to the fact that no two operators can bring about the same degree of deviation, the proposed code may be the means by which we can eliminate more diseased animals on a given test than heretofore, but, above all, it would place every operator on record as to the dimensions of deviations on suspicious animals which are a potential menace in every herd.

The uniform results achieved as a whole by the field veterinarians during the past six years justifies the recommendation of a code that will actually portray the findings of this reliable test.

The proposed code provides a means of portraying the findings in an accurate manner by the use of familiar dimensions—thickness and length of the field involved.

The proposed code does not reduce the opportunity for displaying judgment on the part of field veterinarians in reading and recording their findings, but it simply provides a means of actually checking and recording their judgment.

PRESIDENT MOHLER: We will proceed with the next paper, and have the discussion after all the papers have been presented.

The next address is entitled, "Avian Tuberculosis Infection in Mammals Other than Swine," by Dr. L. Van Es, Director of the Department of Animal Pathology, University of Nebraska, Lincoln. (Applause)
AVIAN TUBERCULOSIS INFECTION IN MAMMALS OTHER THAN SWINE

By L. Van Es, Lincoln, Nebr.

Director, Department of Animal Pathology and Hygiene
University of Nebraska

You may remember that a few years ago I laid before you some evidence to show the degree of distribution of avian tuberculosis in swine, and to that work I need not refer at this time. I would like to tell you, however, that the results obtained in those experiments were such as to suggest that the work be continued, with a view of finding, if possible, whether in other animals avian infection likewise played a part in the production of tuberculosis. What I want to submit to you today is a report of progress. The work is unfinished, but I think that the evidence that we have thus far obtained will be of interest to you, and while it is an incomplete piece of work, I should like to submit it to you without further comments. The results obtained are tabulated in table I.

Before we analyze the figures, I may explain that the various materials that were used in the experiments were obtained from the inspectors-in-charge of neighboring packing-houses and stations. We have somewhat classified those lesions where we use them; the human lesions are obtained from various medical centers and from some of the large clinics, and the avian material that is here mentioned represents the tuberculous chickens and turkeys that once in a while wander into our laboratory to be recognized.

The experiments with human material and avian material are carried out fully. We not only try to find avian infection, but we also try to prove if avian infection is not present, whether the bacillus is of the human type or the bovine type. In the bovine material we do not go so far, however. We concede that wherever you find tuberculosis in a bovine it is apt to be of the bovine type. We were searching for avian infection, and we did not think it was worth while sacrificing animals and effort to find out if human infection in the bovine played a part. We use for the imperfectly-typed forms the term mammalian; we have no right to call them avian.

We have looked particularly for isolated lesions, acting largely
on what previous experience has taught us, that in swine the avian lesions are for the larger portion associated with single gland lesions, mesenteric lymph-nodes, cervical lymph-nodes, and the like, although occasionally we see generalized tuberculosis of avian source. I want to tell you that such cases do occur.

This first group represents bovine isolated lesions, mostly, if not all, lymph-nodes, solitary lymph-nodes. The inspectors find

<table>
<thead>
<tr>
<th>Origin of lesions used in typing</th>
<th>MAMMALIAN</th>
<th>BOVINE</th>
<th>HUMAN</th>
<th>AVIAN</th>
<th>MIXED</th>
<th>NEGATIVE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bovine. Isolated lesions. Mostly lymph-nodes</td>
<td>46</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>4</td>
<td>26</td>
<td>83</td>
</tr>
<tr>
<td>Bovine. Skin lesions</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Bovine. Hemorrhagic lymph-nodes of no-lesion reactors</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Bovine. Uteri of no-lesion reactors</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Human. Lesions other than pulmonary</td>
<td>-</td>
<td>-</td>
<td>22</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>28</td>
</tr>
<tr>
<td>Bovine. Pulmonary lesions</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Avian. Fowls and turkeys</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>33</td>
<td>1</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>23</td>
<td>40</td>
<td>5</td>
<td>94</td>
<td>208</td>
<td></td>
</tr>
</tbody>
</table>

on the killing-floor one mesenteric lymph-node with a tuberculous lesion and that is what we are working with, so let us well understand that if, with the completion of the work, we commence to express ourselves in percentages, for instance, it does not mean that fifteen per cent or thereabouts of the tuberculosis of cattle is of avian origin. It may be fifteen per cent of very carefully selected lesions. I emphasize that fact because previous work has been sometimes badly interpreted. We once
in a while are quoted as saying that swine tuberculosis is due to the avian bacillus at the rate of 88.5 per cent. It is not so. Of certain selected cases of swine tuberculosis, we find 88.5 per cent, but where you reduce it, of course, to the total of all tuberculosis in swine, that figure is reduced in percentage; it does not come up so high.

All together of those lesions we have thus far completed a typing of eighty-three different kinds of lymph-nodes or other material, of which twenty-six were negative. Probably the lesions were old and the bacillus had died. At least that is our interpretation. In some cases we cannot find bacilli, although there is no question that in the period when we got it, it was true tuberculosis. In forty-six, however, we find the mammalian type of bacillus, and I would say that they are all of the bovine type, although I have no right to say so, not having typed it out to completion.

We find, however, seven of this group to be of pure avian type. That is to say, those are tubercle bacilli which would not harm the guinea pig and would cause the generalized progressive tuberculosis in the fowl. Four of those we have classified as mixed. That is to say, those are bacilli or lesions which caused disease in both groups of animals. Perhaps they are mixed; perhaps we are mixed; anyhow, that is the most convenient way of classifying those organisms.

The next group are the bovine skin lesions. We have received all together thirty-eight of those lesions of different animals and different groups of animals from different sources. They typed out negatively unanimously. We have never been able to reproduce the disease from the skin lesion of the bovine nor have we ever succeeded in isolating the organism from it, nor have we succeeded in proving their identity; by feeding the material to pigs and later on testing with tuberculin, using avian tuberculin on one ear, bovine tuberculin on the other, everything has been negative. I do not know anything more about the nature of these lesions than Adam’s house-cat.

Next come the bovine hemorrhagic lymph-nodes of no-lesion reactors. When we are confronted with a farmer audience and demonstrate the effectiveness of tuberculin and open up the animal and find no lesions, we once in a while stumble on hemorrhagic lesions and say, “Hurrah! We are right.” We subject them to the regular test, and here they are. We have thus far completed tests with material of twenty different animals from
different sources, and we obtained uniformly negative results. I think we depend on the hemorrhagic lesions to prove the effectiveness of tuberculin-testing, which should not be necessary at all. I always think it is nonsense, but we go through this comedy with the farmers very often. They do not type out anything. We neither find bacilli in them nor any pathogenic organism in them. We are continuing this work and perhaps the final result will be different.

Bovine uteri of no-lesion reactors. We have only three, and we have found no evidence of tuberculosis. We have one case of sheep tuberculosis of which we have to make a record. It was sent to us at the time by the inspector-in-charge at the Sioux City station. He sent us a little lesion out of the lung of a sheep, and he made comments on it. "We have just tentatively classified this as pseudo-tuberculosis. We give it to you for what it is worth. Let us know what you find."

I can readily understand his hesitating to put the stamp on it, because sheep tuberculosis is about as rare as rare can be. Anyway, we put it through a typing experiment, and lo and behold, in due course of time, after a second set of typing experiments, it developed that the lesion of this sheep lung was true tuberculosis and that the infection was due to organisms of the human type. We do not know the history of the sheep, of course, but I suspect some sheep-herder or some sheep-attendant had been careless in the disposal of sputum and, being tuberculous, the sheep got it in licking up some of it.

We did not get very much of the human lesions. That is significant to anybody interested in tuberculosis as a biological phenomenon. I know twenty years ago we would get all kinds of the stuff. We have excluded pulmonary lesions, because we know the pulmonary tuberculosis of man is almost invariably due to the human bacillitus. The British Commission has practically settled that for all time. Ten or twenty years ago we would have gotten a lot of surgical tuberculosis. I remember the time around medical clinics there would be no trouble at all, in the course of a month or so, to get an abundance of scrofulous glands out of the necks of children. We cannot get them any more. I have not seen a single one, and there are two reasons for it. One reason is they do not occur half so often. In all probability you bovine tuberculosis eradicators have something to do with that, and, too, you are very kind to the youngsters and are not very kind to the pathologist who tries to find
out something. The other reason is when a child has this scrofulous gland, the surgeon in charge does not cut it out any more; he takes the youngster and puts him under the ultraviolet light a few times, and the gland is gone. The effectiveness of that treatment is particularly well shown in our trouble with procuring promising material.

What is represented in those human lesions is practically three types. First is the so-called cold abscess, the sinking abscess of the tuberculous spine, the voluminous abscesses that may start somewhere in the back of a fellow’s head and come out in the end of his toes and keep on going through; the joint lesions of articulations and bones; and the kidney lesions. I think for anyone searching for avian tubercle bacilli the kidney lesions are really the most promising of all. But you see in the twenty-eight cases that we have finished, six turned out to be negative because some of our medical friends may have sent stuff on suspicion and for diagnosis as much as anything else, but we have definite results on twenty-two, and they typed out with a clear distinctness as of human type. We have not thus far found any suggestion of avian tuberculosis in the material that we have examined, but you can see this material is rather scarce.

We recently have gotten some indications in the typing we have not finished that sediment of urine from a tuberculous kidney containing a lot of acid-fast bacillus will type out as a bovine type, because in the human cases we also typed for the bovine, and I think it is almost certain that they would type out as a clear-cut bovine bacillus. I like to show those figures on results with avian material, because it is a very good control on typing technic and a good method of control.

We have thus far finished thirty-five fowls and turkeys, in which one was negative. I do not know what that negative case is. It was a typical case of tuberculosis, but we did not get any results. Why, I do not know.

In one case we found what we call a mixed type. In that case the guinea pigs as well as the rabbits and the fowls became thoroughly tuberculous. What that means I do not know, but I call attention to some work that Dr. Schalk and I did some ten or twelve years ago which was published in the Journal of Infectious Diseases, which showed rather conclusively that birds, in this case chickens and sparrows, may for a long time become a sort of reservoir or preserver of mammalian tubercle bacilli. It may be the tuberculous bird had simply undertaken to also
take care of some other bacilli that it may have found on the farmstead from which it was taken. Anyhow, we got a case in the typing scheme. Those others are all typed out clear-cut as avian bacilli. I think that is really a very valuable control on our work, besides giving us a little information as to the host relations of the various types of bacillus; that is to say, in those thirty-three cases the guinea pigs did not develop tuberculosis. They might have gotten a little necrotic area at the point of inoculation where the bacillus was being maintained. But the fowl became thoroughly tuberculous, and so did the rabbit, which you know, contrary to all expectations, is resistant to the human bacillus and falls for the bovine as well as for the avian bacillus with great avidity. Some of the rabbits injected will die in from two to four weeks, and when we open them we find nothing, but when we make smears we find in some cases tubercle bacilli everywhere, in the muscles, in the skin, in varying amounts. Those are the results I should like to place before you, thinking maybe they will interest you. I hope when we get the work completed I may be able to render you a report that is of still more interest.

PRESIDENT MOHLER: It is with great pleasure that I have the privilege of introducing to you a colleague from the U. S. Public Health Service. This gentleman is deeply interested in the subject of tuberculosis and at the present time is the chairman of the Tuberculosis Research Committee of the National Tuberculosis Association. I take great pleasure in introducing Dr. William Charles White, of Washington, D. C., U. S. Public Health Service. (Applause)

DR. WILLIAM CHARLES WHITE: Dr. Mohler and Members of the Association: I wish first to acknowledge the pleasure which I have in the honor which you have conferred upon me in asking me to address you on a question which is of extreme interest, not only to you, but to every citizen of this country and to everybody in the world...

You have just listened to Dr. Van Es' very interesting paper, discussing a thing which I have referred to in this paper.

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

THE RELATION OF TUBERCULOSIS IN LOWER ANIMALS TO TUBERCULOSIS IN MAN

By WILLIAM CHARLES WHITE, Washington, D. C.

United States Public Health Service

The great known transfer of tubercle bacilli from animal to man is from the cow. In the raw food-products which we use from this source, such as milk, cheese and butter, the bacilli pass from the diseased udder of the cow to the consumer of this food, or by means of the soiled hands of the milker, the dust of the stable, or the spray from a coughing tuberculous handler of
the milk after it has been drawn. At least, since bacilli of the bovine type are found in the lesions of man, we presume that they reach him in this way.

The feasible control of this means of transfer is apparently within our own hands, especially by two methods now in practice in this country. First, it may be controlled by tuberculin-testing and the destruction of the tuberculous cows. Second, it may be controlled by pasteurizing milk before it is used for food in any form. The efficacy of both methods has been proved. The increasing number of tuberculosis-free herds in different areas of this country over several years and the disappearance of bone and gland tuberculosis in children (due to the bovine bacillus), where careful pasteurization of milk has been demanded in cities for years, are convincing proofs. It is clear, however, that neither one is sufficient alone. The appearance of tuberculosis in herds between tests, through carelessness or accident, the possibility of a tuberculous milker, occasional failure of pasteurization plants (of which there is now abundant evidence), requires the conjunction of both methods continuously if we are to have the maximum of protection for our people against the spread of tuberculosis through the milk of cows.

We must face also certain other difficulties before resting with satisfaction on these two methods. In the first place, they are enormously expensive, both to governments and to individual farmers and, through them, finally to the whole population, not only in the price of milk, butter and cheese but also of beef products. You are all familiar with the discouragement which comes after you have had the joy of raising a beautiful pure-bred heifer to her first milking, only to see her led to the slaughterhouse and you receive reimbursement of one hundred dollars for a five-hundred-dollar animal!

It seems only too evident that the limit of study should be exercised to find, if possible, a more economic way of handling this problem. This is the more urgent from the standpoint of individual losses on what are known as no-lesion reactors in cattle. Many explanations have been offered for this phenomenon. While no-lesion reactors form a very small percentage of the total activity, yet they do work hardship on the individual and create a local atmosphere of distrust in the whole process. This attitude I am sure should not grow. It behooves us, therefore, to study the reason most carefully, for none of the
present explanations seems to be the true one. From the owners we must ask a great expression of patience.

It seems to me the likely explanation is bound up with the next phase of the subject I wish to present to you. In opening up this question I think it well to confess at the outset that we have rested too complacently upon our past knowledge. We have been too complacent in the belief that the tubercle bacillus is always and only an acid-fast rod of definite type, which must show definite staining reactions to stamp its presence and that it must conform to certain virulence tests to determine its type, and that the tuberculin we use for diagnosis is a constant and specific substance.

Huxley once said to his students, "Doubt what everyone says is admitted to be true." We are fortunate enough to have in this country, on the question of tuberculin and tubercle bacilli, great, honest doubters like Marion Dorset, Van Es, Schroeder, Cotton, and many others.

Dorset has continuously worked as the most expert student in the field of tuberculin and tubercle bacillus culture. Van Es has just brought to light knowledge which confirms earlier work by the British Royal Commission and several Danish investigators. This may well make us pause and demand facilities for the completion of the work carried on by these men which will save us from future mistakes and great economic loss.

**Porcine and Avian Tuberculosis Increasing**

At the same time that our morbidity and mortality rates from tuberculosis have been falling in a satisfactory way in cattle and in man, it has been assuming rather an appalling figure in pigs and in chickens. We felt rather secure, ten years ago, in believing that if we got cattle tuberculosis under control we would make that in pigs almost negligible. But not only did this not follow, but pig tuberculosis increased, possibly largely due to the avian tubercle bacillus, and now we find that this animal is susceptible to almost any strain of tubercle bacillus and that it is one of the few animals easily infected by feeding. But more appalling than this—a number of avian forms have been cultivated from the ox; the horse suffers a fatal infection from the same bacillus, as shown by Watson, and frequently in man, ox, pig and sheep we obtain mixed cultures of several strains of tubercle bacilli. This has now occurred so often that we can no longer shut our eyes to its importance.
Knowledge such as this, common among those who are familiar with tuberculosis studies, forms the strongest argument against the use of any living tubercle bacilli for vaccination in children. No matter how avirulent a given culture may be it has two very dangerous potentialities: first, it may be a mixed culture with a potentially virulent strain for some one human body; or, second, if it has been rendered avirulent, as is claimed for the culture known as BCG, it may, by a reversal of the same process, become again a virulent strain. I believe that no such vaccination in man should be tolerated in this country. Furthermore, in a disease such as tuberculosis, which naturally occurs in many animals other than man and can be reproduced in almost any degree in widely differing species of animals, I believe that no experimental testing should be done on humans, either with a "cure" or a vaccine, until its value has been proved for some animal family. This opinion fortunately is growing among most of the physicians in the United States, who think more of their patients than of their personal gain.

**POSSIBLE RESERVOIR OF INFECTION**

One can scarcely examine the knowledge accumulating in other fields of bacteriology without suspecting that there may be some reservoir outside the body of this almost universal tubercle family and that the sooner we get busy with a well-organized study of the biology of this group, its life cycle and family relationships, the sooner shall we place its economic control on a safer foundation. The basis for this suspicion rises in such interesting reserves as Spencer and Parker, of the Hygienic Laboratory, have shown to exist in the tick for rocky mountain spotted fever, and Francis and McCoy have shown for the organism of tularemia in rabbits and other rodents; in the wide variation in the form and pathogenicity of the organism of wheat rust, determined by its habitat; in the suspected reservoir of typhus in rats, as shown by U. S. Public Health Service workers and in the problems surrounding B. abortus and Malta fever. This theory is joined in thought with the spontaneous development of tuberculosis in cattle herds free from tuberculosis.

The evidence of a demand for a careful study comes, however, from several sources other than the field of bacteriology; for example, the field of chemistry and the field of experimental biology.

In this address I can present only a few of the reasons. Craw-
ford, in the Bureau of Animal Industry, for instance, has recently shown, in conjunction with Dorset and Schroeder, that there is a certain specificity in the substance we call tuberculin, so that the animal infected with one strain of bacillus may react typically only to a tuberculin produced from the same strain, although it is also evident that numerous cross-reactions occur. This has been shown again and again by other workers and it would seem to be the most likely explanation of many of the anomalous results obtained in the field of tuberculin-testing. The mass of tuberculin for both human and bovine testing, as you know, is made from human strains of the tubercle bacillus only. Because of this work and other work equally important a demand for the purification and standardization of tuberculin from different tubercle bacilli has arisen and as a result a great deal of progress has been made.

Long, Seibert, Johnson and Dorset and many other chemists have demonstrated that it is possible to extract from the tubercle bacillus a substance of infinitely greater purity than any hitherto used. We must know if this purer substance has a definite specificity for different animals of the same and other species infected by different strains of bacilli. If it has, before destroying animals that are valuable and that show no evidence of gross lesions, it will undoubtedly become an economic process to test them with a number of tuberculins of different strains of bacilli to determine whether the animal should be sacrificed or not. A bovine, for instance, if suffering from an avian strain of tubercle bacillus will likely fully recover and it would be wasteful to destroy it.

**LIFE CYCLE FOR THE TUBERCLE BACILLUS**

Bacteriology has suggested that certain strains of tubercle bacillus probably pass through a life cycle in which the granules, so evident in it, under some conditions may exist in nature outside of the animal body as part of a great reservoir of dangerous character of which we know little today, and such a suggestion agrees fully with the thought that is uppermost in the whole study of bacterial life.

In asking your indulgence with the progress of these studies I wish to impress upon you two facts: first, no change in the present efficacious methods, such as tuberculin-testing and pasteurization, should be tolerated by your organization until something definitely better is at hand to replace them. Secondly, let me reassure you with the information that a well-organized
study has been under way for the past five years, in which the U. S. Public Health Service, the Bureau of Animal Industry and the National Tuberculosis Association have been cooperating to gain the knowledge which all need for the solution of this problem.

At the risk of tiring you, I think I should in one or two paragraphs describe this work. The broad problems that are at present under study are the chemical analysis of the tubercle bacillus. In this work a single strain of human tubercle bacillus (H-37) has been taken as a base-line. The protein component of this organism responsible for the tuberculin reaction which is under investigation has progressed rapidly. The characteristic fat of the tubercle bacillus is being studied by expert fat-chemists and the sugar fraction is likewise in the hands of expert sugar-chemists. Each substance that is produced in the analysis of the bacillus is tested biologically in different laboratories where the most careful thought is given to the choice of the research student. As soon as this human strain of tubercle bacillus (H-37) has been carefully studied, cultures of avian, bovine and other acid-fast bacillus strains, including the lepra bacillus, will be plotted against it by exactly similar methods. These will all be grown on the same medium.

Another division of study has to do with the body cells that multiply so rapidly under infection and with the growth of the tubercle bacillus in the animal body. These cells are being studied by biologists, chemists and physiologists, so that the relation which must exist between them and the infecting organism may be clear.

Another broad research has to do with the anatomy of the different animals, to explain the difference in the location of the tuberculous processes in different species. Another has to do with the interpretation of the various shadows cast on the X-ray plate by tuberculosis in different locations. Another with the tubercle organisms occurring in childhood. It is too soon to speak of the results of this work, because it is necessary to check and to recheck the experimental part but, at least, we are not building misleading propaganda on an insecure foundation of knowledge.

Now it is quite clear that the two great bodies that will profit by all such efforts are: first, all those who work in connection with the animal industry; and, second, the insurance companies, which two bodies taken together perhaps constitute our greatest
American industry. Neither has so far aided in this work. Let me make a special plea for your interest, your influence and your gifts—that this cooperative research in the field of our most important economic disease problem may be fully supported, so that we shall obtain the knowledge which we need to relieve us of this great wastage, known as tuberculosis.

President Mohler: I am sure we appreciate the very interesting address by Dr. White. In order to show the appreciation of the Association, I am going to ask you for a rising vote of thanks.

A rising vote of thanks was extended.

President Mohler: Continuing this symposium on tuberculosis, I shall now call on Drs. Butler and Marsh to present their paper on “Tuberculosis of the Human Type in Garbage-Fed Hogs.” (Applause)

Dr. Butler read the paper. (Applause)

TUBERCULOSIS OF HUMAN TYPE IN GARBAGE-FED HOGS

By W. J. Butler and Hadleigh Marsh

Montana Livestock Sanitary Board, Helena, Montana

Garbage disposal has always been a serious problem for the sanitarian. It becomes more serious when the garbage is from a hospital housing patients suffering from an infectious disease.

The question of disposal of garbage from such a hospital has recently been brought to our attention in the case of a hospital in Montana, which houses a number of patients who are suffering from tuberculosis. This hospital was an old army post, and was not built with any idea of it ever becoming a general hospital or tuberculosis sanitarium. It has been enlarged and improved to meet new conditions but no provisions were made for garbage sterilization or incineration. The garbage from the hospital has been sold to local hog-feeders.

The Montana Livestock Sanitary Board and the State public health authorities considered the feeding of this garbage to hogs as dangerous, but, as we had no specific knowledge of human tuberculosis having been transmitted to hogs through garbage, we were not in a position to prohibit the sale of this garbage. However, to prevent any spread of disease, should disease occur, we quarantined the hog-lots and the hogs, subject to postmortem inspection.

The quarantine was issued on February 16, 1926.

On February 24, 1926, twenty-one of the hogs were slaughtered under official supervision, and no lesions of tuberculosis were found.
On April 6, 1926, twenty hogs were slaughtered, and slight tuberculous lesions were found in the mesenteric glands of five of these animals, or 25 per cent. All the lesions were very small, appearing in the glands as small yellow spots, only one of them showing any gross calcareous deposit.

On April 23, 1926, twenty hogs were killed, and lesions of tuberculosis were found in five, the same number and percentage as found on April 6. In four of these animals the lesions were in the mesenteric glands. Two of the four also showed minute lesions in the cervical glands. The fifth hog showed a small lesion in the liver. All the lesions were apparently of recent origin, none showing any gross calcification. One mesenteric gland showed a tuberculous abscess about 15 mm. in diameter. All the other lesions were very small.

On July 1, 1926, the garbage contract was taken over by a hog-feeder on a farm about ten miles distant from the first farm. These premises were also quarantined and the hogs held subject to postmortem inspection. On August 25, 1926, eight hogs were slaughtered on this farm, and in six of them, or in 75 per cent, tuberculous lesions were found in the mesenteric glands. The lesions were from 10 to 15 mm. in diameter, with calcareous granules in a soft, yellowish-white, thick pus.

On September 1, 1926, nine hogs were slaughtered, and in seven of them tuberculous lesions were found, or in 77 per cent. All of the seven affected hogs showed lesions in the mesenteric glands. In one of these hogs a minute lesion was found also in a cervical gland. The lesions were of the same type as those in the hogs killed on August 25.

On October 22, 1926, eight hogs were slaughtered and in three of them, or 37 per cent, tuberculous lesions were found in the mesenteric glands. Two of these three hogs also showed minute lesions in the cervical glands.

Summarizing the results of the postmortem inspection, we find that on the first farm sixty-one hogs were slaughtered, and lesions of tuberculosis were found in ten of them. On the second farm, twenty-five hogs were slaughtered, and tuberculosis was found to exist in sixteen of them. In all, eighty-six hogs were slaughtered and tuberculosis was found in twenty-six of them, or slightly over 30 per cent. The diagnosis in each group of hogs killed was confirmed by positive smears from the lesions, and by animal inoculations.
<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Material Inoculated</th>
<th>Method of Inoculation</th>
<th>Date Killed or Died</th>
<th>Lesions</th>
</tr>
</thead>
<tbody>
<tr>
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<td>4-8-26</td>
<td>Hog lesions</td>
<td>Intra-abdominal</td>
<td>6-8-26 Killed</td>
<td>None</td>
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<tr>
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<td>4-8-26</td>
<td>Hog lesions</td>
<td>Subcutaneous</td>
<td>6-8-26 Killed</td>
<td>Generalized</td>
</tr>
<tr>
<td>Guinea pig</td>
<td>6-8-26</td>
<td>Guinea pig lesions</td>
<td>Subcutaneous</td>
<td>8-24-26 Died</td>
<td>Generalized</td>
</tr>
<tr>
<td>Guinea pig</td>
<td>6-8-26</td>
<td>Guinea pig lesions</td>
<td>Subcutaneous</td>
<td>8-25-26 Died</td>
<td>Generalized</td>
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<tr>
<td>Guinea pig</td>
<td>7-26-26</td>
<td>Original cultures made 6-8-26</td>
<td>Subcutaneous</td>
<td>8-29-26 Died</td>
<td>Generalized</td>
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<tr>
<td>Guinea pig</td>
<td>7-26-26</td>
<td>Original cultures made 6-8-26</td>
<td>Subcutaneous</td>
<td>9-8-26 Died</td>
<td>Generalized</td>
</tr>
<tr>
<td>Rabbit</td>
<td>4-8-26</td>
<td>Hog lesions</td>
<td>Subcutaneous</td>
<td>6-8-26 Killed</td>
<td>Slight diffuse subcutaneous lesion</td>
</tr>
<tr>
<td>Rabbit</td>
<td>6-8-26</td>
<td>Guinea pig lesions</td>
<td>Subcutaneous</td>
<td>9-3-26 Killed</td>
<td>Slight subcutaneous. Several minute lesions in lungs</td>
</tr>
<tr>
<td>Rabbit</td>
<td>6-8-26</td>
<td>Guinea pig lesions</td>
<td>Subcutaneous</td>
<td>9-3-26 Killed</td>
<td>Slight subcutaneous. Several minute lesions in lungs</td>
</tr>
<tr>
<td>Rabbit</td>
<td>7-26-26</td>
<td>Original culture made 6-8-26</td>
<td>Subcutaneous</td>
<td>10-17-27 Killed</td>
<td>Local lesion at point of inoculation. Several minute lesions in lungs</td>
</tr>
<tr>
<td>Rabbit</td>
<td>7-26-26</td>
<td>Original culture made 6-8-26</td>
<td>Subcutaneous</td>
<td>10-28-26 Killed</td>
<td>No lesion at point of inoculation. Three minute lesions in lung</td>
</tr>
</tbody>
</table>
Typing tests were immediately started, using rabbits and guinea pigs as the test animals. Two guinea pigs and a rabbit were inoculated with material from the lesions in the second lot of hogs slaughtered. After sixty days these animals were killed, and two guinea pigs and two rabbits were inoculated with material from lesions in one of the original guinea pigs. At the same time cultures were made on Dorset egg medium, to the surface of which a little sterile serum was added. When these cultures had developed a good growth, two guinea pigs and two rabbits were inoculated with cultures.

Table I shows the results of the animal inoculation.

It will be seen from the table that of six guinea pigs inoculated, five developed generalized tuberculosis. The sixth pig was entirely negative. It was the only one inoculated intra-abdominally, and was inoculated with the original material, smears from which showed very few tubercle bacilli.

None of the rabbits developed generalized tuberculosis within a period of ninety days. The local lesions at the point of inoculation were non-progressive. The only other lesions were a few minute tubercles in the lungs. The results of the inoculation of guinea pigs and rabbits demonstrate that the hog lesions in this case were caused by infection with tubercle bacilli of the human type.

This diagnosis is confirmed by the morphological and cultural characteristics of the organism recovered from lesions in the test animals. Smears from these lesions all showed bacilli of a long, slender type, many of them distinctly "beaded." The cultures on glycerin agar in the second and third generations developed more quickly than is usual in our experience with cultures of bovine origin.

The typing tests recorded here were made on material from only one lot of hogs, the first in which lesions of tuberculosis were found. The work on material from the other lots of hogs killed has not yet been completed.

In connection with the work on the test animals, an interesting observation was made in regard to the location of the most extensive lesions. In the guinea pigs showing generalized tuberculosis, while the liver, spleen and lungs were all involved in every case, the most extensive lesions were always in the lungs. In fact in all of the guinea pigs, the lung tissue was almost completely replaced by miliary tubercles. In four of the rabbits a few minute tubercles developed in the lungs. There were no
other lesions except retrogressive subcutaneous lesions at the point of inoculation. This apparent selective localization may indicate a pulmonary origin of the strains of tubercle bacilli infecting these animals.

CONCLUSIONS

1. Hogs being fed raw garbage from a hospital housing a large percentage of tuberculosis patients developed glandular tuberculosis within a feeding period of sixty to one hundred and twenty days.

2. Typing tests have shown that this tuberculosis was due to infection with tubercle bacilli of the human type.

3. The strain of *Mycobacterium tuberculosis* of the human type isolated from the hog lesions shows in laboratory animals a marked tendency to localize in the lungs.

4. Garbage from premises where there are active cases of human tuberculosis is dangerous and should not be fed to hogs unless it is sterilized.

PRESIDENT MOHLER: The last address on the program this morning is by a gentleman who requires no introduction. He has been before you on so many occasions previously that all that is necessary is to say that Dr. E. C. Schroeder will now speak on the subject, “Some Thoughts on Tuberculosis.” (Applause)

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

SOME THOUGHTS ON TUBERCULOSIS

*By* E. C. SCHROEDER

*Superintendent, Experiment Station of the United States
Bureau of Animal Industry, Bethesda, Md.*

When the invitation of the chairman of your Committee on Tuberculosis to present a paper on tuberculosis at this meeting was received, the International Union Against Tuberculosis and the National Tuberculosis Association, one after the other, were about to assemble at Washington, D. C., and as this was near home for me, and as I am a member of both organizations and had determined to attend as many of their sessions as I could, I was confident that I would hear more than enough to stimulate “Some Thoughts on Tuberculosis.”

Though it is not strictly relevant to the subject, permit me to begin by calling attention to a repeatedly and strongly expressed approval of an example in program-making set by the International Union Against Tuberculosis. Each technical ses-
sion was devoted exclusively to a single subject, on which one, and only one, formal paper was presented by a commonly recognized authority. The discussion was opened by one and continued by one or two persons, named in the program, known to be thoroughly conversant with the subject, and then, within reasonable bounds, was permitted to become general. This proved truly enlightening, and helped to obviate the clouding of salient factors and confusion of ideas fostered by the presentation and discussion of several intricate subjects in too rapid succession.

The Union devoted one session to “Tuberculosis and Milk,” a subject equally the province of this Association, and one statement made by the authority who presented the formal paper merits our attention; because, coming from an international organization with a membership composed largely of tuberculosis experts and investigators, it is likely to be quoted widely and misinterpreted dangerously, particularly by persons antagonistic to our great and promising campaign to stamp out tuberculosis among our food-producing animals.

The statement follows:

While a considerable proportion of the tubercular children of a community in which raw infected milk is consumed have infection with the bovine type, it is not certain that the total amount of tuberculosis or deaths from it in the community is increased. Many of those who developed tuberculosis of the bovine type might have been protected thereby from infection with the human type. Statistics bearing on this question show no evident difference.

As you will observe, the statement first affirms that a considerable proportion of tuberculosis among children who consume raw, infected dairy products is due to tubercle bacilli of the type that emanate from the bodies of tuberculous cattle, and then it attempts to supply an argument which supports the assumption that this is not a cause for great anxiety, by saying, essentially, that the harm suffered by children is offset or balanced by an immunity, presumably less dangerous, bovine tubercle bacilli engender against the presumably more dangerous human type.

The statistics referred to as bearing on this question, as far as they were quoted and as far as I know them, are too meager to prove anything.

HAPHAZARD METHODS NOT JUSTIFIED

Now, for the sake of discussion, though we may not believe it and I certainly do not, let us assume that the harm suffered
by children who are exposed to raw dairy products from tuberculous cows actually is balanced, or more than balanced, by an immunity against human tubercle bacilli which benefits, not exclusively the children, but the public as a whole, and then ask, "Does this justify the haphazard exposure of children to bovine tubercle bacilli?"

My answer is an emphatic, unmistakable negative.

With the indisputable knowledge that bovine tubercle bacilli cause tuberculosis in children, which, like tuberculosis in human beings caused by human tubercle bacilli, ranges from mild to severe and from severe to fatal, a knowledge which tuberculosis investigators who have studied the different types of the tubercle bacillus responsible for tuberculous disease in human bodies no longer question, it would be barbarous to permit, or to be indifferent to, the unguarded or uncontrolled exposure of helpless children to tubercle bacilli in dairy products, even if it could be proved statistically or in any other way, that such exposure does not measurably increase human morbidity and mortality from tuberculosis. Exposure of this kind, meaning, as it does, the indiscriminate ingestion of tubercle bacilli in doses, oftener than not, too large, too numerous, too virulent and untimely for safety, would be unpardonable, as it would have as one of its evil consequences the sacrifice of the health and lives of many children.

If it is true that the ingestion of bovine tubercle bacilli confers immunity against human tubercle bacilli, and that such immunity would be serviceable in combating human tuberculosis, it should be definitely proved, and after it has been proved, and not before, we might consider the propriety of permitting children to ingest bovine tubercle bacilli, not indiscriminately, but in carefully measured, numbered and timed doses of a carefully determined degree of virulence.

Civilization demands precision, and demands it most imperatively when children are treated with possibly beneficial agents which, used carelessly or unguardedly, are known to cause disease and death. Apart from this, the vicarious sacrifice of children to secure benefits of any kind is an abhorrent idea.

**Premature Publicity Stimulates False Hopes**

The theory, held by quite a number of tuberculosis workers, that the salvation of the human race from tuberculosis ultimately depends upon its entire, benign tuberculinization or infec-
tion with tubercle bacilli, and that such tuberculization is favorably promoted by the existence of tuberculosis among our food-producing animals, requires that statements which affirm or only imply that public health is not materially injured by other types of the tubercle bacillus than the human, or which discount the pathogenic potency of other types for human beings, should not be permitted to pass unchallenged, especially not at the present time, as the wide and premature publicity the BCG, or Calmette and Guerin vaccination against tuberculosis with suspensions of living tubercle bacilli, has received, seems to have inspired much unwarranted hope that a door finally has been opened through which tuberculosis can be driven, easily and speedily, out of existence, a hope which tends to encourage a disregard for tried and proved methods to check human tuberculosis and which raises the question whether our fight against tuberculosis among the lower animals is economically sound, or at all necessary for the protection of public health.

The BCG, or Calmette and Guerin vaccine, according to its originators, is a strain of the bovine tubercle bacillus the pathogenic qualities of which disappeared under long-continued, artificial cultivation and which immunizes against tuberculosis if it is introduced into the body, either via ingestion or injection, before infection with virulent tubercle bacilli has occurred. It is now being studied by a large number of competent and impartial investigators, and the best thing to do about it is to await their reports with patience. In the meantime we should not be too sanguine in our expectations, as history has given us only examples of specific agents for the treatment and prevention of tuberculosis which proved forlorn hopes.

Tuberculosis investigators know and the public should be informed that the tuberculosis vaccines which are now receiving attention present no radically new ideas and offer no previously unconsidered method for fighting tuberculosis.

**EARLY ATTEMPTS TO PRODUCE A VACCINE**

Attempts to immunize against tuberculosis with tubercle bacilli began soon after the discovery, in 1882, of the tubercle bacillus, more than 40 years ago, and their history, with culturally modified or attenuated tubercle bacilli, with tubercle bacilli killed through their exposure to heat, light, chemicals, etc., with tubercle bacilli of one type against another type,
etc., etc., would fill several large volumes and present the names of quite a large number of famous tuberculosis investigators.

The true value of vaccines lies in the aid they give in the control of diseases of which the sources of infection cannot be located, or, because of their character or number, cannot be destroyed or made harmless, and the complete eradication of an infectious disease through the use of a vaccine is an achievement of which we lack an example. Hence, if we give due weight to the low percentage of tuberculosis among our domestic animals, and to reports which show that the percentage among our cattle is markedly declining, and to the complexities and uncertainties with which an eradication campaign dependent upon vaccination would be encumbered, it is exceedingly doubtful, even if the BCG vaccine proved fully equal to the claims its authors make for it, whether it would be wise or profitable to permit its use to supersede our present, rational, eradication methods.

A number of persons seem to entertain the mistaken idea that the treatment of all dairy cows with the BCG vaccine would at once eliminate the danger from tubercle bacilli in the raw milk of tuberculous dairy herds. They should take into account that the vaccine does not cure tuberculosis; that it does not kill tubercle bacilli in the bodies of infected animals; that it does not prevent tuberculous animals from disseminating tubercle bacilli; that it does not prevent the development of tuberculous disease unless it is used before virulent tubercle bacilli have invaded the body, but that it does interfere with the use of the tuberculin test to distinguish between safe and tuberculous animals.

These statements are not my opinions nor my experimentally verified conclusions. The authority for them is abundantly supplied in the various publications on the BCG vaccine by Calmette and Guerin, its originators. Consequently, it seems evident that there is only one way to use the vaccine to make the consumption of the milk from tuberculous dairy herds safe for children, and that is, regardless of what is done to the cows, to vaccinate the children before they have in any manner been exposed to virulent tubercle bacilli. Whether this would be a good plan I leave to your judgment, and I am confident, with pasteurization and the tuberculin test available to secure safety, you will not hastily approve the wholesale vaccination of infants
with living tubercle bacilli of any kind, type or degree of virulence, so that they may safely drink raw, tuberculous milk.

**Two Theories and a Fact**

Antituberculosis vaccination calls to mind two widely entertained theories and one well-known fact, which, considered in their bearing on each other, illustrate that many gaps in our knowledge on tuberculosis remain to be filled.

One of the theories is that most tuberculosis, irrespective of the age at which it becomes physically manifest disease, arises from tubercle bacilli that entered the body during childhood.

The other theory is that immunity against tuberculosis results from the presence of tubercle bacilli and a tuberculcous lesion in the body.

The fact is that arrested tuberculosis often again becomes active.

The first theory derives some support from the definitely proved fact that tubercle bacilli may remain alive long periods of time in the tissues of animals without causing progressive tuberculosis and without losing their virulence or changing their type.

The second theory derives support from the difference between the large number of persons who react with tuberculin and the relatively small number in whom tuberculosis becomes a clinically manifest disease, and the difference between the large number of persons in whose bodies tuberculcous lesions of some magnitude are found on postmortem examination and the relatively small number in whom tuberculosis is diagnosed during life. It leaves considerable doubt about a desirable distinction between a real immunity and the hypersensitiveness for tubercle bacilli of which the tuberculin reaction is an expression. A hypersensitiveness for tubercle bacilli and their products which probably is protective, because the rapidity with which it causes the tissues to react when they are brought into contact with tubercle bacilli hampers the penetration of the germs into the body, and walls off those that are not excluded. It is the condition that makes tuberculosis a chronic, focal rather than a general, rapidly fatal disease, but not an immunity in the commonly accepted meaning of the word.

The fact that arrested cases of tuberculosis often recrudesce has the character of fairly good evidence to prove that tuberculosis may flourish in the bodies of those in whom immunity against it seemingly should be greatest.
IMMATURE STATE OF OUR KNOWLEDGE

I will not go into this matter at greater length, as my object is not to analyze contradictory or, it may be, only paradoxical theories and beliefs, but to show an immature state of our knowledge which should bid us to be very cautious about accepting new theories that have not been confirmed by, or which lack the approval of, those who are best qualified to measure their truth and value, especially if they tend to discredit, not necessarily perfect, but practically tested and proved, valuable means to control tuberculosis among human beings and to eradicate it among the lower animals.

The decline in human tuberculosis during the last twenty-five years, which must be credited to other measures than the use of specific cures and vaccines or the exposure of children to infected dairy products, is very gratifying, as the following data recently published by the federal Department of Commerce show: In the year 1900 the tuberculosis death-rate in the Vital Registration area of the United States was: male, 194.4 and female, 182.8 per 100,000 population, or a combined male and female rate of 188.6 per 100,000 population. In the year 1924, through continuous, gradual decline, this high rate had fallen to: male, 89.7 and female, 77.2, or a combined male and female rate of 83.45 per 100,000 population. To appreciate the magnitude of this decline we must realize that, for a country with the population of the United States, the higher rate means above 120,000 more deaths from tuberculosis per annum than the lower rate.

While we have this encouraging decline in the general human death-rate from tuberculosis in the United States before us, if you are not already informed, it will be interesting for you to listen to data concerning the death-rate from non-pulmonary forms of tuberculosis in the city of New York, since the pasteurization of practically the entire city milk supply has been required. As we know, human tuberculosis due to the bovine type of the tubercle bacillus usually is non-pulmonary in character.

A SIGNIFICANT STATEMENT

The Weekly Health Reports of the United States Public Health Service for September 3, 1926, contained an article based on data previously published in the Weekly Bulletin of the Department of Health of New York City, in August 21,
1926, which presents a table showing that the decrease in the annual death-rate from non-pulmonary tuberculosis per 100,000 population in the city of New York was from 29, in the year 1910, to 12, in the year 1925. Directly below the table the following statement is made, which, in my judgment, merits the widest publication.

Of even greater significance than the declining death-rate for non-pulmonary tuberculosis is the fact that the examination of tuberculous glands of the neck made in the years previous to pasteurization, revealed that in more than 50 per cent the process was due to the bovine bacillus, whereas in only six of fifty specimens obtained since pasteurization has become general, was the bovine bacillus found, and five out of these six cases were from out-of-town patients who had been fed on raw milk.

The last clause in the quotation especially should be noted, as it definitely calls attention to what may happen when children consume raw milk from tuberculous cows in regions where pasteurization is not practiced and never may be economically practicable, and in which sole reliance must be placed on the tuberculin test.

Attempts to estimate the significance of bovine tubercle bacilli for public health, in addition to making due allowance for their known human pathogenicity, should take into account that some quite famous tuberculosis investigators are not wholly satisfied that the common belief that the human type is more virulent for man has been sufficiently proved. For example, not long ago two well-known English investigators, Griffith and Cobbett, independently stated that the assumed greater virulence of the human than of the bovine type for man and the commoner occurrence of the former in human tuberculous disease may be less a question of virulence than of the manner and frequency of the exposure of human beings to the two types. Exposure to the bovine type is limited almost entirely to the ingestion of infected dairy products, while exposure to the human type has no sharp limitations respecting either the vehicle in which it is conveyed to or the portal through which it enters the human body.

**Comparative Virulence Of Different Types**

It may seem remarkable that veteran tuberculosis investigators should question whether any type of the tubercle bacillus is more virulent for man than his own, specifically true type, but there is nothing unnatural or illogical about this, as the specifically true host of a parasite—all disease germs are parasites—is not the organism most easily invaded and most severely
injured by it, but rather the organism between which and the parasite a properly balanced, host-parasite relationship exists, a relationship which provides, among other things, that the host shall not be destroyed too quickly, as guinea pigs are destroyed by mammalian tubercle bacilli, to leave time for that dissemination of the parasite on which its freedom to invade fresh hosts depends. And from this point of view we may say, since the bovine type is more virulent than the human for all species of mammals with which comparative tests have been made, and multiplies more luxuriantly in some species than in its specifically true or satisfactory host, its greater virulence for man might reasonably be suspected and should not surprise us if it was proved.

Thoughts of this kind, though they fail to answer unsolved, technical problems, should leave no doubt in our minds that we are not in possession of knowledge which permits us to take liberties with tubercle bacilli of any type, and particularly not with the promiscuously most pathogenic or bovine type. It is not my wish to exaggerate the dangerous character of this type, but it would be better to do so than to undervalue it.

One paper presented during a session of the Pathological Section of the National Tuberculosis Association, on the biology of the tubercle bacillus, concerned the types of the tubercle bacillus in human tuberculosis. It presented data to prove that all three of the commonly recognized types, with varying degrees of frequency, attack human beings, and that somewhat different types, especially in lupus or skin tuberculosis, are not uncommon. The author referred to such somewhat different types as representing intermediate strains which, in some instances, prevent a strict division of the types, and reopened the old question of the stability of the different types. An instance was defined in which an attenuated strain of the bovine tubercle bacillus was isolated in one individual from pulmonary and intestinal tuberculous foci and an avian strain from a recurrent, infectious, inflammatory disease of the skin, and the statement was made:

The possibility is not to be excluded that under certain conditions a transformation of the primary type may take place in the human organism, and that for the definite decision of the type question a further study of the atypical strains of tubercle bacilli is especially to be recommended.

I presume that many tuberculosis investigators firmly believe that a further study of atypical strains of the tubercle bacillus and their significance is desirable, and with this belief I am in full accord, but I do not think that it should be conducted with
the idea that it may be proved that any, actually established
type of the bacillus is transformable into any other actually
established type.

If tubercle bacilli were transformable from one into another
existing type, the abundant work that has been done to prove
this certainly would have given us something more and better
than a few untenable claims that transformations had been
effected, claims which lack confirmation and which are based
on defective experimental tests incapable of bearing critical
analysis.

**Transformation and Mutation**

Transformation from an existing into another existing type
must not be confounded with the production of mutants, through
the selection of which new types may be established. The former
would signify a protean organism that changed its character as
it changed its environment, and the latter would be a matter
of evolution. And, as we know that the tubercle bacillus is an
organism which produces mutants, of which the less common
and aberrant types are convincing examples, and that it attacks
many species of animals though its perpetuation depends almost
entirely upon three, the thing we should keep in mind in studies
of so-called intermediate and unusual types is the possible origin
at any time of a type which may perpetuate itself through some
animal species which now, though it is a more or less frequent
victim of tuberculosis, contributes little or nothing to the spread
of the disease.

I could tire you with many additional thoughts on tuberculosis,
but am afraid that it would be taking an unfair advantage of
your patience.

**Discussion**

**President Mohler:** These various papers on tuberculosis research will
now be opened for general discussion, and I wish to extend the privileges of
the floor to any of our guests present who may wish to enter into this discus-
sion.

I notice we have with us this morning a tuberculosis research worker from
the University of Chicago. I am going to ask Dr. Long, of the University of
Chicago, to lead off in this general discussion.

**Dr. Long:** I think it is altogether too much honor to give a retiring
laboratory investigator in asking him to address a large body like this of prac-
tical workers in the field. I think we laboratory investigators should come
here more for instruction than for ideas that we can contribute ourselves.

Most of what I would have to say would be in gratitude for the ideas that
have been presented this morning, which furnish further grist for our mill,
which is to say, further material for research.

Two outstanding ideas have impressed me in this discussion this morning. They strike almost a new note or at least represent the continuation of a new
note in modern thought on tuberculosis. One of those is that we must keep
our minds open with respect to the epidemiology and spread of tuberculosis. I have been very much impressed with the papers on the possibility of transference of avian and human tuberculosis to hogs.

It is, I think, becoming appreciated there may be such a thing as avian tuberculosis on a fairly extensive scale. You will notice that I look upon this mostly from the point of view of human tuberculosis rather than of cattle tuberculosis. There has been more or less emphasis lately on the possibility of renal tuberculosis, for example, of avian origin, and a good many methods are being developed now to detect the avian type of bacillus.

At any rate, the old conventional notions that only two types affected man at least need thought if not revision, and we must certainly take very seriously the possibility of spread of human-type tubercle bacillus to other animals and the possibility of spread back to man. I think there can be little question that the human-type tubercle bacillus can affect the hog. We have had occasion to look into it in connection with the sanatorium outside of Chicago. The method we have adopted is boiling the garbage before it is given to hogs for consumption. That, of course, introduces the possibility of human error, and maybe the other method is safer, although less economical.

Finally I will cite a little personal experience. I may say that I have deliberately infected young hogs with the human bacillus. This is on a small scale; I have inoculated four or five hogs. In the majority of these a local lymph-node lesion in the groin was produced which, in the course of three months, tended to calcify, in one instance from what was a mild generalization with the production of a fairly chronic miliary tuberculosis.

As always, I enjoyed immensely Dr. Schroeder's extremely vivid and interesting presentation on the thoughts on tuberculosis. I was particularly impressed with the manner in which he scored the utter barbarity of the notion that we are permitted to be careless with respect to bovine tuberculosis on the ground that a certain amount of immunity is furnished to human beings in later life by that infection thus permitted, as if we in this twentieth century could scientifically rely upon an utterly haphazard method of vaccination for the prevention of such a serious disease. That is not in accord with modern science. I enjoyed the manner in which he put it.

As a laboratory investigator myself, I was much interested in what was presented upon tuberculin. I believe absolutely in the specificity of the tuberculin test, although I feel there is a possibility that certain errors may creep into it. As it is applied, as I see it applied on animals, the kind we work with, I would be willing to accept a specificity varying from 95 to 99 per cent for this test, and let me say at once that is a great deal higher percentage of accuracy than we see in such widely accepted reactions as the Wassermann reaction. I do not believe it is quite 100 per cent, because there are several factors entering. One is the fallibility of human observation, of the inspector himself. Another one that occurs to me is the possible contamination of market tuberculins with other materials to which cattle may be sensitive, which I think is a real possibility. A third one is the possible transient sensitization of animals to dead tubercle bacilli which they may receive in food.

On that ground it seems to me a cow may react because of this sort of sensitization and a few months later have lost its sensitivity; in the meantime, it might have been slaughtered under a false suspicion of tuberculosis. Those make up not over one to five per cent. Even so, it seems to me that from one to five per cent, considering the enormous scale upon which tuberculosis eradication is carried out, is a figure which assumes larger proportions and is worth considering. I believe anything we can do to improve the quality of our testing, to improve the quality of our tuberculin, is very valuable.

In this connection I might mention again the results to which Dr. White referred. Investigation is now under way in several laboratories in the attempt to prepare the active principle of tuberculin. We would have a certain complacency if we rested entirely on the laurels of the past and made no effort to improve the facilities. They are good, but there is room for improvement.

I think if we can develop methods for the preparation of the pure principle of tuberculin, we may wipe out the one to five or one to three and four per cent, which is small, but which is large when you come to consider the number of cattle being slaughtered today.
If there is a certain specificity within the group, a biological specificity, of tubercle bacilli, if it is possible for us to distinguish between avian, bovine, human or other types of tuberculosis, we ought to follow that up. It is much more likely to be done with pure preparations of tuberculin than preparations made along the lines laid down by Koch some thirty or forty years ago. Those are fields which I think are profitable for investigation.

Then with a certain hesitation I should like to mention something and restate my own position on a matter on which I was probably misquoted and certainly to which undue emphasis was given some time ago on the matter of immunity. I put it this way a little while ago: We must consider in tuberculosis eradication the present and the future. Let me say at the outset that I am absolutely heartily in favor of the methods endorsed by the governmental and municipal authorities and others for the eradication of tuberculosis at the present time.

Somewhat as an armchair philosopher, to a certain extent, I wish to raise this point, not as an immediate problem, but as a remote problem, one which is to be considered possibly 100 years from now, one which will mean either thanks or possibly a certain amount of reviling from our descendants if we do not at least give thought to it now, and that is the degree of racial resistance to tuberculosis that we are now developing in our cattle.

If we could absolutely control all cattle in this country by tuberculin test and slaughter for now and forever more, I think we would not need to worry about the future at all. I am not enough of a practical man to know if that is possible, but if we cannot control it that way we must give some thought to the character of cattle that are replacing those cattle which are eradicated on the basis of the tuberculin test.

We do know there is such a thing as variation in racial resistance. We do know there is such a thing as improvement. The best example of improvement in racial resistance to tuberculosis is the human family. The human family has come down through a period where the death-rate from tuberculosis was at times enormous; it was enormous because the people had relatively low resistance to tuberculosis, but through a process, partly of survival of the fittest, we have reached the high stage. Probably everybody in this room has been infected, but yet very small percentages are going on to death from that cause, and extremely small percentages are transmitters of the disease. So as a human race we have been immunized. I will not say it is entirely by infection. There are certain hereditary characteristics; probably tuberculous people have transmitted their characteristics of racial resistance. I simply raise that point to be considered, that in the replacing of cattle we must keep in mind replacing them with cattle of a known high degree of resistance to tuberculosis for the benefit of the generations coming.

Not knowing a Jersey cow from a Holstein, I wouldn't know what kind of cattle to put in. I think I have been grossly misquoted. I am entirely in favor of the present method of the testing of cattle and the present method of eradication on the basis of the tuberculin test. I only feel the subject is not closed, and any research that is properly sponsored in this direction is still worthy of being carried out. (Applause)

MR. HECKE (California): I regret exceedingly that Dr. Iverson, the chief of our Division of Animal Industry, was unable to be at the meeting. As Director of the Department, I arranged to be present at the meeting of the Agricultural Directors, Commissioners and Secretaries, which began here two days ago and it was supposed to last three days. However, in view of the fact that many of the directors and commissioners have been very deeply interested in your own conferences, they decided yesterday to finish their labors and to attend this meeting, and I see a good many are in attendance today.

As you know in 1924 we were suddenly awakened with the outbreak of foot-and-mouth disease in California. On February 21, we knew we had this disease in our state, and at that time the attention of the entire state was concentrated on it. We found ourselves in a very desperate situation, as our Division of Animal Industry suddenly realized that we did not have the proper law to enforce the killing of the infected herds. We also found that in order to pay for the animals that had to be destroyed, we had to proceed imme-
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diantely and collect the money, but there was no such money available. Therefore, one of the first duties that confronted the Director of the Department of Agriculture was to go before the California Bankers' Association and tell them frankly we were up in the air; that there was no law in the State which permitted us to slaughter infected herds unless we had the money to pay for them.

Attorneys who were present called the attention of the bankers to the fact that if they advanced this money they could not legally collect it back from the State. As you can see, it was a pretty bad situation.

After several conferences, however, the bankers saw the business interests of California were very much concerned with the eradication of the disease and, after considerable deliberation and in spite of the warnings of their attorneys, they decided to advance to the State Department of Agriculture $500,000 which enabled us to meet our obligations.

In the beginning it appeared that the disease was limited to three or four locations. Suddenly, however, we found that it had spread to the San Joaquin Valley and from there to southern California. We found that the $500,000 did not go very far to pay for the destruction of the animals slaughtered, and we were compelled to go before the bankers again for a second and later a third time for assistance, just I am glad to say was forthcoming.

If it had not been for this financial assistance we would have been in serious difficulties. Furthermore, in the absence of adequate laws, if public opinion had not been back of the State Department of Agriculture, and had not had faith in the federal aid we were getting, we would never have been able to eradicate the disease in California.

Our condition in California was not far different from the condition found in Texas. In looking over your report of last year I found that Dr. Jarrel, of Texas, described to you difficulties of a similar nature that made it necessary for him to obtain the aid of the business men of that state.

Since the disease has been conquered, we find that the actual cost, divided between the state and federal governments, was approximately $7,000,000. That is a large sum of money, gentlemen, yet it did not compare with the amount of damage that was done to the commerce of California by quarantines during the outbreak.

The quarantines on horticultural and other agricultural products of California were such that many millions of dollars were unnecessarily lost in the State by the imposition, in many instances, of unjust and even ridiculous quarantines. Let me quote just one example. One state placed a quarantine against California, prohibiting the shipment of all foodstuffs from California into that state, and the same quarantine also barred all kinds of horticultural products and even agricultural machinery.

I want to say for the honor of your profession that this quarantine was not drafted by live stock men. It was drafted by the medical adviser of a governor, and he happened to be president of the State Board of Health of that state. I am just citing this to show you how ridiculous sometimes these quarantines may be, and I am quoting it to you because we in California and the people of Texas are through fighting foot-and-mouth disease. In both states foot-and-mouth disease has been conquered, but where will it strike next?

Certain wise precautions have been taken by Doctor Mohler regarding the importation of material that might bring in the infection from countries where we know this disease exists, but you people who are connected with the regulatory work in your own states, have you paid any attention to your own laws? Are you prepared to defend your state, and are you prepared to cooperate with the federal government in case foot-and-mouth disease should unexpectedly strike yours or one of the other states? Do you have laws that permit you to go and kill an entire herd if only one or two or three of the animals are actually infected? Have you a law that will permit you in the case of foot-and-mouth disease to pay the damages that are caused by the destruction of the animals? Have you paid any attention to the quarantines that may be imposed in case you are unfortunate enough to have a visitation of foot-and-mouth disease, rinderpest, pleuro-pneumonia, or similar disease in your own state? If you have not, I advise you that now is the time to consider these questions.
Since the outbreak of foot-and-mouth disease in California, we have enacted a law which provides that in case of the invasion of either rinderpest, foot-and-mouth disease, surra or contagious pleuro-pneumonia, an extraordinary amount of power is vested in the Department of Agriculture to cope with such a situation. In the act there is also a clause which will enable the Department of Agriculture to borrow money legally to any extent, from the bankers of the State, in order to pay the damages that may accrue for the destruction of animals and property.

A section in that act will also permit us to pay for these damages legally, provided that the United States Department of Agriculture will share equally in the expense. Therefore, so far as we are concerned, it is felt that we have done everything that is possible to be done in order to prepare to protect our state in the event of a future outbreak of one of these diseases.

A few words of appreciation for the cooperation received from Doctor Mohler during the campaign in California. The moment Doctor Mohler knew that the disease had broken out in California, he took action and within one week about forty federal veterinarians were on the spot to assist the State. Later on, as the disease spread, he sent Dr. U. G. Houck to California to take charge of the campaign. I want to tell you frankly, gentlemen, that great credit is due Doctor Mohler and Doctor Houck for helping us to overcome our difficulties, and it is due them that I express here the great appreciation of all the farmers of the state of California and other citizens of that state, to these two men who were ready, at a moment’s notice, to come to the aid of California. Of course, you may say it was a national question, and not only a state question. Nevertheless we, in California, feel that this credit is due.

In addition, the representatives of the University of California, Doctors Hart, Traum and Haring, and other University officers, were all ready at that time to come to our aid. Our own men, Dr. Iverson and Dr. Keane, worked hand in hand with the veterinary experts from other states to conquer the disease.

Last but not least, be it said that these veterinarians who came from other parts of the United States worked day and night, month in and month out, with our own veterinarians, sometimes under distressing conditions.

Therefore, being here today and having the privilege of saying a few words, I cannot help but express the appreciation of California for the help that your profession gave us in the time of dire necessity, and I want to thank you, Doctor Mohler, for having given me the opportunity to say these few words of appreciation.

DR. E. A. WATSON (Canada): Ten or fifteen years ago, when we opened a discussion on tuberculosis, it seemed to be a fairly simple matter to know where to start. The more we have learned, in recent years, of this great problem, the more difficult it seems to be to correlate one’s thought on any particular phase of the problem and to know where to begin and where to stop. We have had this morning, I think, a real intellectual fest in the excellent papers presented. I take great pleasure and enjoyment in coming to a meeting of this kind and getting such encouragement to continue our fight against tuberculosis.

The problem always seems to me to be roughly divided, as far as our fight against the disease is concerned, into what we may say is the technical part of it and the administrative part of it. It would not be for me to say which is the more important, but undoubtedly the administrative end and the regulations and quarantines and the other conditions depend largely upon the technical employment in our work.

I think probably the most important researches now under way in connection with the technical concern the study of the nature of tuberculin and the specificity and character of its reactions. There is still a different phase of the subject to be discussed. Sooner or later we come round, in one way or another, to the question of immunity in some respect, and there is still a good deal of anxiety over the comparatively small percentage of no-lesion cases, which also can be regarded to some extent from the light of our knowledge of immunity.

Personally I have great faith that within the next few years we will witness a great improvement, through the studies that are now being made on the
chemical nature of tuberculin and on the serological reactions of tuberculous animals, in our technic. It will advance considerably and we shall be able sooner or later to detect amongst these cases that react to tuberculin in life, not in death, what are no-lesion cases, that is, what animals have been associated with tuberculosis so they will give a reaction, but which, at postmortem, show no lesions.

Professor Long has already said something about tuberculin, but I think the investigation has gone far enough to show tuberculin itself can be split up into certain fractions, and there is no fraction so far that will give apparently a specific reaction.

I am going to mention one little point which I do not think has been noted very much, and that is the possible transmission of sensitiveness to tuberculin in young animals from tuberculous parents. We have recently had considerable evidence that the calves of tuberculous animals will, from birth up to three months at any rate, some up to six months, give tuberculin reactions and serological reactions. I have kept those calves up to two years of age and destroyed them, and they have ceased to react and no lesions of tuberculosis have been found. Their dams were tuberculous subjects. That may be only a small percentage of cases, but there again, with the avian infection and the human infection, there are a number of factors that may cause an animal to react to tuberculin, of which we have to take cognizance.

Dr. Long says we must pay great attention to the epidemiology. We have abundant evidence accumulated to show what happens in the herd where it never had tuberculosis and in the herd where tuberculosis is very common. There are herds, as we all know, that undoubtedly show a high degree of resistance to infection, and virgin herds that never had tuberculosis but, where once the infection was introduced, it spread almost like a prairie fire.

We have again the skin types of cases which we know very little about. In numbers of herds we pick out generalized cases of tuberculosis where the spread is very slow, and in other herds where they never had tuberculosis the spread is very rapid. It gives us some food for thought and further work.

I welcome the suggestions made by Dr. White this morning. Although we have been criticized, possibly, in taking on this great campaign against tuberculosis prematurely, without the basic knowledge, still we may take credit to ourselves; possibly if we had never undertaken this work the knowledge that is rapidly accumulating today and the researches that are in progress today probably never would have come about. A great deal of the work now in progress today is the result of the great campaign we are waging against bovine tuberculosis. Upon that alone depends whether or not the efforts we are making today are worth while. (Applause)

DR. E. C. SCHROEDER: I wish to say a few words about these hemorrhagic lymph-nodes of no-lesion reactors. Dr. Van Es has tabulated twenty cases examined and the whole twenty were negative. In this connection I wish to say that a great deal of work on that subject has been done by the Pathological Division of the Bureau.

I do not know exactly the number of cases examined, but it must be well above 6000, and at the present time they show that 22 per cent contain tubercle bacilli, which is almost conclusive proof that approximately 20 to 25 per cent, or even a larger percentage, of those cases are truly infected with tubercle bacilli. If you take into account the difficulties in selecting proper material for examinations of that kind, the amount of material you get, probably a few ounces at the most, from which you cannot examine more than an infinitesimal fraction, and that that material must be selected by the man who makes the examination, from an animal which weighs 800 or 1000 pounds, you can realize how easily we might reach for that particular lymph-gland which does not contain tubercle bacilli and which will give negative results. Hence the actual discovery of tubercle bacilli in 22 per cent of the cases examined by the Pathological Division would really signify that at least double that percentage are infected with tubercle bacilli when no-lesion reactors are found.

I wish also to point to the first figures, 83 cases examined, 26 negative, 46 mammalian tubercle bacilli, 7 avian, 4 mixed. Seven and four are eleven. That is almost 25 per cent of animals infected with avian tubercle bacilli.
I should like to ask Dr. Van Es whether there is any particular reason for believing that these animals were more intensely exposed to avian tubercle bacilli than cattle ordinarily are. It is rather a remarkable showing. I can understand how it can be possible, since cattle, by permitting them to ingest avian tubercle bacilli and without having tuberculous lesions at all, may possibly reveal, under bacteriological examination, the presence of avian tubercle bacilli.

DR. VAN ES: We know nothing of the history. In the case of swine experiments in tuberculosis, we knew the identity of every farm from which they came. In this case we do not know. This is merely an informative examination, and no more.

DR. SCHROEDER: My assumption regarding their intense exposure is at least tenable.

DR. VAN ES: Yes, it must be.

DR. WHITE: I hesitate to do this, but I may say that some years ago I talked to Mr. Thomas Wilson and then with Oscar Mayer on the question of devoting part of the funds to research in tuberculosis. Here is a fair evidence of the importance of the subject, when practically half of your discussions and program is devoted to tuberculosis as against all other diseases. I would like to suggest, if you have a Resolutions Committee, as most national organizations have, that you recommend this year the apportionment of part of the funds which are devoted to research on tuberculosis, to the well-organized plan that is going on in this country. (Applause)

DR. S. H. GILLIAND: I did not come here expecting to discuss any part of these papers, but there are a few points that have occurred to me, both in Dr. White's paper and Dr. Schroeder's suggestion, that I wish to draw to your attention.

My good friend Dr. White brings forth that the slaughter of the animal and the pasteurization of the milk are possibly the best means or the only means that we have of ridding ourselves of tuberculosis. The slaughter of the animal is an economic problem, as you well know, and twenty-five years ago we could well afford to do it, or could do it, with more ease than we can do it today, as the cost of the animal has greatly increased.

It is doubt far superior to the pasteurization of the products of the animal. The pasteurization is always open to error by the owners or the employees who have charge of the work. As you know, a chain is no stronger than its weakest link, and we must depend upon a grade of employees who does not always understand the value of every step in the process of pasteurization. Therefore, I feel that the slaughter of the animal is superior to the pasteurization of the milk, but nevertheless it is an economic problem, and it is distressing, as Dr. White says, to the person who is endeavoring to raise a well-bred herd, a registered herd, when the heifer comes to milk-producing age, to find that she has tuberculosis and he gets only $100 when she is worth $500.

This is just a suggestion of mine. I do not know that it has ever been offered before. Would it not be possible to select the animals in the tuberculosis-free area or the area we are endeavoring to get tuberculosis-free, to select the registered animals and have them put in an institution in each county and cared for from state or federal funds? And if this is not possible, allow the owners of the animals to bear the expense of the support of such a place. That could be done with one in each county, if necessary.

I have found from actual experience that the Bang system as applied to ordinary herds is not very practical. If you have a herd of 200 or more head and you separate twenty-five of the best cows that are reactors, there is always a certain amount of transmission between the free herd and the herd that is tuberculous, no matter how careful you are in instructing the employe or employees that have charge of the tuberculous animals.

This is only a thought on my part. It is no different from having institutions for the care of the human subject with tuberculosis, and it could be, I believe, arranged for, either through state or federal funds.

The next thought that occurs to me was brought out by Dr. Schroeder in his talk and is in the way of vaccination. I do not know but that it was left in your mind that there has been practically no work done in this country in the way of vaccination. Dr. Schroeder himself may be too modest to bring out
that he has conducted a number of experiments in the way of vaccinating calves against tuberculosis, with living tubercle bacilli. I cooperated with Dr. Pearson, some twenty years ago, and vaccinated over 800 animals in various ways with living tubercle bacilli. The one culture we used was known as Culture M. It was from a child and had the morphologic characteristics of the bovine tubercle bacillus, but it was not virulent for rabbits nevertheless, it was a straight rod and not a beaded one under the microscope, as human tubercle bacilli are. It was non-virulent for calves. This work was reported at various times through the progress of the work as it was done, and at the end was reported by me after Dr. Pearson's death, I think in Bulletin 89 of the Pennsylvania Bureau of Animal Industry, then known as the State Live Stock Sanitary Board. I cannot give you all of the conclusions of this work, but the one fact that is very forcibly brought to my mind is that the tubercle bacilli injected remain in the calf for a period of years indefinitely, and might produce lesions in some part of the body that has poor blood-supply, possibly a joint. This made it impractical for that animal to produce milk for human consumption unless the milk was pasteurized, and then the animal would not be considered.

All of the animals for two to three years after vaccination would give tuberculin reactions. One did not know whether they were tuberculosis-free or had tuberculosis, but in all probability some of the tubercle bacilli that were used in the vaccine were stored away somewhere in the body, though this could not be demonstrated from physical examination.

I recall one experiment with avian tubercle bacilli that comes to my mind this morning, since it was mentioned, in which we vaccinated, I think, ten calves. This was some twenty years ago and my mind is not very clear on it, but we used the same standard suspension that we had used for Culture M and all of these calves that were vaccinated developed tubercular pneumonia. The vaccination being intravenous, as no doubt all of them were, this was due to the rapid proliferation and the rapid multiplication of the tubercle bacilli in the lung. We got tubercular pneumonia and the calves died.

In one or two instances in this same experiment with avian tuberculosis that I mentioned, two of the animals became blind, entirely blind, and I felt at the time it was due to some other condition, but recently I have come to believe that the optic nerve of the animal absorbed enough tubercle bacilli to produce this condition which is well known in human medicine.

I unfortunately am afflicted with the same condition myself, and I have not been able to find anything that would cause the condition of my eye except a hidden lesion of tuberculosis. At one time I had an open tuberculosis.

Dr. T. S. Rucn: Our last speaker has been saying something about Bang herds. Early in the work in Michigan we feared that the slaughter of these pure-bred, valuable animals might be the means of upsetting our whole kettle of fish. Therefore, we made a study and considered starting a Bang herd upon some one of the state farms. Fortunately, we were cooperating with state officials who are wise and who studied the proposition upon the individual farms where they were endeavoring to carry on Bang herds. From their study of that situation we never got very far with our centralized herd upon a state farm, and today I think it would be almost impossible to get breeders in our state, in any number at least, to take part in handling a Bang herd. Several tried it. It was a failure in almost every case, and as far as I know there is not a single Bang herd today in the state of Michigan. It is possible there might be one or two pure-bred sires in existence, isolated, but I do not know of a single herd that is a Bang herd. Those who tried it, today condemn it. The expense is too great and the results too uncertain.

Dr. J. I. Gibson: In years past in dealing with this question in the state of Iowa, where we had no indemnity, I felt it was positively cruel to the breeder of pure-bred cattle to require him to destroy his reactors. At that time I advocated a Bang farm to be maintained by each breed association, the choice pure-breds only to go to this farm, to be either appraised by a committee for the purpose, or in special cases the owner might place an exceptionally valuable animal at that farm, the offspring to be his without competitive bid.

I have known of a good many individual Bang farms. By the way, I think the Holstein breeders in a part of Illinois once assembled to establish a district
farm of this kind. I do not know what became of that. It is something like
talking about offering the carcass of the condemned chicken to the consumer.
He won't have it. They may get confidence in the inspected poultry at a
later date. It is the same with the product of the Bang farm. Some of the
best breeders I have ever known have attempted to maintain the Bang system
on a separate farm, but it has apparently cast a cloud upon their breeding
business, so I want to protect my standing today and say I am not in favor of
the Bang system in any way.

DR. GILLILAND: I had the experience of only one herd under the Bang
system, and that was a herd in Maryland, of over 200 head, in which there
were, I think, thirty-seven or thirty-eight, very valuable animals set aside.
We did not care anything for the animal or the product except the offspring,
but we were able to save enough of the offspring to pay the expense of the
place. On two occasions I am afraid the Bang herd infected the main herd of
over 200 head. As soon as the calf was dropped, it was washed with a mild
antiseptic, removed from the herd and taken to the main herd. The owner
succeeded in raising enough of those calves to pay the expense but, as Doctor
Gibson says, he finally dropped it, and I think it did not warrant the great
trouble he was put to to carry it on. But the herd is now free from tuberculosis.

DR. GIBSON: The history of one case of this kind in the state of Missouri is
interesting. There were some sixty head of the finest bred animals of the
breed, isolated on a special farm. To provide water for these cattle, a good well
was drilled near one side of the farm, with a good windmill. To be sure that
there would always be water in the tank, the windmill was permitted to run
continuously, and whenever the tank was full it flowed over. It flowed over
a good many times, and a good deal of the time it was in that condition, and
a little stream was formed. Of course this Bang herd came around that
watering-tank and stood there much of the time. The droppings from the
diseased animals were all around the tank and were washed away by the little
stream of water that went only a short distance before it reached the adjoining
farm. The owner of the cattle on the adjoining farm pastured in that particu-
lar field, and the time came when this owner on the other farm had a test.
Every animal reacted. The last I knew of it he was prosecuting the man with
the Bang herd for infecting his herd.

DR. N. F. WILLIAMS: My reaction to this session is not conducive to criti-
cism or questioning. The profundity and vitalness of the subject matter of
this symposium is an inspiration for all of us to renew our devotion to the cause
of tuberculosis eradication and crowd a little closer in and strike a blow that
may turn the tide of battle in favor of humanity.

To me, more forcefully than ever before, the realization comes that the
Bureau of Animal Industry and the United States Public Health Service are
carrying the true banner in the contest, and it behooves all of us to rally
beneath the standard and under their guidance carry on.

DR. J. W. CONNAWAY: Can some of the men who have traveled recently in
Denmark give us the status of the Bang system in Bang's own country?

DR. H. J. STAFSETH: This is a cattle session and I am a poultry man. I
can only say it is my impression that the Bang system has worked very well,
but you must remember Denmark is not the United States. There are a lot
of differences between Denmark and the United States, and any system that
is practical in Denmark might be highly impractical in the United States. I
do not know what the Bang system is like there just now.

If there is no further discussion, this session will

ADJOURNMENT.

THURSDAY AFTERNOON, December 2, 1926

The fourth session convened at 1:30 p.m., President Mohler presiding.

President Mohler: Dr. Kiernan is here, and without further introduc-
tion I will ask him to take the floor. (Applause)

Dr. J. A. Kiernan read his paper on "Tuberculosis, Its Extent
and Eradication."
TUBERCULOSIS, ITS EXTENT AND ERADICATION

By J. A. Kiernan

Chief, Tuberculosis Eradication Division
U. S. Bureau of Animal Industry
Washington, D. C.

That progress is being made in decreasing animal tuberculosis can not be denied. To those who are rendering active service in the conduct of the work credit is due. We shall not, however, fail to bestow upon our predecessors a full share of credit for their indispensable contributions to this great cause.

What little we know about tuberculosis has been acquired by a study of the works of the master minds on the subject and by their practical application in the field. For example, who can calculate the indebtedness of the world to the renowned Koch, for his discovery of the tubercle bacillus and its epoch-making product, tuberculin? Without these discoveries our task would be a futile one!

RESUMÉ OF EARLY MEETINGS

If you have not had the opportunity of perusing the past proceedings of this organization you have suffered a great loss, for they are replete with thoughts of high aspirations, expressions of rare wisdom, declarations of convincing logic; admonitions that fortunately have been followed; and recommendations that have echoed and reechoed down the years of preparation which led to the inauguration of the cooperative campaign in 1917.

I attended one of the early meetings, probably the second, which was held in Fort Worth, Texas, in 1898. I am sure that tuberculosis was not discussed that year because of the pressing need for developing a method of dipping cattle so as to destroy the Texas-fever tick and permit cattle to be moved north of the quarantine line.

At the third annual meeting, and at each succeeding meeting, some reference was made to tuberculosis and the necessity for inaugurating measures for its control.

In the proceedings of the third annual meeting, which was held in Chicago, in 1899, considerable time was given to a discussion of this disease. Addresses were made by Prof. Adolph
Gehrmann and Dr. W. A. Evans, on infective possibilities from tuberculous milk. Our distinguished friend, Dr. Evans, made the following statement:

When we come to consider the question of infection through milk, two forms of inquiry branch off. The one relates to the spread of the disease to other domestic animals; the other relates to its relation to the disease in the human subject. In relation to the disease in the human subject, this is in reality the greater question of the two, even with the stockman. The life of a man and his family must ever be superior to any question of property. People with tuberculosis are not fit companions for stock any more than stock with tuberculosis are fit companions for people.

Resolutions were offered by Dr. Leonard Pearson, state veterinarian of Pennsylvania, setting forth the necessity for controlling tuberculosis, and in a very classical manner he presented a rather lengthy paper on the subject.

At the fourth annual meeting, held in Louisville, Kentucky, October 2 and 3, 1900, tuberculosis was discussed. Among those who entered the discussion was Dr. F. W. Smith, secretary of the New York Tuberculosis Commission. He stated that the matter of suppressing bovine tuberculosis in the state of New York was under the direction of two members of the State Board of Health, known as "The Tuberculosis Committee"; that the State Legislature appropriated $30,000 for making inspection and paying indemnities for tuberculous cattle. He said that so much opposition had been encountered in the work that no appropriation had been made in the two years following. In 1899 a committee was appointed by the Legislature to investigate the subject. The committee held several meetings and listened to proponents and opponents of the work. The report of the committee said, in closing:

The evidence, therefore, seems very abundant that the State can better use its funds along the lines of educational work requiring better sanitary conditions in the stables rather than following the present policy of destroying all animals showing a reaction under the tuberculin test.

At the eighth annual meeting, held in St. Louis, in 1904, very vigorous resolutions were adopted. The chairman of the committee did not read the report, which was written by Dr. C. A. Cary, because he was unable to decipher Dr. Cary's handwriting. That committee made specific recommendations of a very noteworthy character, declaring that:

Whereas, bovine tuberculosis is an infectious disease, transmissible to cattle, hogs and, in some instances, to man; and whereas, this disease is gradually extending its limits in many states and territories; therefore, be it resolved that the federal, state and municipal authorities should take active and efficient steps toward checking the spread of bovine tuberculosis.

The committee at the same meeting resolved that action be
taken by the U. S. Department of Agriculture to protect cattle-breeders by preventing the interstate traffic and importation of cattle from foreign countries that were affected with tuberculosis. One of the most insistent members of the Association in those early meetings was Dr. D. F. Luckey, of Missouri, who demanded that vigorous action be taken to check the spread of the disease.

At the eleventh annual meeting, held in Richmond, Virginia, in 1907, Dr. A. D. Melvin, then Chief of the Bureau of Animal Industry, and Dr. O. E. Dyson discussed at length the necessity for early action in the matter. Dr. Melvin pointed out that year the necessity for having the support of public opinion in carrying on a campaign of this character. He said:

"It is our duty as sanitarians to point out to the public the danger to their live stock and to themselves from the various diseases; but to undertake radical measures before the people are ready to sustain them would probably result in all work of eradication being done away with, at least for some time to come. This is particularly so with tuberculosis, which, on account of its insidious nature, does not produce the alarm which malignant diseases do.

And so on down through the annual meetings our people, with confidence born in a school of experience (than which there is no greater teacher), counseled for an early crusade against the great common foe. Our offensive and our defensive methods were not built overnight, nor did they grow strong on theoretical hypotheses. I maintain that what we know about disease control work was acquired by practice and not by theories.

**Some Lessons from the Campaign**

Tuberculosis of live stock is an eradicable disease, and has been so declared by the veterinary profession of the United States and Canada for more than thirty years. Badly infected herds have been reconstructed into free herds and maintained on that basis indefinitely. On that premise we wage our campaign, not with fear and trembling, but with an unshaken conviction that herds that have been made free from tuberculosis will remain free until infection is reintroduced by a tuberculous cow or in some other way. We all have reason to appreciate the insidious character of tuberculosis, and to stand in awe lest infection shall be reintroduced into free herds maintained in close proximity to infected herds. At the same time we know by experience that thousands and tens of thousands of herds in the southern and western states have remained free from infection
for years, unless exposed to infection by the importation of
tuberculous animals.

The more one reviews the insidious nature of tuberculosis the
greater is he impressed with the absolute necessity for suppress-
ing the infection. This must be done before he can feel any
degree of certainty that herds have been permanently established
on a free basis. The presence of a badly diseased herd in a com-
munity may be a source of infection to herds heretofore free of
disease. No more outstanding illustration of the danger induced
by infected cattle can be brought to mind than the recent move-
ment of tuberculous cattle from northern counties in Illinois,
where for twenty years the resistance against the tuberculin
test was very effectual. Some people of that locality (the milk-
shed for the city of Chicago) resisted the testing of their cattle,
notwithstanding the fact that they were badly diseased, until
public opinion revolted. The authorities of that city having
tolerated the condition of diseased herds supplying milk to its
people as long as patience could endure, adopted the well-
known ordinance which became effective April 1, 1926. When
it was found that it was impossible to tuberculin-test all the
herds in that territory prior to April 1, so as to permit their
owners to ship milk into the City, a considerable number of
cattle-owners undertook to dispose of their herds and shipped
cattle into various states. It seemed to be the idea of many
such owners to dispose of their cattle at the highest price possible,
regardless of where they went or for what purpose they were
sold. If it had not been for the alertness of the various state
officials there would have been a great deal more tuberculosis
introduced into clean territory and clean herds than there was.
Every shipment that went from that territory was apprehended,
quarantined at destination and retested, with the result that a
very high percentage of the cattle reacted. It proved a boomerang
for the cow-dealer who thought he was going to circumvent state
and federal regulations and surreptitiously dispose of his tuber-
culous herd.

EXTENT OF TUBERCULOSIS

We have a very comprehensive idea of the extent of tubercu-
losis in the United States, as shown by chart 1. The first map
of this kind was prepared in 1922; the second in 1924; this map
was prepared recently. It sets forth the task before us, and
also shows by the white modified areas the territory wherein
Chart 1. Extent of bovine tuberculosis in the United States, May 1, 1926.
fact, as indicated by the tuberculin test, that while the average percentage is low there are some herds even in such areas that have been found badly infected. Now, if it were possible to locate such herds without testing, they could be taken care of and the balance of the territory released, but they spring up sometimes where least expected. Therefore, we should hesitate,

![Diagram showing cattle under supervision in 1922, 1924, and 1926.](chart2.png)

Chart 2. Number of cattle under supervision in 1922, 1924 and 1926.

and carefully consider this matter before taking action to declare any area free from tuberculosis, unless the cattle are subjected to the test.

It was the recommendation of this Association last year that a study be made of the extent of the disease, with the object
of establishing zones so as to regulate interstate movement of
cattle for dairy and breeding purposes according to the zone
classification. It was proposed to place in Zone 1 cattle from
accredited herds, free areas, or modified accredited areas. At
the present time under state and federal regulations cattle may
move interstate from accredited herds and modified areas with-

![Chart 3. Increase in number of accredited herds.](image)

out being subjected to any additional tuberculin test, subject,
of course, to the regulations of the state of destination. At the
present time there is no area in the United States designated as
"free area"; therefore, the proposal under Zone 1 does not differ
from the present condition.

Under the provisions suggested for Zone 2 it would appear
that cattle from comparatively free areas (this class may include those from Zone 1) are cattle which have been subjected to the tuberculin test and the area found to be comparatively free from disease. These cattle need not necessarily be tuberculin-tested immediately prior to shipment. In regard to this I may say that Regulation 7, B. A. I. Order 292, governing the

![Chart 4. Reactors removed from accredited herds.](image)

interstate movement of cattle, provides that if no reactors are found in the previous test in herds under state and federal supervision, the chart covering the interstate movement may be based on a test applied as long as six months prior to the desired movement of the cattle. The proposed provisions of
Zone 2 will make comparatively no change in the present plan, unless the period of six months now provided by the federal regulations is extended.

Under the provisions of Zone 3 it is proposed that dairy or breeding cattle shall not be moved interstate unless from herds under state and federal supervision that have passed a clean tuberculin test. This would be a much more stringent requirement than exists at present, and there is some doubt of the possibility of making it operative.

After a careful study of the proposed plan for zoning the country, the only change in the present plan of operation that it appears can be made at this time with safety is to modify the Uniform Plan so as to permit areas to be placed in modified status on completion of the testing of all dairy and breeding cattle; and a reasonable percentage of the strictly range cattle. That would permit the modification of range states without subjecting all the range herds to test; likewise, it would take care of a large percentage of territory in the southern states. This suggestion is offered without any specific recommendation for its adoption this year, but for further consideration and action at some future time.

The development of the work has increased from year to year, as indicated in chart 2, which shows the number of cattle under supervision in 1922, 1924 and 1926, respectively. Your attention is called to the number of dairy cattle under supervision compared with beef cattle. It was believed that this information would be of considerable interest, as there is a great deal of speculation regarding the division of herds under supervision. Of course it is a difficult matter in some cases to state absolutely that a herd is strictly a beef herd. Many such herds contain cows that are used for dairy purposes.

From time to time charts have been shown indicating the development of accredited herds. Chart 3 shows the accredited herds for the years indicated at the bottom of the columns. You will recall that the original Uniform Plan provided for the accrediting only of pure-bred herds of cattle. This was modified at the 1918 meeting, so as to permit the accreditation of grade herds as well. In the development of area work some of the states have practically abandoned the practice of accrediting individual herds, for the reason that it requires too much time and expense in the assignment of veterinarians to do scattered testing. I think it advisable to maintain an accredited-
herd list and to endeavor to get every pure-bred herd of cattle in the country on that list. It means a great deal to the prospective buyer to have a list of the names of accredited herds.

A study was made last year of the number of accredited herds removed from the list because reactors had been found on retest. Chart 4 is a summary of that study, which shows that of the

18,795 herds reported on from the various states, 984, or 5.2 per cent, were removed from the list on subsequent retest. Of the 984 herds removed, 659 contained one reactor each, and but 83 herds were found to contain more than three reactors. The principal reason for the removal of the herds from the list was the introduction of new cattle, which at a subsequent test were found to be tuberculous.
Tuberculin Testing by Accredited Veterinarians

Chart 5 shows the very important part taken in the campaign by practicing veterinarians. It will be observed that each year the number of herds and cattle tested by them is increasing rapidly. This trend of operation is in line with the original program adopted at the inauguration of the work in 1917. In a paper read before this Association, on December 2, 1918, before the work had really gained any degree of impetus, the speaker made the following observations:

The veterinarian engaged in private practice is in a position to render very valuable service to this campaign, which is in the interest of the nation's great live stock industry. He is in a position to encourage the accredited-herd plan, as he is in daily contact with the breeders of cattle in his territory and thereby induces many owners to place their herds under supervision and to cooperate with the official supervising. The campaign is now a national problem, and must be officially conducted; but it will be impossible for the states and national government to furnish sufficient help to tuberculin-test all the cattle in the country, and the veterinarian engaged in private practice will naturally be employed by the owners to make tuberculin tests in a great many cases. The official testing of herds without cost to the owners may temporarily diminish the amount of test work done by private veterinarians, but ultimately his business will be greatly increased, as he will be called upon by the hundreds of owners who now test only when they are compelled to do so in order to ship an animal interstate. These owners will sooner or later appreciate the fact that they must clean up their herds and keep them healthy in order that they may enjoy the patronage of buyers who are intent upon dealing in tuberculosis-free cattle. This is the history of veterinary practice in every section of the United States where tuberculosis eradication work has been carried on.

It is the policy of the Bureau not to assign its employes to retest accredited herds; furthermore, it does not wish its employes to be assigned to the retesting of herds in modified areas. This responsibility of maintaining herds free, and areas free, rests upon the individual owners, the counties, and the respective states. The retesting of such herds should be done by accredited veterinarians, as was contemplated from the very inception of the work. This policy also applies to the annual testing of dairy herds under municipal ordinances. A recent study was made of the number of towns and cities which had ordinances requiring the tuberculin-testing of dairy herds. This research revealed the fact that there were 1249 towns and cities requiring the test. All this line of work should be done by local veterinarians. Tuberculosis-testing of all the herds in the country is not the aim and purpose of this campaign. Its aim is to make our herds free of the disease and to maintain them on that basis. This can be accomplished only by eternal vigilance of live stock owners and live stock sanitary officials. The condition of herds
can not be determined, however, unless they are tuberculin-tested at regular intervals.

**Area Work**

The area plan, which has almost supplanted the individual accredited herd work in most of the states, is well adapted to any program adopted for suppressing the disease. Area work does not necessarily mean carrying on the campaign in large counties, or in several counties simultaneously; it can be applied in such a way as to fit the condition in any state. I am not advocating launching into area testing on a wide scale. I think it preferable to go into it slowly—grow into it, as it were. But
I do recommend to your careful consideration area work of some kind. I think it will help to solve many of the difficulties, especially the reinfection that occurs in individual herds under supervision. In those states that have tried area work the project has extended until in some of the states at the present time it is being conducted on a state-wide basis.

Chart 6 shows the development of area work. In 1922 there were 205 counties engaged in the work; in 1924, 485 counties; in 1926, to November 1, 804 counties out of a total of 3073. On November 1, 1926, 235 counties were in modified area; 154 additional counties had completed one or more tests; and the remainder (415) were actively engaged in testing. In addition to the 804 counties there are a number of counties in several of the states that have signified their intention of taking up the work at a subsequent date. At the present time 26 per cent of the total counties in the United States have taken up area work.

**AVIAN TUBERCULOSIS**

Your attention is particularly called to chart 7, on avian tuberculosis. This phase of the subject has been discussed at our meetings more particularly during the last three or four years. We have not given it the attention that the poultry industry deserves. Avian tuberculosis exists to but a slight degree in the eastern and southern states, but it is causing great losses in the middle western states. As a matter of fact the losses due to avian tuberculosis, in some of the states, are much greater than the losses sustained from bovine tuberculosis. The disease is not a new one. It has been known to exist among poultry for many years. It has also been known that swine are very susceptible to avian tuberculosis, but no one believed that the disease existed to the extent which it does until it was pointed out by Dr. Van Es, who made careful investigations of its existence in Hillsdale County, Michigan; in Nebraska, Iowa, and other states. The facts now in our possession, which show that the disease is a most serious one, should stimulate more vigorous action in its control and eradication. The best method for combating the disease may not have been worked out, but that fact should not prevent us either from proceeding with the task or from improving methods from time to time, as was done in the early stages of bovine tuberculosis eradication. The field veterinarians engaged in cooperative work can carry on this part of the campaign very readily along with their other
work. The task is before us. Tuberculosis of swine will not be conquered until the disease is suppressed in poultry. Several of the states have been active in this work during the past year. Their actions are highly commended.

Inasmuch as this phase of the subject will be taken up in detail at another meeting, I will not attempt to discuss it further at this time, except to urge again greater activity in this direction. The map which is here shown indicates a preliminary survey of the extent of this disease. This information was obtained from field veterinarians, state officials, and others interested in the subject. Several of the veterinary departments
of state universities are carrying on investigations on this subject, with which we should keep in touch. In short, we should put into operation such measures as will be effectual in exterminating poultry tuberculosis.

**Chart 8.** Cattle retained for tuberculosis.

**Tuberculosis Under Federal Meat Inspection**

Your attention is called to chart 8, which shows the percentage of cattle retained on account of tuberculosis at federal-inspected establishments. This chart covers the period from 1907 to the present fiscal year. You will note that the peak of retentions
was reached in 1915. It was then 2.3 per cent of all cattle slaughtered at official abattoirs in the United States. Since then there has been a gradual decline in retentions until during the present year it reached the low level of 1.3 per cent. This does not include the 1,000,000 reactors slaughtered since the

beginning of the campaign. It merely shows the regular run of cattle received at federal meat inspection establishments.

Chart 9 shows the retention of swine for tuberculosis at federal meat inspection establishments. The percentage of retained hogs
increased from 1907 to 1925, at which time, however, it began to show a downward trend. One thing must be considered in this drop, and that is the order issued by the Bureau respecting "pin-point" lesions. It is to be hoped that each succeeding year will show a continued diminution in the number of swine retained for tuberculosis.

FORECASTING THE END OF THE CAMPAIGN

Chart 10* shows a map of the United States indicating the year when the several states will have accomplished the modification of all their counties. It should be understood that this is only an estimate, and is based upon the idea that the public sentiment which now exists for the suppression of the disease will not abate until the great goal is reached. Furthermore, it assumes that, while public sentiment demands that the work shall go on, the legislatures, state and federal, will abide by the will of the people and provide funds for the continuation of the work. It is only reasonable to expect that here and there there will be set-backs, and that the program will be subject to modification. The estimate given does not commit the state to any binding forecast of what is to come. It is merely an expression of a program of work without which the accomplishment of the task would be much more complicated. The taxpayers and their representatives in the legislative halls are anxious to know where this program is to be carried on, and how long it is going to be necessary to continue to make large appropriations for indemnity and operating expense. They are entitled to the best information we can furnish on the subject; therefore, this map is submitted as a program of the work, which we all hope to see consummated as outlined thereon.

PRESIDENT MOHLER: We will now have the pleasure of listening to Dr. George Hilton, Veterinary Director General, Department of Agriculture, Ottawa, Canada. His subject is "The Development of Bovine Tuberculosis: Control Measures in Canada." (Applause)

Dr. Hilton delivered his address. . .

*Chart 10 could not be secured for reproduction in this report. Editor.
THE DEVELOPMENT OF BOVINE TUBERCULOSIS CONTROL MEASURES IN CANADA

By GEORGE HILTON, Ottawa, Canada

Veterinary Director General, Department of Agriculture

When I received an invitation from the chairman of your Tuberculosis Committee to prepare a paper to present to this convention, upon some phase of tuberculosis eradication, I felt it was my duty to comply. I, however, found myself in a very difficult position, because I realized that whatever phase of that subject I might select I would undoubtedly, as the saying goes, be carrying coals to Newcastle and would probably bore you to extinction. I therefore decided, with the approval of the chairman of that Committee, to speak to you briefly upon the development of bovine tuberculosis control measures in Canada.

Thirty years have passed since the late Dr. McEachran first urged the Canadian government to pass an act providing for the taking of measures to eradicate bovine tuberculosis. In his annual report to the Minister of Agriculture in 1896, he emphasized the great importance of taking suitable measures to eradicate this disease while it was still within the bounds of control and could be suppressed at a reasonable cost. He made the statement that with the discovery of tuberculin there was no excuse to tolerate this plague. He asked for a provision of $100,000 for this purpose and issued a warning that unless prompt and adequate measures were taken to control the disease, it would assuredly increase, and with the development of the live stock industry would eventually constitute a great menace to that industry and to the health of the nation.

There were at that time not more than 1,900,000 cattle in the Dominion, with probably a low incidence of the disease. Owing, however, to the antagonistic public, a golden opportunity was lost for removing or materially reducing what has in the intervening years proven to be a great hindrance in the development of our live stock industry and has also been the cause of much misery and suffering amongst our populace.

It was not long before it was realized that progress in the control of this disease would depend very largely upon the state of public opinion and that an educational propaganda procedure was the first essential to success.
Starting Tuberculosis Eradication

The government consequently adopted, in 1896, a free tuberculin-testing policy for the purpose of giving live stock owners an opportunity to become familiar with the test and of ascertaining the extent of infection in their herds. There was no compulsion with regard to it except that live stock owners were required to segregate cattle and dispose of them for slaughter purposes only, but no compensation was paid. Even though the testing of these herds was entirely optional so far as the live stock owner was concerned, it was not long before serious opposition was encountered. Many live stock men claimed that healthy cattle were being infected with tuberculin, and they objected very strongly to the presence of tuberculin-tested cattle in their district. They carried on a persistent agitation against the test and the press of the day was full of ridiculous and misleading articles with regard to it.

The testing policy came under severe criticism because they claimed that reactors were not being properly segregated, and many of them were being disposed of for purposes other than slaughter. It was consequently decided, in 1903, to mark reacting cattle permanently by punching the letter “T” through the right ear, and in that year an act was passed providing for making this method of marking for identification purposes, and prohibiting the exportation of such cattle out of the Dominion.

In spite of the tactics of those opposed to the policy, sound educational propaganda and the demonstration of convincing lesions in the carcasses of reacting cattle gradually resulted in a greater demand for the test. Applications for the test soon became too numerous for attention by government officials. It was then decided to supply tuberculin free of charge to qualified veterinary practitioners, under certain definite conditions.

It was required that live stock owners must apply for the tuberculin and when doing so must give the name of the veterinarian whom they intended to employ to conduct the tests, and also the number of cattle owned by them. They were further required to hold reacting cattle on their premises until they had been permanently ear-marked by a veterinary inspector.

The veterinary practitioner conducting the test was required to forward a report of the test upon forms forwarded to him for that purpose. This action resulted in a few years in a large number of cattle being submitted to tuberculin, and there were then,
for the first time, indications of a demand for cattle which had passed the test. With a view to encouraging that demand the government adopted the supervised-herd plan in 1905. Any live stock owner could take advantage of this plan provided he signed an agreement to observe its requirements. These herds were tested free of charge by government officials and every effort was made to eradicate tuberculosis in them and to maintain them free from this disease.

No indemnities paid

However, as no compensation was paid for reactors, the government was not overwhelmed with applications for assistance under this plan. Although opposition to the test was now decreasing, the ear-marking of reactors was decidedly unpopular, and there was a great deal of dissatisfaction because the government had not adopted the compensation policy. The question of adopting a compensation policy was one that was very carefully considered, but at that time it was not considered advisable to do so. While we were not actually making progress in the control of the disease, the continued publicity of the government's policy awakened the interest of the general public.

With the inauguration of the meat-inspection service, in 1907, further convincing proof of the existence of this disease in our food-producing animals resulted in the public giving more thought to the soundness and wholesomeness of what they consumed. There was now a greater agitation for the suppression of the disease from a public-health viewpoint, and there was also a marked and very noticeable demand for a safer milk supply.

The dairymen now took a hand in the problem and strongly objected to any suggestion of any aggressive measures, and they threatened, if they were compelled to submit their herds to the test, there would be a milk famine.

After spasmodic agitations on the part of the consumer for a period of seven years, the municipal tuberculosis order was passed. This order was passed for the purpose of assisting municipalities desiring to obtain their milk supply from officially tested breeds. It was consequently limited to municipalities, and it was the first policy of the government providing for the payment of compensation for the reacting cattle. Under its provision the municipality was required to limit its milk supply entirely to officially tested herds. The municipalities, however, experienced a great deal of difficulty in passing by-laws to meet
the requirements of this order and, two years later, in 1917, it was necessary to amend it because the majority of the dairy-men absolutely refused to submit their herds to the test, and those who were in favor of the test were not in a position to produce an adequate milk supply.

The amended order permitted the sale of milk from untested herds, provided it was properly pasteurized in addition to the raw, untreated milk from tuberculosis-free herds. While this change was not in the interests of bovine tuberculosis eradication, it nevertheless afforded a means of protection to the consumer, and it was anticipated it would be of value as an educational factor.

**PROMISCUOUS TESTING NOT A SOUND POLICY**

The amended order soon became more popular and more municipalities took advantage of it. However, after having tested approximately 175,000 cattle under its provisions and slaughtering a little over 21,000 reactors, the compensation cost being $907,819, it was quite apparent that this order was not a good, sound business proposition from a bovine tuberculosis eradication viewpoint. While we were slaughtering reactors, we were not removing the centers of infection in the untested herd, which were only too frequently coming in contact with the tested herd; we were not under these circumstances able to reduce materially our percentage of reactors. Owing to public sentiment, however, it was not considered wise to cancel this order, although we have not for some time accepted additional municipalities under its provisions. There is no doubt that with the more general adoption of our more recent policies, this order will eventually be discarded. It has nevertheless been of real value, and apart altogether from its benefits, from a public health viewpoint, it has been a valuable means of educating the public, which has been evidenced by the fact that the demand for milk from tuberculosis-free herds has very materially increased.

Many dairymen were now demanding assurance that the cattle which they purchased were free from tuberculosis, and the breeders of dairy stock were commencing to realize that unless they produced healthy cattle they could not obtain a ready market for them.

About this time there was agitation in this country for the adoption of some practical, suitable method to control this
disease. This agitation resulted in the selection of the accredited-herd plan. Two years later, in 1919, this plan was adopted in Canada. You are all familiar with this plan. It soon became very popular in this country. The requirements are similar, with one or two minor exceptions. In Canada it was at first limited to recognized pure-bred breeding herds. With the demand for assistance from other owners it was soon necessary to change our policy in this regard. It was then decided to accept herds containing at least twelve registered cattle, and still later this number was changed to ten registered cattle.

This action, however, did not overcome the dissatisfaction on the part of a very large number of livestock owners whose herds consisted principally of grade animals. Like the wheels which need the grease, they made the biggest noise, and we were for the first time in our tuberculosis control work forced to consider seriously our ability to meet the obligations which were being pressed upon us.

LIMITED FUNDS HINDERED PROGRESS

Our funds were limited, and we were unable to meet the demands. After further consideration it was decided to limit this work to herds containing at least five registered cattle, one of which must be a herd sire, and further, that the registered animals must comprise at least ten per cent of the herd. It was anticipated that this action would have a twofold effect, in that it would sufficiently reduce the number of applications to enable us to deal with them, and it would also encourage the improvement of stock.

Accredited-herd applications, however, continued to increase due, undoubtedly, to the increase in demand for tuberculosis-free cattle, which forced many stockmen to clean up their herds.

It was not long before the stockmen who had taken advantage of the accredited-herd plan began to realize that it paid them better to keep healthy cattle than to lose money and feed in maintaining tuberculous ones. They commenced an agitation for a greater extension of this work and arranged for a discussion of this problem at the annual meeting of the Western Canada Live Stock Union, which was held in Regina, in December, 1921.

Much impressed with the progress being made in this country, the Union secured, through the courtesy of Dr. Mohler, a speaker from your Bureau of Animal Industry. Dr. Snyder, who was
then stationed in Montana, addressed this meeting upon the subject of cooperative tuberculosis eradication work in the western states. He dealt especially with area work, and gave such encouraging accounts of the progress being made, that the Union adopted a resolution urging the government to establish similar areas in Canada.

It was not until a year later, in 1922, that the necessary regulations for this purpose were passed. They require that at least two-thirds of the cattle-owners in a specified area sign a petition signifying their desire to have the regulation applied to that particular area and, further, the petition must be approved and endorsed by the government of the province in which that area is located.

Although this plan has been in operation in Canada for nearly four years, it has not so far developed into progressive cooperative effort, as obtains in this country. Our provincial and municipal governments are not cooperating insofar as providing funds and professional assistance are concerned, although they are assisting in other ways. In view of these circumstances, we have not been able to satisfy the demands of the public for the establishment of these areas in Canada.

Valuable Opportunity Lost

With not more than 1,900,000 cattle in the Dominion thirty years ago, with probably a low incidence of the disease, public opinion prevented the adoption of adequate measures for its control, and today, with more than 9,000,000 cattle and with a greater incidence of the disease, we are experiencing the greatest difficulty in meeting the demands of the public for suppressive measures. It is now very largely a question of cost. When we consider that it has for very many years been generally acknowledged that bovine tuberculosis causes tremendous losses to the live stock industry and that it also is a real menace to the health of the nation, it is remarkable that the disease has been permitted to increase and that we are met with so much opposition in the adoption of suitable measures for its control.

We have even at this late date, after a world-wide experience with tuberculosis for over thirty years, opposition in some quarters to the slaughter of animals which react to it. Our accredited-herd plan has been criticized because seven per cent of our fully accredited herds become reinfected. No prominence or consideration is given by our opponents to the fact that we
have been able to eradicate the disease and to maintain herds free from it in ninety-three per cent of the herds dealt with.

We have been able to do so in spite of the fact that the majority of these herds have been constantly changing their composition by purchases and sales, and that the self-contained, self-supporting herd has been the exception. Careful investigation has shown that the majority of the seven per cent of reinfected herds have become reinfected in a very natural way, although the owners invariably assume a mystified attitude.

Some of the sources of reinfection have been the feeding of raw, untreated milk and skim milk obtained from unknown sources, the feeding of so-called pasteurized milk and skim milk obtained from unknown sources, and contact with untested cattle in various ways; failure on the part of the live stock owner to observe the conditions clearly outlined in the contract which he saw fit to sign. We cannot hope for much improvement, even if the tuberculin test through continued research should some day prove to be 100 per cent efficient, so long as the human animal remains what it has always been. We have, I must admit, been exasperated at times to find a fully accredited herd badly infected, due undoubtedly to one or more generalized cases in it, which have failed to react to tuberculin or to be recognized upon physical examination. These cases, however, have been quite exceptional, but unfortunately some of them have been very widely advertised.

**Slaughter Policy Questioned**

The wisdom of the slaughter policy has been questioned because we have been unable, with our present knowledge, to eliminate this and other similar occasional, unknown factors in our control work. We are, I believe, all agreed that the disease should be controlled and eradicated and that the research worker should be allowed to toil on for the long results. Teamwork is indispensable in animal research, and our experience, particularly in bovine tuberculosis control work, shows or indicates that we are justified in meeting the demands of the public for the suppression of this disease now, while our technical workers are engaged in solving the special problems which confront us.

We cannot afford to wait, for if we do we shall assuredly find ourselves in the same position as the countries of Europe. Our experience shows that bovine tuberculosis can be eradicated,
with our present knowledge, in individual herds and in definite areas at a cost which is not prohibitive and that these herds and areas can be maintained free from the disease at comparatively low cost.

We must also remember that we cannot overestimate the value to our people of the redemption from deformities, misery and suffering which assuredly results with the eradication of this disease in cattle.

**Pernicious Propaganda**

We are finding that our tuberculosis control work is running true to form, in that we are still experiencing opposition of various kinds from various sources. Quite recently a printed pamphlet has been in distribution in a restricted area in the province of Manitoba. It is entitled, "Poison Milk Supplied for Babies," and I have a copy of it with me, but it is not worth reading, as it contains such ridiculous and absurd statements. The first paragraph will give you some idea of its contents:

Mothers and Milk Users: Do you know when you use milk from a cow which has been injected with tuberculin you are using poisoned milk? Tuberculin is a factory-made, filthy, unsanitary extract and essence of germs and their filth.

It is supposed to be signed by a veterinarian, a specialist in cattle practice in the state of California, and it is printed by the American Medical Liberty League of this city. While the statements in this pamphlet are so absurd that they cannot be excused, even from the viewpoint of a Rip Van Winkle, they are nevertheless a good indication of the extreme measures which have been adopted for many years in an endeavor to deter progress in this work.

Public opinion in the Dominion is, I believe, too favorable to be influenced materially by propaganda of this kind. Tuberculosis is in the air; it is in the minds of the people, and they realize more and more that it is their duty to control this disease, and irresistible pressure will be brought to bear upon our various governing bodies for adequate funds to launch a systematic, progressive, cooperative eradication campaign.

The wonderful progress you are making in this country in this connection is proving a strong incentive to Canada to follow your example and, occupying, as we do, part of this Continent, we are naturally very much interested in your progress. You are leading the world in this most important work, as only a great country can.
THE REACCREDITING OF MODIFIED ACCREDITED AREAS

By WILLIAM MOORE

State Veterinarian, Raleigh, N. C.

In presenting a paper on this subject it is, of course, necessary to confine my remarks to the work in North Carolina, since I am not sufficiently familiar with the work in other states to comment on it.

North Carolina began active tuberculosis eradication in 1918, under the accredited herd plan, taking up the area plan in 1921. Up to the present time we have completed the work in seventy-four counties and are working in thirteen others. During this time we have tested a total of 602,289 cattle, of which 3397 reacted, or slightly in excess of one-half of one per cent of infection on the original test, ten of these counties having no reactors. I presume that you are familiar with the rules covering modified accredited areas and that you recall that at the 1925 meeting of this Association the Committee on Tuberculosis recommended that the rules be amended so as to allow counties that did not exceed two per cent of infection on original test to be reaccredited by testing twenty per cent of the herds. This was adopted without discussion.

During 1926 North Carolina had ten counties to be reaccredited, all of which will be completed during this calendar year. In order to do this it was necessary to test 6048 herds in these counties, at a cost of more than $6,000.00. In three of these counties no reactors were found, in three counties one reactor each, and in one county three reactors. Two of the remaining three counties are more than half completed, with one reactor each. During 1927 we will have sixteen counties to reaccredit, two of which disclosed no reactors on the original test. Under the present rules this will require the testing of 10,836 herds, at a cost of more than $10,000.00. In 1928 we will have twenty-six counties to reaccredit, which, under the present rules, will require the testing of 14,308 herds at a cost of around $15,000.00.

This places a financial burden on us that we are not able to
assume. We cannot consistently ask that the counties or the Legislature appropriate funds to apply this large number of retests where no disease exists, nor could we justify the expense when there are many other live stock disease problems that should receive attention at this time. To continue to require this will mean that the reaccrediting of these counties will have to be abandoned. This we would regret very much. It certainly seems unreasonable to place counties showing less than one-half of one per cent on original test in a class with counties up to two per cent of infection. I think a mistake was made in not providing another classification for the former counties. I, therefore, recommend that the Modified Accredited Rules be amended to read as follows:

Modified accredited areas in which, on the original test of all cattle, the extent of infection did not exceed one-half or one per cent, may be reaccredited if less than one-half of one per cent react as a result of retesting all previously infected herds, at least one herd in each township and such other herds as the State Veterinarian and Inspector-in-Charge may designate, which shall include so far as possible, after thorough investigation, all herds to which cattle from other than accredited herds or modified accredited areas have been added.

PRESIDENT MOHLER: We will continue the symposium by calling on Dr. S. E. Bruner, Pennsylvania Bureau of Animal Industry, Harrisburg, Pa., to address us on "Protecting Tuberculin-Tested Areas." (Applause)

. . . Dr. S. E. Bruner read his paper. . . .

PROTECTING TUBERCULIN-TESTED AREAS

By S. E. Bruner

Pennsylvania Bureau of Animal Industry
Harrisburg, Penna.

Tuberculosis is usually spread by direct contact and by feeding young animals tuberculosis-infected milk. The history of tuberculosis in cattle shows that when it is once introduced into a non-infected district its tendency is to spread from herd to herd with a rapidity proportionate to the cattle traffic. If the interchange of infected animals between herds is frequent, the disease usually spreads rapidly. If, on the contrary, there is little interchange of animals, the disease is characterized by a slow development in the newly infected community. Years ago the local demands for meat and milk were met by local producers and cattle were rarely moved long distances. A certain amount of cattle traffic developed as a result of the tendency towards centralization of population. However, during the last few years great efforts have been made to develop and improve cattle for
special purposes as for beef, milk and butter. The change made in this class of herds are not nearly so frequent as in those practicing straight dairy methods.

With reasonable cooperation on the part of the owners, the improved methods of testing, cleaning and disinfection and also through correcting faulty sanitation, practically all infected herds can be placed on a tuberculosis-free basis in a comparatively short time. The length of time herds and areas continue to remain free of tuberculosis depends largely upon the protection of the herds against infection.

A common way in which herds become infected is by adding diseased animals. Therefore, one of the very important phases in connection with the establishment and maintenance of tuberculosis-free herds of cattle is to protect the tested herds or areas from the further introduction of tuberculosis.

**Progress Made in Pennsylvania**

In Pennsylvania, area tuberculin-testing began in April, 1923. Since that time we have tested all of the cattle in 536 townships in 45 counties. This means that more than 30 per cent of the total cattle population of Pennsylvania has been tuberculin-tested on an area basis. This area testing includes complete county-wide testing of all the cattle in eleven counties. Seven of these eleven counties are in the official modified accredited class.

At the time of the preliminary work in connection with the survey to determine the attitude of the owners as to whether or not they desire to have their herds tested, the attention of the herd-owners is called to the requirements governing the introduction of cattle into the tested areas. In some tested areas we have called attention to the regulations by letter to each individual herd-owner. At every opportunity we have stressed the importance of the fact that when owners buy cattle for herd additions they should purchase from herds operating under federal-state supervision, that have passed at least one negative test.

The regulations as provided for in the modified accredited area plan governing the manner in which cattle of various kinds may be taken into the tested areas are embodied in a quarantine. In order to make the quarantine conform to our law, a notice of the regulations embodied in the order of quarantine is published in a newspaper which circulates within the tested area.
and, in addition, at least ten quarantine notices are posted in prominent places within the area. Furthermore, many cooperating agencies have the quarantine regulations printed and widely distributed within the tested areas. Even with the cooperation extended on the part of the owners and cooperating agencies, to protect the tested areas against the further introduction of tuberculosis, the results thus far obtained have not been entirely satisfactory.

Pennsylvania does not breed and raise a sufficient number of dairy and breeding cattle to meet the demands. During the calendar year 1925 there were 22,000 dairy and breeding cattle brought into Pennsylvania and 5500 of the same class were exported and, in addition, there are annually brought into the State approximately 100,000 feeding cattle. In other words, Pennsylvania is a cattle-buying state. In order to protect our tested herds and areas adequately, necessary precautions must be taken by the owners and cooperating agencies to prevent the further introduction of tuberculous animals into the tested herds. The extent of tuberculosis in the untested herds ranges from 1 per cent to 50 per cent in the 67 counties throughout the State.

Two Classes of Areas to Protect

In the section of the State that breeds and raises a sufficient number of dairy and breeding cattle, the interchange of cattle is limited and the extent of the disease is slight in comparison to that section where many interchanges are made in the herds and where practically no breeding is followed and straight dairying is practiced. This means that we have two classes of areas to protect and we may divide the State into two groups.

Group 1 consists of 50 of the 67 counties in which the methods followed by the owners are such that there are comparatively few animals taken into this group for dairy and breeding purposes. Area work has been conducted wholly or in part in 40 counties of this group and in the areas that have been retested practically all owners who added animals into the tested areas have complied with the regulations as provided for in the Modified Accredited Area Plan.

In one county in this group, from a county-wide standpoint, the degree of infection on the initial test was 2 per cent. On a yearly retest in the same county there were 4189 herds, consisting of 21,870 cattle tested, of which 110, or .5 per cent,
reacted. A number of the 110 reactors were moved into this county from adjacent untested counties, in violation of the quarantine, but on account of slight infection in these untested counties little damage has resulted. Of the untested cattle taken into this county, in only one instance could definite proof be established concerning the quarantine violation. Tuberculosis spreads very slowly if the cattle traffic is limited and the chances are slight for introducing infection into such tested areas.

The foregoing is rather well illustrated in this particular county. On the initial test of four townships, there were 402 herds, consisting of 2857 cattle tested, of which a total of 49 or 1.9 per cent reacted. The infected herds were retested until they passed a negative test. On a retest of all the cattle, three and one-half years from the date on which the initial test was applied, there were 425 herds, consisting of 2986 cattle tested, of which 9 reacted. The degree of infection was .3 per cent.

Summarizing the results thus far obtained in this group of counties that breed and raise a sufficient number of cattle to supply their demands, the problem is rather a simple matter not only to establish but also maintain tuberculosis-free herds under either the Individual Accredited or Area Plan.

However, the situation is quite different in connection with group 2, in which may be placed the remaining 17 counties, where straight dairy methods are practiced and where breeding and raising dairy cattle is extremely limited. Practically all the feeding cattle brought into Pennsylvania are placed in this group of counties. The degree of infection in the dairy and breeding cattle in this group of untested counties ranges from 15 to 50 per cent. The number of cattle mentioned above that are annually brought into Pennsylvania are placed in herds located within these 17 counties. Area work has been conducted in four of these counties.

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It will be noted by table 1 that in applying the initial test to the cattle in 21 townships, in 4 different counties, 23 per cent
reacted and infection was found in 40 per cent of the herds. On a retest of the infected herds 412 additional reactors were detected. In other words, the disease was reduced as a result of one test to 1.8 per cent. Following the initial test, in 9 of these 21 townships there were 2431 added animals that passed an initial tuberculin test before they were taken into the tested areas, and on a 90-day retest of these herd additions 123, or 5 per cent, reacted. The indemnity paid to the owners of the reactors in these townships to date totals $334,737.73.

In this group of counties where straight dairying is practiced, the degree of infection is high. The owners depend almost entirely on their monthly milk check and it is necessary for them to replace the reactors immediately with other cattle. There are no surplus cattle that these owners may purchase for additions within the tested area or in adjacent counties. Many such owners do not avail themselves of the opportunities of having the cooperating agencies act as a guide in purchasing cattle from herds under supervision. Many of these owners are not in a position to avail themselves of this assistance for the reason that they are under financial obligations to the local cattle-dealer. Many of them apparently are not acquainted with the fact that there is more to a cow than just the hide. As a result replacements in many cases are made from herds that are unsafe from which to purchase healthy cattle. Unless the existing procedure is changed and the percentage of herd additions which prove tuberculous is reduced, it will be extremely difficult to establish and maintain accredited areas in this group of seventeen buying counties.

If, as a result of the retest of the tested areas, it is found that very little progress has been made and that the degree of infection is not maintained at a minimum, it can not be expected that large sums of money will be available annually for a long period of years and it will also mean that the cooperating agencies will withdraw their support and the effort to establish clean areas will have to be abandoned.

We in Pennsylvania are optimistic as to the future. We have found it necessary, however, to inaugurate more stringent methods to protect the tested areas against outside infection. It was deemed advisable to require dairy and breeding cattle brought into the tested areas, originating from herds not under supervision, to pass two tuberculin tests, one at point of origin and a second test 60 to 90 days from date of the initial test,
after which time the herd additions are eligible to become part of the herd. Such herd additions are not subject to indemnity should they react to either the initial test or the retest.

**HANDLING FEEDER CATTLE**

Feeding cattle that are taken into the tested and quarantined areas are fed in small lots. On the majority of farms the facilities for isolating the feeders are limited, which has necessitated testing a large number of the steers before they can be taken into the quarantined area.

It is essential that constant vigilance be maintained over these tested areas. It has been found that the local individuals and agencies can best perform this service. When such local cooperation and assistance is not being given it must be developed. We appreciate the cooperation that has been extended by the federal and state regulatory authorities and various other cooperating agencies in helping us to safeguard Pennsylvania from infection.

Our job in preventing and eradicating bovine tuberculosis in Pennsylvania will be further simplified:

1. By the formation and adoption of a plan by which feeding cattle originating in modified accredited areas maintain their identity from point of origin to destination, which will permit them to be placed in tested areas without being tuberculin tested.

2. By the movement into the State of only dairy and breeding cattle that originate in at least once-tested free herds.

**THE RELATION OF THE MILK DEALER TO THE PROBLEM OF TUBERCULOSIS ERADICATION**

*By F. D. Walmsley, Chicago, Ill.*

*Vice-President, Borden's Farm Products Co. of Illinois*

The milk dealer is vitally interested in any problem which directly or indirectly affects the production, distribution or consumption of dairy products and has subscribed, when he becomes a member of the International Association of Milk Dealers, to a
very definitely worked-out program, to the end that more intimate, cordial and friendly relations with our producers and the confidence of our customers in us may at all times be maintained.

Our lives are dedicated to the task of seeing to it that an uninterrupted supply of the millions of quarts of pure, fresh milk is delivered to the homes, schools, offices or factories each twenty-four hours every day in the year, rain or shine, whether it be in the sub-zero weather of January or the withering heat of August. Early in the life of the industry, probably because of the very nature of milk, a decided need for constant supervision of the raw product was recognized. This pioneer service on the part of the milk dealer, at first looked upon somewhat in the light of meddling, soon became of vast importance to the producer, because he found that adherence to a certain definite line of fundamentals in sanitation brought additional revenue to his credit, simply through a little added precaution in methods of production with the addition of very little overhead. It was found that the proper cooling of his product alone enabled him to derive much more in the way of financial return through the salvage than he had heretofore thought possible under a system of improper methods of cooling and the loss that invariably followed. The fact that a healthy cow must be the foundation of a properly supervised milk supply was the reason for the early employment of graduate veterinarians to form the foundation of a sanitary corps, not only because of their educational fitness for this service, but because in most instances these men come from farms and have a natural understanding of the producers' problems.

In addition to making a survey of the general physical conditions of the premises on which the milk is produced, cooperating with the producer toward correcting conditions which might be in need of attention, the veterinarian made a careful physical examination of the cattle comprising the herd. This examination was made to bring to the farmer's attention conditions from a health standpoint that might in any way affect the milk supply.

**Value of Physical Examination Questioned**

It may be argued, and with justification, that the physical examination has not always been efficient in detecting tuberculosis, and therefore should not be considered a factor in its eradication. The veterinarian, well trained in the science of
physical examination, can detect tuberculous lesions of appreciable size in the udder and in the lung. Further, he can recognize many other morbid conditions of much importance to the health of the cow and the wholesomeness of the milk produced. From the milk-producing point of view, the physical examination stands out conspicuously as a method for eliminating undesirable animals and in detecting numerous affections incompatible with a clean and safe milk supply. Such findings have been so numerous that the physical examination can no longer be questioned as the most efficient method of bringing to the attention of the farmer the presence not only of tuberculosis but of many other diseases. Information thus obtained has been of great educational value to the owner and often convinced him that he should eradicate the disease. We are satisfied that there is only one way in which bovine tuberculosis can be satisfactorily eradicated, and that is through the education of the producer from his standpoint of the economic reasons for its elimination. The milk dealer has always felt that the eradication of this disease from the herds of the nation was largely a question of agricultural economics. The annual waste to agriculture resulting from its presence runs into the millions, and only in specific cases through the country has this issue become one of public health. This phase of the subject is always to be deplored, because it brings at once into the eradicating program the matter of speed in accomplishing the work, which always results in vast expenditures of money, loss of markets heretofore enjoyed by the producers over a long period of time, demoralization of whole producing sections which years of intensive work have built up, destroys the credit of many farmers and seriously strains the feeling of cooperation which has existed between groups of producers one with the other, dealers with their producers, and a distrust of the motives underlying the whole eradicating program.

**ORDERLY PROGRAM HIGHLY DESIRABLE**

In one of the great producing centers of the Middle West, the program of tuberculosis eradication was practically at a standstill. The matter was agitated pro and con to such an extent, and over such a period of time, that the matter finally entered the public health phase. It is well known what the actual results of this phase of the situation were. To be sure, the program of eradication received an impetus which assured
its success, but at a cost which will take years to determine. A great deal of this cost could have been avoided if the great benefits of orderly elimination of this disease had been properly understood by the producers. In this, we are willing to take our share of the criticism, but have the helpful knowledge that where we apparently failed, another subsequent program of an orderly nature has been successfully carried out. The whole plan has advanced by leaps and bounds, spreading over all parts of the country, and it is very gratifying to note that this has been greatest in those most densely populated with cattle.

No doubt, before this Association again meets, many more cities, towns and villages, yes, whole areas, will have been added to the clean territory. We are not unmindful of the benefits to the whole industry of having a situation exist where no milk would be produced, other than that from cattle having passed a satisfactory test. The added confidence of the consuming public in the product that comes to them every day would provide, through increased consumption, a market for many more farmers, a goal that all producers are very glad to avail themselves of, due to the difference in return between this product and that of a manufactured nature. We are sure that the milk dealers of the nation are heartily in accord with any plan that will rid the industry of the presence of probably the most important disease that affects the bovine animal. We believe it is generally conceded that the dealer has rendered very valuable service to this campaign through his contact with producers and the educational work that has been carried out among them.

**Pasteurization a Question of Control**

The process of pasteurization, probably the most important single discovery to the milk industry in the conservation of human life, is largely a question of the control. We believe that the elimination of bovine tuberculosis is rapidly entering the control stage, and the producing element needs the best that is in us all toward keeping a herd from reinfection. What better agency could be employed for this than a complete physical examination, not only of the cattle comprising the herds, but of the premises on which the milk is produced or herds are kept? We are told by authorities in the realm of human medicine that the greatest aid to the propagation of any disease is the lack of resistance. Thousands of medical men, graduate
nurses and expert dietitians are now working in our schools, factories and offices to build up a resistance in the undernourished child and worker, so that they will be in a better position to withstand or ward off an attack of a disease that would drain the human system and make the child or person unfit for the work that is before him. Careful study and much money has been provided to insure the school child at all times a proper amount of pure, fresh air. Physical examinations are given to the children to detect those undernourished who, when found, are placed in groups provided for that purpose and special attention given to them. We can see in every direction around us the evidence of plans to conserve human life and prolong the use of each one.

With the present drain on the cattle resources of this country, is there not a place in the control of animal diseases for a campaign which will have for its purpose the conservation of the cattle of the country by means similar to that which in the human family has been recognized for some time as a real asset in their conservation program? Is there not a service that might be included in, or as an adjunct of, this program, which points out to the producer certain defects in the cattle under his supervision, neglect of which might predispose toward reinfection of a herd from which he has attempted to eliminate tuberculosis?

Responsibility Rests on the Producer

When it comes to the last analysis, the producer will be the one on whom the responsibility rests for the eradication of tuberculosis from his herd, and how well he succeeds will depend largely on his versatility with the fundamentals of control. He needs all the help he can obtain, covering the reasons for the disease, how the disease is spread, the effect of certain adverse conditions on the animal and, above all, a sympathetic regard for the problems with which he is confronted every day.

We believe that the centralized cooperative plan of eradication, such as is now being used, will eventually meet the demands that are placed upon it; that the producers of milk, in order to preserve markets for their product, will submit to a tuberculin test. A great many have not as yet seen the value of the eradicating program from a cattle-conservation standpoint, and it is only through all agencies working together in
this educational campaign that the producer can be properly enlisted as a valuable aid toward this end.

PRESIDENT MOHLER: The last address of the symposium will be given by Professor H. R. Smith, Live Stock Commissioner, National Live Stock Exchange, Chicago.

. . . Professor Smith delivered his address. . . .

FINANCING AND COMPLETING THE PROJECT OF ERADICATING TUBERCULOSIS IN THE UNITED STATES

By H. R. SMITH, Chicago, Ill.

Commissioner, National Live Stock Exchange

You have already heard so many addresses on this subject that I do not want to burden you with a lengthy talk. I will try to make it as concise as possible, and I shall endeavor to incorporate in this talk a report of the Legislative Committee.

The first appropriation for tuberculosis eradication was made by Congress in 1917, amounting to $75,000. At that time the states of this Union had a total of approximately $8,000. More or less work was being done in individual states, but not very much progress was being made because of a lack of concerted effort on the part of all the states. I think I am safe in saying real progress has been made. It is of interest to note the gradual increases in appropriations that have been made, year by year, during the past eight or nine years. It reflects the growing sentiment in favor of this project, because without public sentiment we cannot expect to get adequate appropriations. I think this increase in appropriations is a real barometer of public sentiment in this country in favor of this project.

In 1918 we secured the first appropriation of $500,000 from Congress. That, with a total of about $2,000,000 from the states and counties, gave us that year a total of $2,225,000 or $2,500,000. I am not going to read the appropriations for each year, but the increase in the federal appropriation has been steady each year, with the exception of one, and I may say that that one year was the year that we did not have public hearings in Washington. It has convinced me of the necessity of having these public hearings, where we can present factors bearing upon this project to convince Congress of the necessity of larger appropriations for this work. That was the year 1922.

At that time we had a total of $2,577,600. The states and
counties had a total of $4,000,000, giving us practically $7,000,000. The increase after that year has been quite steady, and this year we have a federal appropriation of $4,653,000, with a state and county appropriation totaling $12,403,000, making a total of $17,056,000. With these increased appropriations from year to year, there has been a consistent increase in the testing of cattle. Starting with 134,143, in 1917, it has grown steadily each year until during the year 1924 we tested a little over 7,000,000 cattle under the cooperative plan. In 1925, we tested 8,650,790. I believe that by the end of this fiscal year we will have tested approximately 10,000,000, or not very far from that figure. It is of interest to note also that the decline in the percentage of reactors in these breeding cattle (they are mostly breeding cattle) has progressed from the year 1917, when it was 4.9 per cent of all the cattle tested, to last year, when it reached 3.4 per cent. It is of interest, too, to note what the effect of this has been on the condemnation in the market centers. According to the figures I have from Washington, the retentions were 2.5, and this last year 1.3 per cent, exclusive of reactors. It would appear, then, that tuberculosis in cattle in this country is approximately fifty per cent out of the way, or approximately half done, so far as the number of cattle tested is concerned and the retentions in the cattle killed under federal inspection.

According to the census, we have now tested nearly one-half of the breeding cattle of the United States. We would expect a very material decline in retentions in all cattle slaughtered. The effect of this work upon swine retentions has not been pronounced. The retentions in swine increased steadily from 2 per cent, in 1918, up to 15.2 per cent, in 1924, but decreased last year to 14 per cent. Comparing the past fiscal year with two years ago, we find the condemnations have decreased approximately 20 per cent. I have no doubt that the great volume of area testing has been chiefly responsible for that decrease in retentions and condemnations in swine.

The retentions are still high, and we all know why that is. The investigations made by the Bureau, Dr. Van Es, Dr. Graham and others, whereby it would seem 75 per cent of the retentions in swine are caused by the avian type, are entirely consistent with our records on special killing tests of hogs in accredited counties.

At each of the important markets of the country we have a commissioner who is giving all of his time to educational work;
at each of these points we are keeping records on the killing test of accredited hogs. We now have records on a total of 626,391 hogs from accredited counties. The retentions on these hogs for the past year are 10.6 per cent. The retentions on all hogs slaughtered under federal inspection throughout the entire country last year were 14 per cent. That shows a reduction of one-fourth, comparing the hogs from accredited counties with the entire kill throughout the United States.

The condemnations, including sterilization, on these "accredited" hogs are 0.13. The condemnations on all hogs slaughtered last year throughout the United States were 0.41. Comparing, therefore, these "accredited" hogs with the total slaughter last year, the reduction in condemnations is just about two-thirds, compared with the reduction of one-fourth in retentions. That seems quite consistent with the results of recent investigations, which show that approximately 75 per cent of the retentions are caused by the avian type. It is certainly encouraging, particularly in the line of cattle, and I believe that with the systematic campaign to eradicate the avian type, we might reasonably expect a marked reduction in the retentions as well as the condemnations.

Last night we had a conference on avian tuberculosis, participated in by representatives of the Middle West states. We confined this to the Middle West because avian tuberculosis is a real problem in the Middle West. For some unknown reason, the eastern states do not have much avian tuberculosis. They certainly go ahead of us in cattle tuberculosis, but they do not have the problem of the avian type that we have in the West. The South has very little avian tuberculosis.

A committee was appointed and a plan has been prepared for eradicating avian tuberculosis. We will have that mimeographed in a few days, and I will make it a point to send to each member of this Association a copy of that mimeographed report. It represents, I think, the best thought on this subject. It was prepared by a competent committee and has been scrutinized not only by sanitary officials from all the Middle West states and representatives of the government, but also it has been submitted to poultry experts. I believe it is a plan that represents the best thought of the country on that subject.

I want to say there never was a time when the sentiment in Congress in favor of this work was better than it is right now. At the hearings last winter we had quite a large delegation of
representative men on the committee from this Association which appeared before the House. The Budget Director had cut the request for $3,000,000. As a result of the House hearing, they put it up to $4,000,000. In the Senate hearing we asked for $6,000,000, as we did in the House hearing, and we had at the Senate hearing some of the best medical authorities that could be assembled. The testimony of Senator Copeland, formerly Health Commissioner of New York, was, I thought, extremely valuable testimony on the public health phase of this problem. We also had Dr. Bundesen, who is very well known for his courageousness in putting through the ordinance which we have here in Chicago. We had Dr. Evans, Dr. Robertson, and others. I want to say now that I believe the public health testimony was more helpful in getting the Senate to recommend $6,000,000 than the testimony of any of the rest of us who talked more particularly on the economic phases of the problem. The Senate increased the appropriation to $6,000,000; the House left it at $4,000,000. The conferees agreed finally on $4,653,000, but the conferees agreed also that if the money should become exhausted before the end of the fiscal year they would approve of an emergency appropriation to be immediately available.

I think the judgment of our committee was demonstrated by the fact that they do need $6,000,000 for this fiscal year. In corresponding with the various state officials throughout the country, asking them through a questionnaire how much is needed to carry on the work in their respective states to the first of July, we find that these reports show a total of considerably more than $1,000,000 in addition to the present appropriation, so our mark of $6,000,000 was not too high.

I am very glad to say that we have from Dr. Mohler the information that the committee has already met and they have asked him how much is needed. He has told them in plain words, and they have agreed to accept his recommendation in the House committee. I think that is a very favorable thing.

We will have more nearly what is required the next year than we have ever had before. We should have approximately $6,000,000, and of that a considerable amount will be immediately available. That looks very well, so far as the federal appropriation is concerned. I think we may reasonably expect material increases in state appropriations during the next few years.

It seems to me it is rather remarkable, in view of the agricul-
tural depression that has prevailed throughout the West during the past few years, that the state legislatures and counties have done as well as they have. In going before the county boards (and we do that a great deal) we find that the greatest obstacle in making county appropriations is the argument of their increased taxes. In view of the fact that the agriculturist has never felt the necessity of economy more in his life than he does now, I think we can well be pleased with the results obtained in the matter of financing up to this time.

I do not believe we need to hesitate to ask for all that is required. It seems to me one of the worst things that can happen is to have a long waiting-list in any county and not have adequate funds. When this matter gets cold, it has a bad effect on the public. It seems to me we ought to have funds that keep up with public sentiment at least. I hope that in every state you will not try to be too economical. Ask for all that is needed. It is too important a problem to be skimmed. We should get everything that is required.

When will the peak be reached? That is hard to say. It has been reached now in several states. I can point to a number of states where, from now on, the requirements are going to grow less. We have not reached it throughout the country as a whole. It will be reached in a very few years, and then there will be a downward trend.

The appropriations for the past eight years have averaged approximately $8,000,000 a year. Suppose we have no more next year than we have this year, $17,000,000; it would seem as though by the end of another five years, with adequate funds, there would not be very much tuberculosis in cattle left. There will be some of course; there always will be some.

I believe the chart presented by Dr. Kiernan is very conservative. I think the estimate of when the states will be cleaned up in many cases will get ahead of that schedule, because public sentiment is improving all the time.

I believe from now on we should give very much more consideration to the avian problem. You cannot stop the cattle program now; it is too well advanced. As Dr. Mohler mentioned last night, if all of us would drop out of the picture, the program would go on just the same because of public sentiment. The need now, I think, is to give much more consideration to the elimination of the avian tuberculosis. We are apologizing and explaining, all the time, to the packers who are paying the
ten-cent premium, and it amounts to a tremendous sum; it amounts now to somewhere near $200,000 a year in premium checks on hogs from accredited counties, and we ought to make them more nearly worth the extra ten cents.

As near as I can determine, the loss on heads from these accredited counties is such that the packer does not get back more than about one-half of the ten-cent premium. It is only because of the interest of the packers in the whole campaign that they are willing to go along with us and have the patience they have had in this proposition. They are extremely interested in the success of the whole program.

We are hoping that we will get improvement in the results of the killing test on the accredited hogs. We believe that if we all give considerable attention to educational work on the avian problem, we can improve to a great extent the losses from that source. I have reason to believe that 75 per cent of the farmers and poultry-owners of this nation will take early steps voluntarily to eradicate the disease if they know they have it. The cost will not be great, because no indemnity is required. It is just a matter of getting them to make some effort to clean up. It will not be a difficult task.

I wish that we had means of bringing about a little pressure to hurry this along, and we are considering it right now. At a meeting of our commissioners, held last Tuesday, we recommended to the National Committee, consisting of the principal members of the packing industry, a modification which will require that, on and after a certain date, all hogs entitled to a premium must be tattooed, so that we can get a clear and concrete check on their killing records. As it is now, in keeping these hogs separate, there is bound to be some difficulty. By the system of tattooing, they will not have to be killed separately. The tattoo mark on the killing-floor will identify the hog, and by that means we can trace right back to the particular farmer who produced those hogs, and we can tell him whether or not his hogs killed clean. I believe by that means we can get the farmers to clean up their chicken coops if they have the knowledge of the situation.

Another thing that can be done is this (I am not saying it is going to be done): In the certificate we can require each owner to state that his hogs have not associated with tuberculous chickens. That would help a great deal if we could get them either to keep the hogs separate or clean up the flock. Of course,
the natural thing is to clean up the flock. I believe, too, more rigid inspection by the cities would help to bring about some pressure in this direction. We cannot get very far with the plan unless we get public sentiment behind it. That is what we need at this time.

I was much interested in the results of the killing test of the Rath packing Company, at Waterloo, Iowa. That is in the center of a badly infected district. The Rath Packing Company has followed a system of tattooing hogs for a number of years. They have been keeping records on the kill of practically all the hogs brought in by trucks. This is the information that we get from the Rath Packing Company: On all the hogs slaughtered from a certain accredited county in this territory, the loss caused by tuberculosis was four cents per hundred. The loss on all other counties in that territory was fifteen cents per hundred. By paying the ten-cent premium Mr. Rath was still ahead one cent per hundred. He is very much pleased with the results of the program in that territory. I believe that we can improve a great deal on the records of these hogs from accredited counties. I believe we have enough public sentiment to give us sufficient money to carry it on, and if we can solve this avian problem, I believe the way is clear for a rather quick consummation of the work. In this connection, I want to say we would never have the public sentiment that is favorable were it not for the efficiency of the work of you men who have been in the field and you men who have been administering this work.

The work would have fallen down long ago had it not been for efficiency in the field. The confidence of the public has been established. It is not 100 per cent perfect, but the work has been so well done that it has certainly been a great aid in creating public sentiment. So I think if we go along this line with the work properly administered and properly done in the field, we will have the public sentiment to give us the funds that are required, and it seems to me we have every reason to be optimistic of the final completion, when there will be very little tuberculosis left in this country.

Discussion

President Mohler: Gentlemen, this very important topic of tuberculosis eradication is now open for general discussion. I am sure we would all like to hear from the Health Officer of the City of Chicago, Dr. Bundesen, who recently received, as you well know, a $1,000 medal from a local donor for being the outstanding person in this city who had contributed the most to the public welfare of its citizens. (Applause)
DISCUSSION OF TUBERCULOSIS ERADICATION

DR. HERMAN BUNDESEN: About a year ago it was my privilege to talk to you gentlemen. At that time, as many of you will remember, we were in the midst of a hell of a fight. (Laughter) We made a statement to you that I remember well; I memorized it; I used it on milk dealers and on producers; I used it on bankers and on every one. Having used it so often, it still remains in my memory. It was this: We were going to see that every drop of milk that was delivered in the city of Chicago came from healthy cows, free from tuberculosis, if it was the last damned thing we ever did, and there wasn't any power this side of hell that was going to stop us. I might say I haven't gone to hell yet, so I haven't been stopped.

At that time, those who were opposing us made this statement: that it couldn't be done; that disaster would happen in the city of Chicago; that milk would then become a dollar a quart; that babies would starve by the hundreds, and the result would be the people would not drink any more milk. That was a year ago.

I might tell you, for your own benefit, that order was put into effect the first of April. Some of our opponents were inclined to refer to the occasion in a witty way as April Fool's Day. Well, it was April Fool's Day, but it happened to be April Fool's Day for the fellow who was opposing us.

As a result now we are going along. What have we in the city of Chicago? Every drop of milk that is delivered in the city of Chicago now—2,500,000 pounds a day—is free from tuberculosis.

In answer to the statement that milk would be a dollar a quart, at the time we started the fight it was fourteen cents a quart and today, with increased costs, it is still fourteen cents a quart. In answer to the statement that babies would die right and left, we might say that so far this year we have had 454 fewer deaths in babies under one year than we had in the same period last year. (Applause) If it isn't worth saving 500 babies to have safe milk in this country, it isn't worth fighting for anything.

That fight was not a fight that I had made. That fight was a fight I happened to be in the center of, but if it had not been for the support of you men, if it had not been for the support of Dr. Mohler and Dr. Herman and particularly his representative here, Dr. Lintner (who God only knows had the intestinal fortitude when we needed it) we couldn't have won this fight.

Milk consumption has been increased. Every milk dealer in the city of Chicago solidly backed the move, and not only that, but when I decided to put out forty or fifty new inspectors to see how safe our milk was and to make it safer, we found that the milk dealers were doing the same thing in the city of Chicago and they were leading us to places where the milk was clean. In the future those people who are selling milk are going to have their own inspectors in large numbers out to safeguard the milk of any community.

Milk, as you men know, is the basis of everyone's diet. If you want to live to a good old age and live while you are living, you must build your diet around milk—a quart of milk for a child and at least a pint of milk for every adult.

Recently, in Japan, extensive researches have been done which would tend to show that it is a deficiency of vitamin A that produces cancer. They were able invariably to produce a cancer in the guinea pig on the 175th day. What is the greatest single source, in modern times, of vitamin A? It is milk. For that reason we must give the public milk, and it must be safe milk.

I felt quite proud when I looked at this map. Definite progressive testing pays. It seems great to look at Illinois. The other fellows will not be clean until 1940 and 1933 and so forth, while in Illinois, at least in Chicago, we can guarantee it, it must be all clean because there isn't any figure in that spot.

In the Health Department in Chicago we received hundreds and hundreds of letters from people all over the country wanting to know what they could do to start eradicating tuberculosis in their own community. There is not any doubt that this movement has started, and there isn't anything that is going to stop it from spreading all over the country. You are the men who
We want to thank you for the fine support you have given us in making this a success, because it has been a success in Chicago. (Applause)

Mr. A. L. Felker: Mr. Chairman and Gentlemen: I think we all understand the reason we hesitate to follow such a man as Dr. Bundesen. He is too much of a whirlwind or western cyclone for us to keep up with. (Applause)

There is one thought which I should like to leave with you. You and I, after all of these years of following the leadership of Dr. Mohler and others, are pretty well won over. We believe in what we are doing. I believe also we know what we are doing, and we, that is you and I, are going to stay by the old ship until we win the victory. But I am just harking back now to this thought that we want to take home with us, whether it is in New England or in Iowa. Not all of those splendid men back there, the men who milk the cows, the men who feed the hogs, are thoroughly convinced yet, and it is largely due, I believe, to the fact that we have not been quite as aggressive as we might have been in leading them to see both sides of the picture. I think it was Dr. Hilton who made the suggestion here this afternoon that from the economic point of view some have seen and the producers have followed.

I should like to say that those producers can see the other side of this picture when it is pointed to them straight, as Dr. Bundesen has pointed it to you and me this afternoon, stressing the saving and the conserving of life among the children of such a city as Chicago; and Chicago with its teeming population is but small and miniature in size when compared with the great areas and the densely populated sections all over the United States. We have got to save babies in Boston; we have got to save babies in Denver, and everywhere else, and this must appeal to the farmers. (Thank God I have the privilege of being one of them.) It must appeal to the farmers from both angles, the economic angle and from the standpoint of the health of their own children.

Somewhere around more than one-third of the population of this country live out on the farms, and those people have got to have the same advantages applied and given to them that these splendid people in these splendid cities like Chicago are enjoying. So this work must go on.

I have intimated to you that there is a problem of education yet to be announced and carried to the very four corners of our country, and I am going to give you the reason. This happens to be a hog cholera case instead of a tuberculosis case, but it applies just as well. In this city this week there are 1250 boys and girls, and I know no time in past history when we have had a better bunch of better looking, more healthy, forward-looking boys and girls anywhere assembled than we have in this city this week out at the great International Show.

I have had the great privilege of meeting and talking with a few of those boys and girls in the restaurants and the hotels around about us here. This morning I met two boys, splendid types of American youth. One of them had a baby beef here. He was as proud as a peacock in telling me what he had made on the baby beef.

I said, "What state did you come from?" He told me. (I guess I won't repeat it here.) But he said, "We raise a lot of hogs and a lot of corn out in my state." (Perhaps you can guess it.)

"Well," I said, "young man, take this from me, don't do as your daddy has done during the past year or two and lose a large percentage of those splendid hogs, that are worth so much money at the present time, for failure to take precautions and prevent a disease that it is possible to prevent."

This is the reply he made to me, and this is the thought I want you to get in your souls and take back home: "Well," he said, "there's a lot of our people out home who feel that in injecting or vaccinating our hogs we are just poisoning them with vaccine."

Didn't Dr. Hilton tell you something about that in the bulletin that has been circulated? I think, friends, there are people in these great splendid states of ours today, farmers who are raising the hogs and the cattle and the sheep, who just believe that you are sticking poison under the skin. It is
up to you and to me to tell them differently and to point them the way. They have not had the privileges of understanding these things that you and I have had. This applies just the same to cattle.

I said to that young man, "You get it straight, no matter what your daddy believes. You cannot afford to lose ten per cent of all the hogs in your great wonderful state as reported to me only last night by the Commissioner of Agriculture who rules over a certain branch of your state government."

Let's go back home and drive this thing to the very point of contact with the men out on the hills and in the valleys of this grand old country of ours, that to listen to some is nothing but giving credence to hearsay, while we can point the way to safety through precautionary methods, through faith and belief in the leaders who have led this fight through, as Dr. Bundesen has, to the finish.

I think, friends, that is one of our big jobs. (Applause)

PRESIDENT MOHLER: The city of Cleveland, Ohio, is about to put into effect a milk ordinance similar to the milk ordinance here in Chicago. I am going to ask Dr. Leslie, city veterinarian of Cleveland, to say a few words on that subject. (Not present.) Dr. De Fossett, have you anything to say?

DR. A. J. DE FOSSETT: As we sum it up, the Cleveland situation is going to be somewhat similar to our Chicago situation, or rather as the Chicago situation was. On January 1, we understand, a health ordinance goes into effect in the city of Cleveland, requiring that all milk coming into that city must come from tuberculin-tested herds. Naturally the milk coming into the city of Cleveland now is being brought from a dairy section in which we have very heavy infection. Some of the counties are running from fifteen to twenty-five per cent infection in the herds. In some townships in these counties the infection will run from forty to fifty and sixty per cent. Our people who are producing the milk naturally are very frantic at this particular time. Some have been stalling along for the past year or two, knowing that sooner or later this ordinance was going into effect. They have tried to shoulder the responsibility of their problem by shifting it from one shoulder to another, but they are being drawn into it just like it is coming in every state in the Union or in every large city sooner or later, when they will have to meet the problem of producing a clean, wholesome and healthful milk supply, because the public is demanding it.

The consumer is paying a price for his milk right now that he should not have to pay for the kind of milk he is getting. Dr. Bundesen told us they paid fourteen cents a quart for a milk which probably was hardly fit to drink. It doesn't cost a cent more today for milk that is coming from clean, healthy herds.

Dr. Leslie could add something to this discussion because he knows more about the problems there and what they are going to do. We can discuss it only from the field standpoint because we are working shoulder to shoulder with the people in northern Ohio who own the herds and with the Department of Health, in getting the people together and trying to go about it in a sane, careful manner, with the view of having the herds cleaned up just as quickly as our funds will take care of it.

Testing herds and cleaning up tuberculosis is one phase of the subject, but paying for the reactors is quite another thing. We can clean the herds, but the finances sometimes do not permit going as fast as public sentiment would wish. Our state is cooperating in every manner possible, and I know we are going to get the cooperation from the people and also from the Health Department.

I just thought I would mention this to show how public sentiment is swinging, not only in certain sections, but it is becoming nation-wide. Other cities are going to meet this same problem that Chicago has met, that Cleveland is meeting now, and I think it is well to carry the thought back home to prepare your people, because sooner or later they are going to meet it. (Applause)

PRESIDENT MOHLER: I would like to introduce the recently appointed Director of Animal Industry of Massachusetts. (Applause)

MR. FRANCIS B. CUMMINGS: I have been itching to say something, and still I felt that perhaps I came here to listen, only having been in office for
three short weeks, or three long weeks, whichever way you take it. If I
did not have something to say to this body I might be guilty of proving the
truth of the old axiom that fools rush in where angels fear to tread. I am
a pinch-bitter, but I am here to register before you all the idea that Massa-
chusetts is going to line up on this important matter of tuberculosis among
cattle. As a layman I felt for a long while that I was not technically prepared, but my objections were over-
ruled and I am so thoroughly sold, as a result of attending these meetings,
that I want to dedicate the rest of my life to the work of eradicating tuber-
culosis in our section of the country. (Applause)

Dr. C. E. Cotton: With reference to Dr. Bruner's paper, I think it is my
duty at this time to relate some of the experiences we have had in Minnesota
as a result of the feeder or beef cattle question. In our area work, imme-
diately when we sign the agreement and start the test, we put a quarantine
on the county and do not allow any animals in unless they are properly
tested, with the exception of steers, which can go in under certain quarantine
provisions. We did not have any trouble with our dairy counties, but when
we got down in the southwestern part of the State, where the beef industry
is very large, we experienced some trouble with the feeder steer. We found
that rather than put up with the inconvenience of the quarantine and the fact
that they could not allow hogs to follow the steers, they decided they had
better test the steers. We are getting higher than six per cent reactions in
the steers out of the South St. Paul yards.

I regret very much that Dr. Fretz's paper could not have been presented
before a body of regulatory men, so it could have been thoroughly discussed,
and I want to take this opportunity to make a motion that Dr. Fretz's paper
be referred to a committee to study and report back, a year from now, relative
to any necessary, or as they may think necessary, recommendations in the
change of the technic and the interpretation of the test.

The motion was seconded and carried unanimously.

President Mohler appointed Drs. W. J. Butler, chairman, W. J. Fretz,
Clark Hayes, C. H. Case and S. E. Bruner as the Committee.

Dr. C. H. Hayes: Regarding feeder cattle, Nebraska is rather peculiarly
placed in this particular. We are producers of a great number of feeder
cattle. The question with us is the one raised by Dr. Cotton. We have no
specific data as Dr. Cotton has, but we recently tested in one of the counties
that does possibly supply some feeder cattle. It is not so much a range
county today, but just a few years ago it was. I do not believe the cattle
population has been greatly changed by importations into that county. It
has been classed on the maps as having less than one per cent infection among
the cattle, but on our test of the herds in that county just completed, 2.6 per
cent of the cattle were found to be infected.

We have had these figures regarding the normal kill at our packing centers.
I am just wondering how much that reflects on the matter of tuberculosis
among our range herds. We can cite many specific cases where strictly range
cattle have been found to be infected with tuberculosis, but when we come to
review the evidence, we are faced and confronted by the many things that
intervene in the handling of the cattle, and contacts that might have been
the means of exposure.

Just recently one particular lot of cattle, originally bought off of the Sioux
City market, a bunch of heifers, was slaughtered after a feeding period at
the Omaha market and a large percentage were found infected with tubercu-
losis. There were no contacts whatever except market contacts, and those
cattle were range cattle. We are in position to handle the testing of cattle
on our ranges, at least in Nebraska, with the uniform methods and rules
that are used in other parts of the country. However, the pressure must be
brought largely from outside sources demanding that this be done. I have
advanced the suggestion that it might be a profitable undertaking in some
of our markets to have such a handling of the proposition as has been recently
suggested in the handling of dairy cattle. We should like to see such pres-
sure brought to bear as would assist us in carrying this into the range cattle
country and testing the herds.
NUTRITIONAL DEFICIENCIES IN ABORTION

Dr. J. I. Gibson: I think all the gentlemen here who are engaged in tuberculosis eradication work ought to be permitted to take home with them all the encouragement that can be truthfully given.

Look with me at the map, showing the black and the green and the yellow; the figures on the total retentions of hogs were given from all three colors—that vast area in yellow with very little infection, the green with a little more, and the black with the heavy infection. The figures that have been given us on accredited hogs have come almost exclusively from the black area; we would have a true comparison, and it would give a little more favor to the work and to the result of the eradication of bovine tuberculosis as shown in the retentions of the hogs and the condemnations as well. Really the saving in retentions is greater than has been presented to us today, if we will compare these results with the accredited market run, from the same area.

President Mohler: There is another very important symposium on Infectious Abortion to come before us this afternoon. I am sure we are all very much pleased to have as our guest this afternoon an expert on nutrition who formerly was connected with the Bureau of Animal Industry. Unfortunately the program still places him in this Bureau, but he is now in the Bureau of Dairy Industry. I take great pleasure in introducing Dr. E. B. Meigs, who will speak to us on “Evidences That Nutrition Deficiencies Are Factors in the Problems of Abortion and Sterility in Dairy Cattle.” (Applause)

Dr. Meigs read his paper.

EVIDENCE THAT NUTRITIONAL DEFICIENCIES ARE FACTORS IN THE PROBLEMS OF ABORTION AND STERILITY IN DAIRY CATTLE

By Edward B. Meigs, Washington, D. C.

Laboratories of the Bureau of Dairy Industry

U. S. Department of Agriculture

In the last ten years, students of nutrition have become entirely accustomed to the idea that deficiencies in the rations fed to animals are likely to interfere with reproduction. Most of the experiments which justify this statement have been carried out on rats. It was inevitable that the first results along this line should come from small animals which can be maintained and studied in large numbers, for the effects of faulty diets on the physiology and health of animals are never entirely uniform.

Perhaps the most definite and thorough work on the connection between nutrition and reproduction is that of Evans. He finds that when female rats are fed on certain kinds of rations they fail entirely to give birth to any young. They grow at the usual rate and appear in good health, and ovulation and the implantation of the embryo occur apparently normally. But at a certain stage the embryos are always resorbed, so that no young are born.

These results on reproduction are produced by feeding diets which are deficient in an organic substance which is found in
lettuce, alfalfa, and various kinds of seeds. Other investigators have found that rats fail to reproduce normally when their diets are deficient in other ways, and it is particularly interesting in connection with the results on swine and cattle, which are to be described later, that Reynolds and Macomber, Salmon and Kennedy report that rats do not produce satisfactorily when fed on rations deficient in calcium.

Hart and Steenbock have found that swine do not reproduce satisfactorily when fed on rations composed chiefly of grain. On such rations they often fail to come in heat; and, if they do come in heat and become pregnant, the young are likely to be born dead or weak. Rations composed of grain are always low in calcium; and the reproductive difficulties above described are corrected if alfalfa, which has a high calcium content, is added to such rations.

The experiments on rats above described have been carried out, as a rule, without any accompanying study of the bacteriology of the abnormal conditions produced. Such a study would very likely throw further interesting light on the subject; but nobody, who has made a careful examination of the work, would claim that such a study was necessary to establish the connection between the nutritional deficiencies and the abnormalities in reproduction. In the case of rats it is possible to use so large a number of animals that connections of this sort can be established even in the face of a certain amount of individual variation. With cattle, unfortunately, the use of large numbers becomes very expensive and progress must necessarily be slower. But the investigations which have been carried out on this class of animals have already reached a stage where they cannot be disregarded.

**Extensive Investigations Conducted**

Three fairly extensive investigations of the effects of different rations on reproduction in dairy cattle have been carried out at the University of Wisconsin, and published in 1911, 1917 and 1920, respectively. The two later investigations will be considered first. In these, some of the animals were fed for a fairly long period on rations which consisted of grain combined with straw as the sole roughage; others, on the same basal rations, but supplemented with various inorganic and organic salts; still others, on the same grains, but with different kinds of roughage altogether. The results indicated that reproduction was not
successful, unless the rations contained fairly liberal amounts of calcium.

It was found, for instance, that the calcium content of the straw varied, and that reproduction was more successful when the straw with the higher calcium content was fed.* It is desirable, therefore, to consider first the results which were obtained when the animals received straw with a low calcium content as the sole roughage.

There are seventeen such animals. Three of these never came in heat, and could not, therefore, be bred at all. The other fourteen came in heat, were bred and became pregnant. They calved from ten to thirty-five days before they were due—twenty-one days before, on the average. Of the calves, four were born dead, and the other ten were small and weak, and all died within a few days.

If these results stood just as they have been described so far, with nothing more to support or supplement them, they would still be very strong evidence for the view that cattle cannot reproduce successfully when they are fed on rations which contain low-calcium straws as the sole roughage, and that the effects of such treatment on reproduction are either failure to come in heat altogether or the premature birth of weak and dead calves. It rarely or never happens that there are one hundred per cent of abortions in any considerable series of animals, even from herds that are badly infected with contagious abortion, and an experimenter would certainly be very unlucky if fourteen pregnancies in fourteen cows which were picked out at random for a certain kind of treatment all resulted by pure chance in the premature birth of calves which were either born dead or survived only a few days. But the results are very far from standing just as they have been described so far.

Other animals in the same herd and under the same general conditions as those which have just been considered were fed on rations which contained alfalfa or clover hay as roughage. All the calves born from them were alive and strong or fairly strong, and all survived. One was born 41 days before it was due; the other nine, from 1 to 13 days before. The average number of days before due for the whole ten is about 9; leaving out the one that was born 41 days ahead of time, the average is a little more than 5 days. Among the animals in the same

*Low-calcium oat straw contained 0.47% CaO; wheat straw, according to H. & M., contains 0.29% CaO.
herd that received legume hay, therefore, there was only one abortion from ten pregnancies, and all the calves, including the one which was born 41 days too soon, survived.

**Contagious Abortion Excluded**

Precautions were taken to exclude contagious abortion as a cause for the results obtained with the animals which were fed on low-calcium straws as the sole roughage. The animals in the 1917 investigation were subjected at intervals to the agglutination test for contagious abortion. All animals in this group which aborted were subjected to the agglutination test several months after the abortion took place. The animals in the 1920 investigation were subjected to the agglutination test periodically during their periods of pregnancy and up to several months after they calved or aborted. The animals of which the records are published and considered in the foregoing pages were all negative to the agglutination test for contagious abortion during their periods of pregnancy and for several months after they calved or aborted.

The results obtained in the 1911 investigation are fairly similar to those obtained in the two later ones, but are considered separately, because it is not reported that these animals were tested for contagious abortion. Sixteen heifers were divided into four lots of four each. One lot was fed on corn and corn stover; another, on wheat and wheat straw; a third, on oats and oat straw; and a fourth, on a mixture of equal parts of each of the three above rations. The feeding was continued as described with all four lots for a period of three years. The animals on corn did well and produced eight strong calves in the three years from 10 days before term to 4 days after term—a little less than two days before term, on the average. The animals on wheat did not grow quite so well as those on corn, and two of them died before the end of the three years. There were six pregnancies among them, from which the calves were born 16 to 34 days before term—25.5 days on the average. All the calves were either born dead or died shortly after birth. The animals on oats and on the mixed ration were intermediate in their reproductive history between the other two lots.

At the end of the three years the rations of the animals which were left were interchanged. The animals changed to the corn ration did well and reproduced satisfactorily. Those changed to the wheat ration did badly. Only one became pregnant,
and she gave birth to a dead calf 18 days before it was due. The animals changed to the oat and oat-straw ration were again intermediate between the other two lots. The oat straw used in this investigation contained .084 per cent CaO, as compared with 0.47 per cent CaO in the 1920 investigation.

In the three investigations there were 21 pregnancies in animals fed on low-calcium straws, all of which resulted in the premature birth of calves which were either born dead or lived only a short time. Numerous other animals in the same herd and under the same general conditions, but with different rations, reproduced quite satisfactorily. Numerous tests showed that the herd was comparatively free from contagious abortion.

**Wisconsin Experiments Confirmed**

The results obtained at the University of Wisconsin have been confirmed at other stations. At the Michigan Station four heifers were fed on grain and wheat straw. One of these died fairly early in the experiment. Of the other three, two threw their calves one and two months, respectively, ahead of time. One of the calves was born dead, and the other died in two days. The third heifer appeared to be in very poor condition some time before she was due to calve and was given cod-liver oil. She carried her calf to term, but it was born blind and paralyzed, and lived only 18 days. The authors report that all these animals were free of contagious abortion.

Eckles reports that two Jersey heifers which were fed on rations low in calcium* both aborted, although neither reacted to the test for contagious abortion.

As far as I know, there have been no cases of successful reproduction reported in cattle which were fed for any length of time on rations containing low-calcium straw as the sole roughage.

In experiments carried out at the Beltsville, Maryland, Station of the Bureau of Dairy Industry, eight milking cows have been fed for fairly long periods on rations which contained timothy hay of rather low calcium content and corn silage as the sole roughages. The reproductive history of these animals has been studied, and various tests for contagious abortion have been applied from time to time.

Of the eight animals, four have never given any sign of being infected with the *Bacillus abortus* during the period of the experiments, while the other four have reacted positively to the

*Timothy and corn gluten.*
agglutination test at one time or another, and, in some cases, have aborted fetuses from which the *Bacillus abortus* has been isolated.

Of the four infected animals, one had two periods on the timothy hay rations, so that there are five cases of infected animals which were bred while on these rations. In three of these cases there was no particular trouble about getting the cows with calf, but in the other two there were six and eleven unsuccessful breedings respectively. Both cows became pregnant later, after they had been changed to better rations.

Of the four non-infected animals, three became pregnant without any particular difficulty, but one was bred six times unsuccessfully on the timothy hay ration, and did not become pregnant until after she had been dry for some time.

There were eight calvings or abortions on the timothy hay rations. Of the four infected animals, three gave birth to living calves less than two weeks before they were due, while one aborted at seven months. Of the four non-infected animals, only one calved normally; the other three aborted from twenty days to ten weeks before they were due, and the calves were either born dead or lived only a few hours.

Two of the aborted fetuses from the negatively reacting cows were examined and found not to be infected with *Bacillus abortus*. The third one unfortunately was not examined, but the same cow later aborted again, and this fetus was found not to be infected.

**Alfalfa Fills Important in Role Ration**

Among animals fed on alfalfa in the same herd and of the same general type, there has been much less trouble with breeding and much less abortion than among the cows fed on timothy hay, and particularly among animals which have reacted negatively to the agglutination test. Taken in connection with the Wisconsin results, therefore, the Beltsville results indicate that the reproductive failure, which occurs uniformly when cattle are fed on low-calcium straws as the sole roughage, may also occur frequently, though not uniformly, when the roughage consists of low-calcium timothy hay, either with or without corn silage in addition.

In order to understand the effects of different rations on the calcium metabolism of dairy cows, it is necessary to keep in mind the situation which has been revealed by the recent in-
vestigations of the subject. Cow's milk has a fairly constant calcium content of about one gram per kilogram. The need of a cow for calcium in her diet will, therefore, vary with her milk yield. A cow giving only 5 kilograms of milk daily can get along with comparatively little calcium in her food; while one giving 25 kilograms of milk must absorb 25 grams of calcium daily from her intestinal tract if she is to remain in calcium equilibrium. This is much more than is needed by young cattle for bone-building during the period of most rapid growth.

In numerous recent experiments the calcium content of dairy rations has been studied, and the proportion of the dietary calcium absorbed by cows during periods of liberal milk yield. It has been found that dairy cows do not usually absorb more than 20 per cent of the calcium contained in their food, and that dairy rations often do not contain more than from 50 to 100 grams of calcium daily. If a cow is giving 25 kilograms of milk daily, receiving a ration with a daily content of 80 grams of calcium, and absorbing 20 per cent of this or 16 grams, she will be losing about 9 grams more calcium in her milk daily than she is absorbing from her food. The calcium metabolism of cows under conditions closely approximating those just described has been investigated in a great many cases, and it has been found that the absorption of calcium from the alimentary tract is very frequently not sufficient to cover that which is secreted in the milk, and that, under such conditions, cows often undergo a long-continued and extensive loss of calcium from their bodies, taking from their bones as much as may be necessary to supplement that which they can absorb from their food in covering their requirement for milk secretion. The adequacy or inadequacy of the calcium content of a given ration for a dairy cow depends very largely, therefore, on her milk yield.

**Hay Should Be Well Cured**

There are other factors which still further complicate the situation. Calcium is absorbed by cows to quite different extents from different kinds of foods, and even from the same kind of food treated in different ways. It is much better absorbed, for instance, from well-cured hay than from poorly cured hay or straw. Further, it is somewhat better absorbed by cows exposed to the ultraviolet rays contained in sunlight than by the same cows on the same rations, but kept in-doors.

In view of the complicated nature of the situation, it is clear
that it is not an easy matter to say whether a given ration is adequate or inadequate in its calcium content for a dairy cow under any given conditions.

It cannot be concluded, therefore, that, because dairy cows are not often fed on rations which contain straw as the sole roughage, it is safe to assume that calcium deficiencies play no part in the reproductive difficulties which are so common in many of the high-producing herds in this country. The milk yield of high-producing cows constitutes such a strain on their powers of assimilating calcium that what are generally considered very good rations may be just as deficient for them in this respect as were the straw rations for the non-milking or low-producing heifers used in the Wisconsin experiments.

Without questioning the great importance of the *Bacillus abortus* in causing the abortions which occur among cattle under practical conditions, it must still be remembered that the effects of infection with this bacillus are not constant. In many cases cows abort once after having acquired the infection, and then give birth to a succession of normal calves. In some cases, however, they abort several times in succession; while, in others, they do not abort at all. The results of the nutrition experiments give every reason to think that nutritional factors may often be the cause of this great variation in the severity of the disease, and they ought to receive the fullest consideration both from the scientific men and from those of the general public who are interested in this question from the practical point of view.

**DISCUSSION**

**Dr. Meigs:** If I may take just a few minutes to add to the written part of this paper, I would like to say that we at Beltsville have been very much interested, naturally, in the experiments which have been going on at the Michigan State College, along more or less similar lines, and when I saw that Prof. Reed was going to discuss this paper I got in touch with him in order that we might go over the differences and resemblances of our results and differ.

The Michigan results have differed from ours in that they have fed cows there for long periods on timothy hay and have had practically no trouble with reproduction, no more trouble than they have had with other cows that were fed on alfalfa. These results are, of course, very important and will have to be taken into consideration with the great number of results now being obtained on this subject all over the country when a line comes to be drawn under it.

Prof. Reed and I have been trying to discover what differences might have caused this difference in the results, and we find, as people most always find when they discuss two sets of experiments which are along the same line, that although our experiments are in general similar, in many important respects they are very widely different. Our cows received a much higher protein content in their rations than did the Michigan cows. They also
received a much higher phosphorus content, and I think there is a good deal
of reason to suspect our hay was not of such good quality as the Michigan
hay.

The Michigan results have brought out a very important aspect in the
situation. I do not want to dwell very much on this, because I do not want
to trespass on Prof. Reed's territory. He will speak about it later on. But
it may possibly be that the calcium question has been a little too much em-
phasized and that we will have to consider more fully the organic factor which
is contained in well-cured hay. As far as the big question of the possibility
of producing premature births in cattle on deficient rations is concerned, the
Michigan results are entirely in harmony with the results that have been
obtained at Wisconsin. Although they have been getting good reproduction
on a fairly good quality of timothy hay, they have in all cases failed to get
reproduction where they fed straw, and Prof. Reed has been able to give me
some more cases to add to those which are reported in the paper, in which
the cows instead of being fed straw were fed very restricted amounts of
timothy hay, and in which the reproduction was just as unsuccessful as it
was in the Wisconsin and in the other Michigan experiments with the straw
ration. (Applause)

PRESIDENT MOHLER: This paper by Dr. Meigs will now be discussed by
Professor O. E. Reed, of the Michigan Agricultural Experiment Station,
East Lansing, Michigan.

PROFESSOR REED: You have already listened to a discussion about this
subject of deficiencies in the diet, and its relation to sterility and abortion.
I have not a long speech to make, but I just want to give you some of the
things that we have tried to find out and some of the things which we have
definitely determined on as far as our work in Michigan is concerned.

In the first place, since this beginning work, the work put out by Wisconsin
several years ago, there has been quite a lot said and quite a lot written and
quite a lot done toward supplying calcium in rations that otherwise were
thought to be low in this particular element. In our methods of thinking
and working we have rather believed, or have talked or in some way come
about the knowledge, that calcium was the big factor in mineral feeding, but
as far as our results in Michigan are concerned, I will say it is not altogether
calcium.

While the work that Dr. Meigs has reported here shows lack of reproduction
and cases of sterility on low-calcium rations (we have some substantiating
evidence for that), we find phosphorus is one of the big factors that is lacking,
and since we found that out some two or three years ago, we have found other
causes. In Minnesota, particularly last year, they had a great deal of trouble.
Dr. Eckels is working with the problem; he went out into the field and found
it was the phosphorus deficiency that was causing that trouble.

In talking to Dr. Welch, of Montana, since coming to your meeting (Dr.
Welch and I happen to be old associates), we naturally fall to discussing the
problem. He tells me they have a problem out there of deficiency in minerals
and particularly deficiency in phosphorus, and on the range many farmers
and ranchers have been losing calves and have failed to get cows with calf.
Analysis of the hay they have been feeding has shown that it is high enough
in calcium, but extremely low in phosphorus. He also states that he has cor-
rected that by shipping great quantities of bone meal to that section. I want
you to know calcium is not the only thing in which a ration may be deficient
and that would cause some of the troubles we are having, but phosphorus is
likewise a factor in certain sections of the country.

The other thing I wanted to tell you about is something of our work at
Michigan, the beginning of which was prompted by activities in commercial
fields, by nutrition experts trying to supply the rations that were low in
calcium, trying to supply that in some form or another in organic or other
compounds.

Some five years ago we started quite an extensive experiment. We have
always assumed alfalfa as a basic ration is about as near perfect as we could
get for animals, so we have one check lot on alfalfa. These animals were
bought from one herd, pure-bred, unregistered animals, Holsteins, bought
when they were just a few days old and brought to the station farm, and there divided up into groups or lots.

As calves came along we put them into one of the groups, and as a consequence our results are scattered over a period of years, and it will be another year or so before we gather complete results. Each lot was placed on a restricted diet. The first lot was put on alfalfa as a basal ration for hay, and they all received the same grain, made up largely of corn, oats and cottonseed meal. These calves have been measured and weighed regularly. The growth has been noted. We kept track of the growth and measurements every six months.

The second lot received timothy hay as a basal ration; that is the only way it differed from the other.

The third lot received a ration of timothy hay with an addition of bone meal.

The fourth lot received a home-made ration. As you know, a lot of people are addicted to the habit of making up home remedies, so we had another lot with timothy hay as a basal ration, and to that we added a certain percentage of a mixture of calcium carbonate, limestone rock, hoping to supply the calcium and phosphorus in that way.

The market has been full of remedies along this line because of the work at Wisconsin. We have a great many mineral mixtures. We refer to them in the laboratory as shot-gun preparations. The people used to give a little of this and a little of that, thinking it would not do any harm. You are all more or less familiar with the preparations on the market today that have a little calcium carbonate in one form or another, bone meal for the phosphorus, magnesium salts and Epsom salt and iodin and a little of this and that.

We went on to the market and got the one most widely advertised at that time and put another lot of five heifers on timothy hay with this mixture as a supplement.

When we got into the experiments we decided we had better make them under more natural conditions, and we put another lot on timothy hay and let them run in the pasture.

I am going to take up a few minutes to tell you how the lots have come out in the three definite ways, first as far as growth is concerned, second as far as reproduction is concerned, and third as far as milk-production is concerned, because we started these animals at a few days of age and have carried them all through the line in dry-lot conditions where they received nothing whatever except the things that we wanted them to receive, as I have already outlined to you.

I am going to give the weights and measurements at thirty-six months. Alfalfa lot: 1126 pounds at thirty-six months of age. Timothy group: 1116. Timothy and bone flour: 1173—the heaviest lot we have. The calcium carbonate and limestone rock group: 977. Complex mineral group: 770. We do not have the 36-months weight on the pasture group as yet.

As an index to the growth, we will take the height at the withers, which is 135 centimeters for the alfalfa group, 131 for the timothy group, 135 for the bone flour and timothy group, 133 for the rock and calcium carbonate group, and 139 for the complex mineral mix.

We count the alfalfa group as normal. We find the timothy hay and bone flour groups are also normal. As far as percentage of normal is concerned, the timothy lot was normal, but these others were more above normal than the timothy lot, and the calcium carbonate group and rock phosphate were below normal, while the complex mineral group was very much below normal.

We might enlarge upon that, but time does not permit. As far as reproduction is concerned, I might say we had all the animals taken to the Veterinary Department, where they were given the agglutination test and other tests as time went on.

In the alfalfa lot the gestation period averaged 270 days, and all the calves were strong. In the timothy lot the average period of gestation was 266 days. The fetuses were healthy and strong. In the bone flour group we had one poor animal but she came through with a strong calf. (All the calves were
The average gestation period was 270 days, and all the calves were all right except one which was born dead, and even it was all right as far as size and such things were concerned. In the rock and calcium carbonate group, all but one animal remained negative. They all expelled except one that was born dead. In the complex mineral group, all these animals remained negative. They carried an average of 268 days gestation. One was born with stiff legs; one died in two days; another was born dead; another was born with scours, which is unusual, as far as my experience is concerned; another was undersized and died within ten hours.

We have some reproduction with 268 days carried through as far as pregnancy is concerned, but as far as the living calf is concerned there is no report to make, in the last group.

That is the story with respect to reproduction, but there is one other big factor, and that is milk-production. I also have the second year's lactation, and that follows just about the same as the first year, but I won't take your time to read it.

In the alfalfa lot the five heifers averaged 8,250 pounds of milk; in the timothy group they averaged 8,900 pounds of milk and 275 pounds of butter-fat. Some of you fellows think timothy hay is a very poor cow-feed. Don't get excited; we are bringing timothy to the front in this experiment, and that is milk-production. We had to make good the protein deficiency in timothy hay. We had a balanced ration as far as that was concerned. The low calcium in timothy did not seem to bother, and we did not get very much additional calcium in the rations. Of course, we had a good ration and had phosphorus in the grain ration.

With bone flour added we got a production of 8,600 pounds of milk and 288 pounds of butter-fat. That is really better than the alfalfa. All three are about in the same line. I would not differentiate between those.

We got the jolt in the next lot, where we had the home-made mix. We got 6,660 pounds of milk and 205 pounds of butter-fat, quite a reduction as far as milk-production is concerned.

There was something wrong, and we think we found out by check experiments with another animal started at birth that raw rock phosphate contains something that is very detrimental to the health of the animal and to the appetite. When they eat this they do not relish their roughage. They eat grain that contains the calcium, and eat it with a relish, but they seem to lay off the roughage for some reason or other. A further investigation is being carried on with this particular element, calcium.

We had a real jolt in the complex mix group. The average production is 4,900 pounds of milk and 157 pounds of butter-fat—almost one-half the production of the other groups. I think perhaps there are some things in some of the complex minerals that should not be fed. As a matter of fact, the cows tell us that in the experiment. Here is a group of cows, in every way handled just as the others were handled, and still we get practically no reproduction with that particular mineral mix, and we do not get a profitable milk-production, and we get far from normal growth on this particular lot that is fed on the complex mineral mix.

Dr. Meigs has told you about the limitations as far as the calcium is concerned. I have emphasized the phosphorus, as he did.

There is another thing that we found out, as he has already mentioned, and that is that there is perhaps another factor that goes along with our low-calcium ration on timothy hay, if it is low calcium. Our timothy, as far as the calcium content is concerned, has run from .25 to .3 per cent, which is very low, and is lower than some of the straw fed at the Wisconsin station. We have reason to believe that there is some factor—I do not know just what it may be; it may be the vitamin in well-cured hay that will help out in this proposition. We have noted that and a good many other things.

There is just one other thing I want to mention with respect to well-cured hay. We have heard a lot of what is called cottonseed meal poisoning in the South. We have searched the literature through and through, and in all the cases reported where cottonseed poisoning has been present in an animal, there is not a single case that we have found on record where a well-cured hay has been fed. We have some data to show that we can cause the same
sort of poisoning with corn protein and with other heavy protein feeds if we eliminate this factor in well-cured hay.

If you have a client who has a smattering knowledge on the line of feeding mineral supplements, if he has well-cured hay and the cow does not give more than 10,000 to 12,000 pounds of milk in a year, it is doubtful that he needs any additional minerals added to that ration unless perhaps it is phosphorus. I am speaking particularly of calcium. Our phosphorus might be deficient, but with the grain it is not very likely to be. If they do insist on feeding some sort of mineral and you have got to feed in order to appease their minds, in our judgment and in quoting the records as far as our cattle are concerned after this quite lengthy and exhaustive trial, the best thing to feed would be the bone meal, and that is the best recommendation that we can possibly make if you are going to feed minerals at all. It is the best and cheapest thing in the long run, and the most satisfactory as far as our results are concerned and as far as the results backed up by Dr. Welch's work in Montana are concerned.

There is no question that the low-calcium diet, even if the other factor may or may not play a part, has caused sterility or has failed to get reproduction. Our work shows that. But if we are going to feed minerals, our recommendation is to feed the one that will at least not do any harm and the one that so far shows the most good. (Applause)

Dr. Meigs: I have already said that we feel a great interest in Prof. Reed's results, and as far as the question of trying to make up for the lack of good hay in the ration by feeding mineral supplements is concerned, our results at Beltsville are entirely in accord with his, or so nearly in accord that the differences are not really worth speaking about.

It is a very curious and rather disconcerting situation. Where the need for calcium is high, we cannot supply it in the way we think it could be supplied, with experience from other animals, by feeding it in organic form, but that is the result, by the way, of our experiences, and until everything is strong enough to offset it in the other direction, there is nothing for us to do except stand by what the others at present show.

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THE VALUE AND NEED OF UNIFORM METHODS FOR CONDUCTING TESTS FOR BOVINE INFECTIOUS ABORTION, WITH AN ACCOUNT OF EXPERIMENTAL WORK

By C. P. Fitch, St. Paul, Minn.

In the presentation of this subject, I wish to emphasize the necessity of control men checking up their laboratories. I have it constantly brought to my attention in Minnesota by our control man that the laboratory technician is an absolutely impractical individual who sees animal disease control pretty largely through the test-tube or through the microscope. It is important that these two groups closely cooperate.

In the control of bovine infectious abortion we have come to
UNIFORM METHODS FOR ABORTION TESTS

the point where control men and laboratory men should get together. It has been demonstrated in the talks and papers given before this Association for the past three years that the actual control of bovine infectious abortion rests upon clean herds, and at the present time the only satisfactory test must be made in a laboratory.

Certain states, as you well know, require a test for contagious abortion for the introduction of new animals. That this require-

Table I—Comparative results of serological tests of samples sent from Minnesota, March 13, 1924 (first group)

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If it happens that laboratory results are conflicting, and are conflicting to the point where they interfere with the efficiency of such a test, then this work will be seriously handicapped for a number of years. I am speaking today because I wish to emphasize the point that you should go home and get into communication with your laboratories and find out exactly how they are carrying on their tests.

This came to me forcibly a few years ago, as I will show in the slides in a few moments, when I happened to send to another
laboratory a few samples of serum from animals that we were using in our experiments, and the results returned from these laboratories varied markedly from those obtained in our own laboratory. I began to wonder whether these varying results were anything like a usual procedure, and in order to determine that, I sent to several laboratories a group of serum samples. The first slide which we will show will give you the results which were obtained from the first group. I asked each laboratory to make its own diagnosis.

I am not going over each individual test, but I want to point out one or two things in connection with the chart. You will note that there are four laboratories to which the same samples of serum were sent. Three laboratories ran the complement-fixation test, and one did not. One laboratory absolutely refused to make a diagnosis. The other laboratories reported in the manner that you note on the chart. This varied considerably. You will note, also, in the first animal, one laboratory had positive results; the other three were negative. In the second animal, one was positive, one was suspicious, and one was negative, and one positive by the complement-fixation test. In the third, one was suspicious, one negative, one negative and another negative.

We will go down to sample 26, which gave a suspicious reaction in the first laboratory, suspicious in the second, positive in two other laboratories. In other words, the results convinced me that there was need for some uniform method of conducting this test, but in order to get a further survey of this situation I selected another group of samples which I sent to a larger group of laboratories, the results of which will be shown on the next slide.

We have eight laboratories in this group. You will note the varying way in which these laboratories reported their results. I am not going over each individual animal, but I think you can readily note, especially in the complement-fixation test of Laboratory No. 6, how exceedingly variant these reports were.

We would find there were exceedingly variable results in this group if we had the time to analyze carefully the results obtained with these sera. You will note that this work started in the spring of 1924. To me this was convincing evidence that something needed to be done in order to put this test on a more uniform basis.

In order to help bring this about, we secured the cooperation of five laboratories. They were the state laboratories at Michigan, Maryland and Pennsylvania, the Bureau of Animal Industry,
### Table II — Comparative results of serological tests of samples sent from Minnesota, May 20, 1984 (second group)

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and our own laboratory at Minnesota. Men from each laboratory met here in Chicago two years ago. We went over our technic carefully. Each laboratory gave and took. We drew up what would be considered a nearly uniform method for conducting the tests. We took into consideration the various elements of which I will speak more in detail in a few moments. Each laboratory man went home and attempted to and actually did put into effect these methods which were agreed upon. We sent duplicate samples of serum to each of the laboratories. Each
group was carefully studied and correspondence carried on in respect to the results. This work was carried on last year. As a result certain procedures were modified in the last plan drawn up, and the next slide will show you what was actually accomplished.

I leave it to your judgment on a casual observation if the results reported on this slide are not a great deal more uniform than the results which were reported on the previous two slides. You will note from just a casual examination of the figures on the screen that the results were fairly uniform, and the next slide, which is compiled from another group of samples, will bear out even more strongly this statement.

In other words, an animal that was positive at one laboratory was positive at the other laboratories. We are always going to have the condition of the suspicious animal. I speak in particular of animals 1, 2 and 19. You will note that animal 19 at the first laboratory gave partial agglutinations at 1-25 and 1-50: In the next laboratory it was strictly negative; in the third laboratory it was one plus, another one partial, and the complement-fixation test at Minnesota was two plus, at Michigan and Maryland negative, at Pennsylvania one plus and at the Bureau of Animal Industry negative.

There is always going to be that particular group of individuals in any disease in which a laboratory or other test is employed. You meet this group every day in your control work in respect to tuberculosis. The results of this cooperative work showed that uniform results could be obtained on infected animals in approximately 92 per cent of all sera tested. There were disagreements in the suspicious zone and work will necessarily be done further to clarify the procedures in these cases.

There are one or two features I desire to call to your attention in particular. One of the first is the concentration of the test fluid or antigen used. Not many months ago I collected from eighteen different laboratories in the country the antigens which were used in their tests. (Shows block containing specimens of antigen.) The concentrations from this end to this end are progressively greater, until you have antigens which are at least twenty times as concentrated as the antigen at the other side. The results which are obtained at certain laboratories necessarily cannot agree, because the agglutinins upon which the test depends are used up before the bacteria are entirely agglutinated in the more concentrated antigen. In other words, we are
### Table IV—Comparative results of serological tests in which uniform methods were used by the different laboratories (fourth group)

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obliged to recognize that it is necessary to secure a more or less uniform concentration of antigen. The cooperating laboratories decided that a concentration of approximately the first tube of the McFarland nephelometer was about the proper density, and these samples (about one-half) show but little variation. In other words many laboratories are using the same concentration.

Another feature which deserves consideration in respect to the test is the period of incubation. We found that it did not make very much difference whether the incubation was carried on over a period of forty-eight or seventy-two hours. Some laboratories incubate for only twenty-four hours, and allow the tubes to remain at ice-box or room temperature for another twenty-four hours. It is not our belief that this either makes a great deal of difference, but there are some laboratories which incubate a very short time and then place the tubes in the ice-box and then incubate from twenty-four to thirty-six hours. The results which are obtained will undoubtedly vary from those obtained by continuous incubation.

We did not find that the agglutinating properties of different strains of the abortion organism varied markedly when a good agglutinating strain was employed. In other words, we found that the cultures used in the five cooperating laboratories gave practically uniform results.

Another feature which deserves consideration is the character of the serum which is sent for test. Serum must reach the laboratory in reasonably good condition. It is not absolutely necessary that it be sterile, but it must be relatively clear and in a fairly good state of preservation. Any laboratory worker who has carried on this test knows that serum received from the field is often in very poor condition, and tests carried on with this poor serum necessarily are not accurate and the results should never be reported.

There are many other features in respect to the test which I should like to speak about, but time will not permit. In closing, may I make a final point. The complement-fixation test is used in certain laboratories. It has some advantages over the agglutination test. For example, it will pick up a more recent infection than the agglutination test, and it will still show infection long after agglutinating bodies have disappeared from the serum. If one is going to compare the results of the two tests, you must take this as well as other factors into consideration. For example, we have a calf in our experiment herd which was allowed to nurse
a mother that was giving off abortion germs in the milk. We removed this calf from its mother very soon after birth. After a period of two months this calf failed to react to the agglutination test. It is still reacting to the complement-fixation test after approximately four months. If you were to send the serum from that calf to a laboratory which was using the agglutination test only, you would get back negative results. If you were to send it to a laboratory using the complement-fixation test only, you would get back positive results—both absolutely accurate, according to the test which was used.

The complement-fixation test is a more delicate procedure, but for routine work it is too complicated. The agglutination test, in my judgment, will be the one which will be most widely used in the control of this insidious disease.

Finally, remember that the blood of calves will oftentimes react, as that one in our experiment herd, when they are not carrying an active infection. In other words, tests on calves under six months of age do not mean very much and, as a rule, will not aid materially in the suppression of this disease.

President Mohler: The next is the report of the Committee on Abortion.

Dr. George H. Hart: The Committee on Abortion this year, as appointed by the President, consisted of eleven men. In the month of June we had a majority of them in Chicago and had a meeting. Following that meeting a letter was sent out and a report was made up and sent to all of the members of this Committee. There were some differences of opinion regarding the report as it was sent out. These replies have been used to adjust this report in such a way that it meets with the approval of a large majority of the Committee, if not all of them.

. . . Dr. Hart read the Abortion Committee's report. . . .

REPORT OF COMMITTEE ON BOVINE INFECTIOUS ABORTION

Dr. George H. Hart, Chairman, Berkeley, Cal.
Dr. C. P. Fitch, St. Paul, Minn. Dr. L. W. Goss, Columbus, Ohio.
Dr. E. C. Schroeder, Bethesda, Md. Dr. J. F. DeVine, Goshen, N. Y.
Dr. R. R. Dykstra, Manhattan, Kans. Dr. W. L. Boyd, St. Paul, Minn.
Dr. F. B. Hadley, Madison, Wis. Dr. E. B. Meigs, Washington, D. C.

You will remember that in the report of the Committee on Bovine Infectious Abortion last year two things were recommended: (1) That this Association take official cognizance of bovine infectious abortion as an infectious disease of animals, and (2) that the live stock sanitary authorities of each state study the situation in respect to this disease in their particular commonwealths, and initiate such control measures as they consider advisable, and further, that such authorities be prepared to report to this Association in 1926 the progress which had been made.

Your Committee this year held a meeting in Chicago, in June, and decided that data on what the various states have done in the prevention and control of this disease had better be gathered by the Committee and presented in its
The sanitary officials of each state, therefore, received a letter from the Committee during the past summer on this subject. The Committee has been very much gratified at the amount of information and evidence of work being done in a variety of ways that this circular letter elicited. In a very small minority of the replies, the official considered nutrition a more or less important factor in this disease. Your Committee would like to take this opportunity to outline clearly what it believes to be logical ground on which this Association should stand, regarding the important question of the relation of nutrition to reproduction in cattle.

In this species we have the important infectious disease caused by \textit{Bact. abortus}, which seriously interferes with reproduction. There are, of course, other pathological conditions in this species which also interfere with reproduction, and there is strong evidence for the view that nutritional deficiencies may interfere with reproduction in various species of animals and may even cause the premature expulsion of the fetus in cattle. Subnormal states of nutrition may enhance the manifestation of those changes caused by infection. More than one infectious agent has been demonstrated as being associated with the phenomenon of abortion. However, one infectious agent stands out of paramount importance, namely, \textit{Bact. abortus}. This organism stands today convicted, beyond the shadow of a doubt, of causing millions of dollars loss annually to the live stock interests of this country.

You are in duty bound, therefore, to take cognizance of the convicted \textit{Bact. abortus} within the borders of your respective states and proceed in a sane manner to consider its control and elimination. The atmosphere on this subject will be greatly cleared by eliminating the disease due to \textit{Bact. abortus}. When this is accomplished, there will still remain problems in reproduction in cattle, and if any of them need the attention of this Association, we are sure you will be ready and willing to consider them.

 Replies to our circular letter have been received from all of the states except one.

 The states have been divided into groups in the following manner:

1. **States Considered to be Practically Free from the Infection.**
   - There are six states in this group: North Dakota, Wyoming, New Mexico, Alabama, Mississippi, and West Virginia.

2. **States Not Doing Anything to Control the Disease.**
   - Twenty states were placed in this group and it is quite likely that some of them do not belong there.

3. **States with Few or No Regulations but Live Stock Sanitary Authorities, Experiment Stations, or Practicing Veterinarians Cooperating in Control Measures.**
   - There are ten states in this group: Maine, New York, Ohio, Indiana, Michigan, Wisconsin, Minnesota, Idaho, California, and Washington.

4. **States Recommending the Use of Live-Abortion-Germ Vaccine.**
   - There are three states in this group: Connecticut, Kentucky, and Nevada. Your Committee would not like to see this method of control extended to any more states at present.

5. **States Requiring Agglutination Test for Entering Animals over Six Months of Age.**
   - There are three states in this group: Georgia, South Carolina, and Arkansas. This regulation is proving quite satisfactory in these states and your Committee believes that those states considered to be free from the infection, or nearly so, should follow their example.

 The remaining states need special mention:

 In the states of Pennsylvania, Missouri, and Oregon, on a purely cooperative basis, herds of cattle have been freed from abortion infection and it is within their areas that the field demonstration of the value of the agglutination test has accumulated the largest amount of data. Pennsylvania has 150 herds signed up under the Pennsylvania Plan, which has been in operation since 1920, 8 herds are certified Abortion Free, and over 300 additional herds are carrying out blood-tests for the diagnosis of abortion disease. Breeders are also advised, in connection with tuberculosis work when restocking after reactors to the tuberculin test have been removed, to restock with cattle free from abortion.
Bovine infectious abortion has been placed on the list of reportable diseases and tentative regulations for its prevention and control have been drawn up, a copy of which is appended to this report.

Missouri has tested, through the Experiment Station laboratory, over 900 herds of cattle and demands for this service are increasing because the value of the service is coming to be more appreciated.

Oregon, through its Experiment Station, has also done blood-testing work on a considerable scale in certain areas. Dr. B. T. Simms' work along this line has shown that separating reactors from non-reactors on the same farm is not a satisfactory means of controlling the infection.

New Jersey. Chapter 179 of the New Jersey statutes entitled "An Act to Prevent the Spread of Infectious or Contagious Abortion in Live Stock" constitutes the most advanced regulations for controlling Bact. abortus of any state in the Union. A copy of this law is appended to this report.* It has been in effect since March 26 of the present year. The following is quoted from Dr. J. H. McNeil's letter:

"We have tested quite a large number of cattle during this time, have either slaughtered or quarantined the reactors and accredited two herds that have met the requirements of the Board.

"We are handling the reactors by segregating them on separate farms, many of them several miles from the tested, or what we assume to be the clean animals. We consider this the most economic way of handling this disease. We have tested some very valuable cattle and many grade herds. The percentage of reactors varies considerably but the owners are not discouraged inasmuch as we are able to sell most of the reactors at a fair valuation, much higher than the ordinary beef value.

"They will be maintained on these quarantine farms, which are owned by private individuals, and either milked out and sent to slaughter or bred for future calving. Of course, we do not know just now how successfully this plan will operate but we have the confidence of the breeders and hope that it will meet with more than ordinary success.

"We have partially equipped and are now organizing a laboratory force to take care of this and other work pertaining to the Bureau of Animal Industry."

Montana. The reply from this state covers the question of abortion in range cattle and is discussed in some detail, because the same conditions prevail in a great deal of the Rocky Mountain and Pacific Coast areas.

All students of infectious abortion realize that the problem of control in range cattle is a much simpler one than that in dairy herds. Those with range experience have probably known instances where the disease has disappeared from this class of cattle under favorable conditions when no special precautions were taken against it.

The following is quoted from the reply of Dr. W. J. Butler:

"Under strictly range conditions we do not attempt to control by either quarantine or agglutination test, but we do endeavor to control it, and I believe with excellent results, by restricting breeding activities and endeavoring to prevent the breeding of any animal that has aborted until at least 60 or 90 days after the animal has aborted.

"It may be interesting to you to know that under strictly range conditions abortion has not as yet proved to be a serious condition. In fact I am of the opinion that true abortion disease in range cattle handled under range conditions is not of frequent occurrence. We attribute this greatly to the method in which bulls are handled. In Montana it is against the law to run bulls on the open range from January 1 to July 1. This means that during the calving period there are no bulls on the open range, and naturally very little breeding is done. We usually have the bulk of our bulls in pastures by the middle or end of October, and so from October to July 1 there is very little breeding. This applies to range cattle. Naturally it does not apply to homesteader cattle or to dairy cattle. I think that I am safe in saying that 90 per cent of abortion disease in cattle occurs in homesteader cattle or in dairy cattle.

"It is my opinion at the present time that more good can be accomplished under range conditions by restricting the breeding activities than can be

*To conserve space the text of this law is not being published. Copies may be secured by writing Dr. J. H. McNeil, State Veterinarian, Trenton, N. J. Editor.
accomplished by the agglutination or complement-fixation tests of blood from individual cattle. This does not apply to dairy cattle or to cattle kept under more or less close confinement.”

This report is given in order that observations of a similar nature may be made in other range states, and thus maybe render unnecessary attempts at costly measures which are difficult to carry out in these areas.

In conclusion, your Committee would like to suggest the following:
1. That in the large, dairy-cattle states, with much abortion infection, the possibility of stimulating the cooperative assistance of veterinary practitioners should be given careful consideration.
2. As the control of infectious diseases depends very largely upon reliable means to discover the carriers and disseminators of their prime causative agent, further studies to standardize the agglutination test for bovine infectious abortion should be made.
3. Those in charge of regulatory work should recognize that the abortion agglutination test is a procedure requiring an expert knowledge of laboratory technic to carry out and draw proper conclusions therefrom. It should not, therefore, be entrusted to inexperienced persons.
4. That the present year has been one of progress in the control of this disease. We hope that in the near future the only states doing nothing to control this disease will be those which are definitely known to be free from it.

PROCLAMATION
relating to
BOVINE INFECTIOUS ABORTION
(Bang Bacillus Disease)
Effective September 10, 1926

PENNSYLVANIA DEPARTMENT OF AGRICULTURE
Bureau of Animal Industry

Under authority of the Acts of Assembly approved July 22, 1913 and June 7, 1923, it is adjudged and proclaimed that the disease of animals variously known as Contagious Abortion, Abortions Disease, Bang's Disease, Bovine Infectious Abortion, or Bang Bacillus Disease; is of a transmissible character, and that:

Animals affected with or exposed to or suspected of being carriers of, said Disease, shall be subject to quarantine and the Rules and Regulations that shall be adopted by the Pennsylvania Department of Agriculture for the prevention, control and suppression of Bovine Infectious Abortion.

By DEPARTMENT OF AGRICULTURE,

F. P. WILLITS,
Secretary of Agriculture.

Done at Harrisburg, Pa.
September 9th, 1926.

Attest:
T. E. MUNCE,
State Veterinarian.

PENNSYLVANIA DEPARTMENT OF AGRICULTURE
Animal Industry Regulation
FOR THE PREVENTION, CONTROL AND SUPPRESSION OF
BOVINE INFECTIOUS ABORTION
(Bang Bacillus Disease)

Regulation No.
Effective 1926
Section I
Defining Bovine Infectious Abortion
(Bang Bacillus Disease)

Paragraph 1. Bovine Infectious Abortion, or Bang Bacillus Disease, shall mean the disease wherein any animal is infected with the Bang bacillus irrespective of the occurrence or absence of an abortion.
Paragraph 2. An animal shall be declared infected with Bang bacillus if it has given a positive reaction to the blood test or any other test for bovine infectious abortion; or if the Bang bacillus has been found in the body or its secretions or discharges; or if it has been treated with a live culture of Bang bacillus.

Section II
Restricting Infected Animals

Paragraph 1. Animals affected with Bovine Infectious Abortion as defined in Section 1 of these regulations or animals having symptoms, shall not be sold, given away or removed from the premise except upon express permission in writing from the Pennsylvania Bureau of Animal Industry.

Paragraph 2. Animals affected with Bovine Infectious Abortion as defined in Section 1 of these regulations or animals showing symptoms, may be placed under quarantine when such measure is deemed necessary by the Pennsylvania Bureau of Animal Industry to prevent the spread of said disease.

Section III
Importing Infected Animals

Paragraph 1. Animals affected with Bovine Infectious Abortion as defined in Section 1 of these regulations or animals showing symptoms, shall not be brought into Pennsylvania except upon written permit from the Pennsylvania Bureau of Animal Industry.

Paragraph 2. Animals imported on such permit shall be subject to quarantine and state regulation immediately upon their entry into Pennsylvania.

Section IV
Making Tests Reportable

Paragraph 1. All blood tests and all other diagnostic tests for Bovine Infectious Abortion shall be reported in writing within one week after such test to the Pennsylvania Bureau of Animal Industry at Harrisburg. Each such report shall be signed by the person who shall have made the test and shall contain a complete statement of the actual results of the test; a description, for identification, of each animal tested, and the name and address of the owner.

Section V
Control of Biologics

Paragraph 1. "It shall be unlawful for any person to manufacture for sale, or sell or offer for sale, any biological product intended for diagnostic or therapeutic purposes with animals, excepting upon specific permission so to do from the State Live Stock Sanitary Board (Pennsylvania Bureau of Animal Industry), or unless such product is officially endorsed by the Bureau of Animal Industry of the United States."

Paragraph 2. "No person shall inject into, or otherwise administer to, any domestic animal that is producing, or that is to be used as, food for man, any virus or other substance containing pathogenic or disease-producing germs of a kind that is virulent for man or for animals, excepting upon specific permission so to do from a member or authorized agent of the State Live Stock Sanitary Board (Pennsylvania Bureau of Animal Industry)."

Section VI
Sale and Use of Biologics

Paragraph 1. The holder of a permit to manufacture biologics shall report to the Pennsylvania Bureau of Animal Industry, Harrisburg, Pa., within one week, each sale of any biologic designed for the diagnosis or treatment of Bovine Infectious Abortion.

Paragraph 2. The holder of a permit to administer vaccine for the treatment of Bovine Infectious Abortion shall report to the Pennsylvania Bureau of Animal Industry, Harrisburg, Pa., within one week, a record covering each animal so treated; the name and address of the owner of the animal, and the name of the manufacturer of the vaccine used.
The motion to adopt the report was put to a vote and unanimously carried.

President Mohler: Gentlemen, there is going to be a banquet in this room and the management has kindly asked us to vacate. Therefore, the general discussion on abortion will take place promptly at nine o'clock tomorrow morning.

The meeting adjourned at 5:25 p.m. . . .

ADJOURNMENT

FRIDAY MORNING, December 3, 1926

The fifth session was called to order at 9:00 a.m. by President Mohler.

President Mohler: The unfinished business is the discussion on abortion left over from yesterday's program. I hope this important subject will be discussed freely. Who will start the discussion? If you do not wish to discuss this topic this morning, we will proceed to the first paper on the program, by Dr. T. P. White, of the U. S. Bureau of Animal Industry, Washington, D. C., "Report of the Hog Cholera Situation."

Dr. T. P. White read his paper. . . .

REPORT OF THE HOG CHOLERA SITUATION

Covering a Period from July 1, 1926, with Remarks as to Causes and Practices Involved

By T. P. White, Washington, D. C.

Bureau of Animal Industry, U. S. Department of Agriculture

This report of the conditions as they pertain to hog cholera in the Middle West, at present and in the immediate past, is intended not only to give a résumé of certain observations but to bring about among those present and having an interest in the situation a frank discussion that might assist in the adoption of definite plans to prevent in the future the recurrence of damages such as have occurred in the last six months.

Through a careful consideration of facts it is found that the hog cholera losses for the period, while considerable, will not be nearly so heavy as predicted early in the season. Conflicting rumors and reports have floated about, some claiming the destruction of hogs in larger numbers than in any other period of unusual prevalence. Through information gathered from various sources and on which may be based a fair approximate estimate, it is doubtful if the losses the present year will range much above 60 hogs per 1,000 in the states involved. To this, of course, must be added indirect losses from the shipping of unfinished hogs to market, the selling of brood stock and the depletion of reproducing animals on farms. In previous generalized outbreaks losses have been as high as 130 hogs per 1,000, actual destruction by cholera.
During October and a part of November a survey was made through Iowa, Illinois, Indiana, Nebraska, Ohio and Wisconsin. Interviews were had with state officials, veterinary practitioners, farm bureau representatives, extension workers, swine-raisers and others. Questionnaires were sent to all accredited veterinarians in Iowa, Illinois, Indiana, Kansas, Michigan, Missouri, Nebraska and Wisconsin. Table I is prepared from figures received through these questionnaires and includes the number of outbreaks, the number of hogs that have died from cholera, and the number of herds in which the disease made its appearance subsequent to treatment. It is not to be supposed that the information gathered in this way is exactly correct, but it serves as a safe basis on which to approximate the damages.

<table>
<thead>
<tr>
<th>STATE</th>
<th>OUTBREAKS</th>
<th>HOGS LOST</th>
<th>&quot;Breaks&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa</td>
<td>9,962</td>
<td>465,420</td>
<td>169</td>
</tr>
<tr>
<td>Indiana</td>
<td>7,771</td>
<td>380,000</td>
<td>189</td>
</tr>
<tr>
<td>Ohio</td>
<td>4,079</td>
<td>54,150</td>
<td>Not Given</td>
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<td>Nebraska</td>
<td>2,872</td>
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<td>99</td>
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<td>1,851</td>
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<td>20,762</td>
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<td>Illinois</td>
<td>7,159</td>
<td>275,771</td>
<td>345</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>34,787</strong></td>
<td><strong>1,338,258</strong></td>
<td><strong>954</strong></td>
</tr>
</tbody>
</table>

Several factors have contributed as usual to the spread of infection, some of which were puzzling and impossible to determine. It is quite evident that the large number of susceptible hogs on farms, in comparison to the number of herds immunized against cholera, created a fertile field for the disease to get hold. That, at least, was the "predisposing" factor.

It is a matter of record that weather conditions were bad in the early fall. A continued long period of heavy rains made the average hog-lot a lake of mud. The excessive amount of moisture in the soil made a good medium for the propagation of germ life. Hogs were exposed, in a greater degree than usual, to the many ills common to the swine species, such as necrotic enteritis, "flu," pneumonia, necrobacillosis and worm infestation. Under these conditions and without the protection of immunization the animals were an easy prey to the invasion of cholera infection. So much for what may be termed natural causes.
An economic factor crept into the situation. Owing to the limited demand for anti-hog cholera serum, the commercial laboratories had not been producing an over-supply, operating with sufficient force only to meet local orders. When the wave of cholera began to mount and the swine-owners were stampeded to the serum treatment, the product was not to be had in the quantities needed.

For several years there had been a diminishing interest, generally speaking, in the problems pertaining to the control of hog cholera in the field. True, the scientist, the sanitarian and the public official concerned in such matters had remained active in that phase of agricultural welfare, but on the farm and in the community, vigilance had become lax against the danger of hog cholera. And why? Because the disease had been causing fewer and fewer losses each year. There were those who predicted that cholera would never again interfere to any extent with the growing of swine. Some even advanced the theory that the immunization of successive generations of swine in the past had established a sort of natural immunity or increased resistance to the infection. In short, there had been engendered in farming and hog-raising sections a false sense of security.

The situation was rather puzzling to those acquainted with the nature of hog cholera and its history of unusual prevalence every ten or fifteen years. The ten-year period since the last destructive wave had passed. While sporadic outbreaks occurred from time to time there seemed to be no indication that a general flare-up and spread of infection was threatening. As stated, the serum-producers, in view of a small demand for their biologics, carried little serum surplus on hand. Then rather suddenly, and in the words of a veterinarian, who was vainly seeking for serum, "Hell broke loose and no pitch hot."

**Contributing Factors**

Throughout this outbreak there have been noted the usual number of cases of negligence and carelessness, the usual number of questionable practices, and the usual number of infractions of rules and regulations. We still have with us the farmer who refuses to immunize his hogs in the face of impending danger from cholera, who buys and uses so-called cures and preventives, who cares nothing about sanitation in his hog-lot, who brings infected hogs into his herd, who hides infection, who does not
burn or bury his dead hogs, and who will knowingly send diseased hogs to market.

We have the local dealer who runs amuck through the country, going from infected farms to clean ones, buying anything in the way of hogs that he can gather, sick or well, and herds them in feed-lots or yards that become reeking with infection. If a marketing center is near he transports these hogs, sick ones included, in trucks, sacttering infection on the way.

We still meet the irresponsible veterinary practitioner who does not differentiate between cholera and other diseases of swine when treating unhealthy herds, who cares nothing about the history of the case, who does not use a thermometer, who makes no postmortem examinations, who treats in the presence of disease other than hog cholera, who underdoses if his supply of serum is short, who uses virus after the expiration date, and who never, knowingly or unknowingly, recognizes hog cholera symptoms and lesions in herds that he has treated. This very factor has led to the movement for lay vaccination, another practice that has already been rather costly in certain sections.

Rumors had reached over the country that much profiteering was being done by serum firms and jobbers in biologics. In justice to these agencies it must be stated that with very few exceptions they have played fair. It is fairly authentic that commercial laboratories during the past two years had been quoting prices for serum considerably under the cost of production. No blame can attach to the firms that tried to recoup some of their losses. However, information is on record where figures of 44 cents per hundred cubic centimeters were quoted in June and $2.75 for the same volume of serum in October. Is that profiteering?

Another factor that has entered into the situation is the serum agent or jobber who is loath to admit the existence of cholera in herds that have been treated with the product he handles. I have met with cases, and have heard of many more, where such an attitude has caused the loss of a number of hogs. Admitted that there are instances where the infection is so mixed as to cause a doubt in announcing a diagnosis, I am speaking of clear-cut cases in which the symptoms and lesions are those that have been and are still universally recognized as being caused by hog cholera. It would seem to be good professional and business policy to be frank with a client at all times. When unmistakable symptoms and lesions of hog cholera are present, treatment for
other diseases is of no avail and only results in creating distrust in the minds of farmers regarding the ability of a profession and the value of biologics.

A Dangerous Situation

In connection with the shipping of diseased hogs to market there is another phase of the situation which bears calling attention to, a condition or practice which is deemed of the utmost concern to the general public. We have on file reports indicating that diseased hogs, inspected and so found by federal inspectors in yards where federal inspection is maintained, are allowed to be sold and taken to non-inspected establishments for slaughter. I wish to call special attention to 14 reports, Form I. D. 11C, sent in by Bureau inspectors from one stockyards only. They cover November 1 and 2, 1926.

On the first day of November there were received at this yard 11 shipments of sick hogs; one of 4 hogs, in which all of them were rejected on account of cholera; two shipments of 5 head each, all of them rejected; one of 11 hogs, all of them showing symptoms of cholera; and another shipment of 4, all of them sick. Here we have 6 shipments on the same date showing 100 per cent infection. On the same day a shipment of 15 head was received, in which 4 head showed cholera symptoms; a shipment of 83, in which 7 hogs showed symptoms; another of 27, in which 7 more showed symptoms; one of 34 hogs, in which 20 head were affected; still one more shipment, consisting of 20 head, in which 16 showed symptoms of the disease.

On the second day of November, 2 shipments of 11 hogs each were received, all of which animals were rejected on account of hog cholera, and a shipment of 32, in which 10 hogs were found affected with the disease.

These reports constitute but a small fraction of the volume received on this phase of inspection. It is noted in the cases mentioned that shipment was made by truck. No doubt the hauls were short, perhaps not over a day at the most. In view of this fact and that the percentage of visibly sick hogs at destination was very high, it seems evident that these animals were not any too healthy when they left the lots.

SOLD TO UNOFFICIAL ESTABLISHMENTS

Each form spoken of has a caption entitled: "Disposition of Carcasses," in which space is to be recorded the number of these
hogs passed for food, for lard and condemned. On the reports under discussion these spaces have been left blank, but on the margin of each form is the notation: "Sold to unofficial establishments." In other words, these hogs, filled with an infectious disease, and so determined by expert inspection, were allowed to be bought by slaughter-houses doing an intrastate business only, and where federal inspection is not tolerated. The reason seems obvious. It would be highly interesting to know how many of these pork chops went to the family tables of that state, instead of the fertilizer tank.

While these reports are from one stockyard only, the practice is engaged in at practically all stockyards where non-inspected houses are located. In some instances, sick hogs are loaded on cars and sent to other points where they may be sold in that way. This being an intrastate procedure, the Bureau is powerless to interfere, but it is hoped that the state officials concerned are in position to have a stop put to this practice. The right sort of publicity would no doubt enlist public sentiment in the curbing of these undesirable and dangerous methods.

SUMMARY

To summarize, the situation in brief is this:

1. Losses from hog cholera this year have been large.
2. There have been corresponding heavy losses from the shipping of unfinished hogs to market.
3. There is a depletion of swine breeding-stock on farms.

To avoid repeated losses in the future:

1. The farmer must renew his vigilance in guarding against the introduction of infection in his herd.
2. He must rely more and more on the immunizing treatment against hog cholera.
3. He must become public-spirited enough to assist in checking the spread of infectious diseases.
4. The veterinary practitioner is a potent factor in the control of animal diseases.
5. He must follow the teachings, the highest principles and ethics of the profession he represents, to the end that his services be of the greatest benefit to those whom he serves.
6. The public official entrusted with the safeguarding of domestic herds must see that the laws, rules and regulations promulgated for the welfare of the whole be impartially applied and enforced, with a view to protecting those who abide by the
laws against those individuals who, for selfish and personal gain, endanger the safety of the livestock industry.

President Mohler: The next paper in this symposium is "Post-Vaccination Complications," by Dr. R. R. Birch, New York State Veterinary College, Ithaca, N. Y.

Dr. R. R. Birch read his address.

POST-VACCINATION COMPLICATIONS
By R. R. Birch, Ithaca, N. Y.

New York State Veterinary College, Cornell University

I appear before you today, without apologies, to treat a well-worn subject. At the close of a particularly disastrous year caused by the ravages of hog cholera, we do well to take stock of certain elements which have contributed to the disaster, and to restate certain principles, half-forgotten, which still determine success or failure in handling the disease.

It is approximately correct to say that during the last decade there has been available to the swine-breeders of the country a plentiful supply of potent serum. During this decade, confident expectations have remained unfulfilled, and certain enthusiasms have cooled, leaving us with a residue of well-established facts, some of which are not altogether pleasant.

If we take the long view, it seems evident that we have leaned too heavily on one of the most effective weapons ever developed for the prevention of disease, that we have expected too much of it, and at times have allowed it to divert our attention from other weapons, equally effective, which may have been within our reach. We have used serum as a primary defense rather than as a secondary one, and at times have failed to use it plentifully for the latter purpose.

Some are disposed to cite this year's experience in support of the view that the use of serum in the field has exerted no very great influence on the year-to-year hog cholera curve. It has even been stated that the machinery for hog cholera control has broken down; that, in the natural course of events, a peak in the curve was in prospect about the year 1926; and that the use of serum has not prevented its appearance. We believe, though, that there are sufficient reasons for thinking that serum has modified the curve and held it partially in check, but it is a matter of common knowledge that certain failures associated with serum-virus vaccination, many of which were preventable,
have operated to spread, rather than to check, hog cholera. These failures and their causes furnish my theme today.

**COMING EVENTS CAST THEIR SHADOWS**

Much post-vaccination trouble is really pre-vaccination trouble. "Coming events cast their shadows on before," but if the shadows are unseen, the events find us puzzled and unprepared. For the most part, causes which determine serum failures have been in operation some time before the date of vaccination, and their presence could have been detected in advance by experienced men. In more exceptional instances, the approach of danger cannot be foretold and occasional disasters are, therefore, an integral part of any extensive vaccination program. They are not, as some regard them, a thing apart, and frank recognition of this fact is a step in the right direction. Potency in the serum used, and experience on the part of the veterinarian who examines the herd and uses it are tremendous factors in minimizing losses, but they will not prevent them altogether. If this truth could be universally accepted by veterinarians, serum-producers and swine-breeders, there would be a gain in mutual confidence. The veterinarian would not be embarrassed by calls for explanations which do not explain, the serum-producer would not be tempted to make claims which sometimes fail to materialize, and the breeder, recognizing the element of danger in all serum-virus vaccination, would handle his herd so as to minimize this danger.

Before we consider some of the more specific causes of serum failures, it seems well to emphasize one more governing principle. Training and experience on the part of the man who uses simultaneous treatment are essential, but these qualities must be supplemented by habitual carefulness, both in making herd examinations, and in vaccination technic, or they become, in effect, partially or wholly nullified. The qualified veterinarian who accepts responsibility in handling hog cholera does more than use a hypodermic syringe. He handles a situation. The element of judgment is essential, and this, in turn, rests on training and experience. A novice is born every minute, but training and experience are products of a slow, exacting and painful process.

And at this time, it seems fair to ask those who are in the districts which have suffered most this year, whether they have always protected the interests of the specially trained men in
their communities, and whether they have habitually enlisted their aid and followed their advice. Have they made it a prac-
tice to employ these men in order to avert disaster, or only as a last resort, in the forlorn hope of obtaining salvage?

**THREE CLASSES OF TROUBLE**

Post-vaccination trouble is divided into two general classes: First, that which occurs during the first three or four weeks following vaccination, the so-called “serum-break”; secondly, that which appears subsequent to the fourth week following vaccination, the “virus break.” These classes, for the most part, are referred to causes entirely different, and thus they merit separate consideration.

Serum breaks occur principally when low resistance in the individual co-exists with the reaction which normally follows serum-virus administration. This low resistance, as we have already said, often grows out of influences which are in opera-
tion on the date of vaccination, or on those which could be entirely avoided by prudent measures outlined at that time. It is well, in this connection, to bear in mind that there exist other diseases, often sub-virulent in character, and more or less obscure, which, in themselves, are somewhat dependent on a decline in resistance such as is brought about by serum-virus treatment. The course of these diseases is in no way checked by vaccination; so all diseases following simultaneous treatment against hog cholera cannot properly be charged to the virus employed. But, in the main, when febrile disease occurs in a considerable percentage of a herd between the fifth and twenty-first days following serum-virus treatment, the virus is a contributing factor, either as a primary cause or merely as the “straw which breaks the camel’s back.” In other words, the disease would not have occurred had not the virus been administered and, for the most part, it is hog cholera, with or without complications.

It is, therefore, a safe principle that the administration of serum and virus, at a time when any devitalizing influence is to be brought to bear during the reaction period, always invites unnecessary disaster. Inexperience says it can be done, and proves its point—temporarily—but experience knows better. When trouble sets in, inexperience cries, “Impotent serum,” but experience seeks other causes as well.

Among the more common cause of serum breaks are: heavy parasitic infestations, particularly with ascarids and lung worms;
necrotic enteritis, necrotic stomatitis, the so-called hog "flu," various pulmonary disorders, late stages of pregnancy, shipping, weaning, castrating, exposure to inclement weather during the reaction period, low state of nutrition, injudicious feeding, chasing or rough handling incident to treatment, and hog cholera in the incubation period at the time of vaccination.

**SIGNS NOT TO BE IGNORED**

These influences may operate singly or in combination, and perhaps, unfortunately, some of them may be ignored repeatedly without disaster. But, if they are ignored consistently, they take their toll, and serve to spread hog cholera and to break down confidence in vaccination. A history of recent shipping, an anemic pig or one with jaundice, an ascarid on the floor, a tell-tale cough, a sow heavy with pig, left-over feed in the trough, or any sluggishness or unthriftiness in individuals are danger signals, and the experienced man recognizes them as such and acts accordingly.

Very young pigs are exceedingly sensitive to some of the influences we have just named, and while they are perhaps even a trifle less sensitive to hog cholera virus than is the older shoat, they often become better subjects for serum-virus treatment after they have left behind some of the influences which are especially harmful in baby pigs. Economically, a pig badly stunted is about the same as a pig killed, and vaccination results are best judged on the basis of the proportionate number of thrifty, permanently immune individuals that emerge from the treatment. The word *death* does not describe all post-vaccination trouble.

Potency of the serum used is, of course, an all-important factor in its relation to serum breaks, but we mention it last because we believe that as things are now ordered, impotent serum is in reality a minor factor in comparison with some of those we have already mentioned. The well-directed supervision which the Bureau of Animal Industry exercises over serum laboratories; the character of the firms in the business; the bid for confidence in his products which the serum-producer must constantly make in order to survive in a business way; and the knowledge that in case serum is actually impotent, numerous bottles of it may remain in the hands of his clients, as evidence; all are safeguards which serve a good purpose.

We believe there is good evidence that a two-year date-limit.
on serum is responsible for some serum breaks, and we have been led to wonder whether some of the remote distributing points are carefully checked regarding the manner in which they store their products, and in the matter of outdated serum and virus. Sufficient serum dosage is always indicated when hogs known to be slightly below normal in resistance are to be vaccinated, but a little extra serum is in no way a safe substitute for care and skill in detecting and appraising potential danger.

**Virus Breaks in the Minority**

Virus breaks, or hog cholera, which appears in from one to several months after simultaneous treatment has been administered, have not the sanitary importance associated with serum breaks because, numerically, they are far in the minority. Often, though, they cause very heavy losses in individual herds, for the supposedly immune hogs die as they approach maturity, at a time when they are of considerable value.

Virus breaks are caused by inert virus, and the supposition is, by that which is attenuated, or by insufficient dosage. At any rate, so far as the virus itself is concerned, the veterinarian who uses due care in preserving and administering it does all within his power to establish permanent immunity in the pigs he vaccinates. Provided no disease develops during the first month, obscure qualities of the pigs, or of the virus itself, determine the duration of the immunity.

The producer is responsible for the virus he distributes, but he has no safeguard in the way of a test comparable to that which is applied to serum. He depends entirely on his knowledge of his seed virus, and on the history and autopsies of his virus pigs. These indications being satisfactory, it is assumed that the virus is virulent and that, properly preserved and handled, it will remain virulent sixty days. Perhaps consistent laboratory tests on the expiration dates might explain some virus breaks which now occur, and forecast others. We know, of course, that sixty-day virus is usually virulent, but each day that passes adds its quota, however remote, to the danger associated with its use. All in all, the fresher it can be used, the better.

Virus breaks have been persistently associated with baby-pig vaccination, both in the field and in experimental work. We know of no investigator who has done extensive work on the duration of immunity following serum-virus vaccination of very young pigs, who has not encountered them, even when carefully
controlled virus, which would have been used in the field without hesitation, has been employed.

During many years of active work with hog cholera in New York, in which we made it a universal rule to place a ten-day limit on virus and give serum-virus treatment only after the pigs had reached an age approximating twelve weeks, we did not have a virus break in the immediate herds treated nor do we remember a report of one by any veterinarian in the State who followed the plan. The herds were fed mostly on city garbage, and perhaps the more or less constant exposure to virus reinforced their immunity and accounted for the result, but we have observed a limited number of virus breaks in similar herds vaccinated as baby pigs. One of these which resulted in many deaths involved feeders of the 1924 crop and, in the same herd, sows vaccinated as baby pigs and kept over from the previous year.

**Experimental Data Summarized**

If we use the collective experimental data published so far, we may derive these essential facts.

1. Most baby pigs obtain lasting immunity as a result of serum-virus treatment.
2. There have been enough exceptions to the rule to cast the most serious doubts on the advisability of the plan as a routine measure in the field.
3. These conditions obtained when the virus was carefully prepared and checked, was virulent when used, and would have been used without hesitation as field virus.
4. Individual batches of virus produced lasting immunity in some baby pigs, and failed in others.
5. There are, therefore, causes independent of the virus—either inherent qualities of the pigs, themselves, or obscure conditions relative to their surroundings—which sometimes account for the lasting immunity in some individuals, and its absence in others vaccinated with the same virus.
6. Similar definite experiments with older shoats were not conducted, an all-important omission.

Pending further investigations and field trials, we must regard as unfortunate any interpretation which neglects to average successes with failures in all cases in which deficiencies in the
virus cannot be determined by tests made at the time it is used; which tends to deny individual differences in pigs as a factor in the duration of the immunity established, or causes veterinarians to regard as immaterial the dangers associated with the routine use of virus on young pigs.

The investigators have rendered a very valuable service in showing that the dangers of baby-pig vaccination are not so great as many, among whom the writer includes himself, had supposed them to be.

At present, there are balanced against the obvious advantages, which may ultimately attach to baby-pig vaccination, the dangers (deaths and stunting) which surely will beset a considerable percentage of them kept under rather adverse circumstances at the time of vaccination, together with the comparative uncertainties that still surround the duration of the immunity which their vaccination affords. Field trials are in prospect and should be carried out, but it is prudent to remember that we are moving from methods known to be imperfect but excellent, in the direction of uncertainty, and in the field it is well to move with caution. The breeders' confidence in such a product as anti-hog cholera serum is well worth preserving.

**Sanitary Significance of Breaks**

In conclusion, we wish to refer briefly to the sanitary significance of post-vaccination disease. That which is hog cholera, of course, spreads virus, and we know perfectly well that as long as circumstances require us to use serum and virus extensively, the latter occasionally will get out of bounds and operate alone. For this reason, we do wrong to extend a program of serum-virus vaccination beyond the limits marked by serious and definite threats to the herds involved. Local conditions, both as regards the herd and the district, must be the governing factor in appraising this danger. But, if we do wrong to use serum-virus vaccination where the danger from hog cholera is remote, we are equally in error when we fail to use them consistently and carefully where the danger is great.

We have considered principally serum failures, but our problem does not begin and end in considerations growing out of the manufacture, sale and use of serum. In this country we have three great sources of primary outbreaks:

1. Shipping of infected hogs, especially those from large stockyards.
2. Pork trimmings, both from products of large packing-houses under inspection and from slaughter-houses in which there is no inspection.


In districts with a dense swine population, the primary outbreaks may be smothered, numerically, by those which are secondary. In districts which are more sparsely populated, the primary outbreaks and their causes stand out, but everywhere the primary outbreaks furnish the seed.

Fundamentally then, we can reduce need for vaccination only by persistent pressure on the three great arteries of dissemination which we have named, and ways to exert this pressure are worthy of the best thought of this group of men. The logical place for serum is to fill the gaps unavoidably left by the best control measures which can be devised. For this purpose, it should be used plentifully and consistently, but only by trained and careful men, who know the dangers associated with serum-virus vaccination and how best to avoid them.

PRESIDENT MOILEEH: The next paper is by Dr. Adolph Eichhorn, of the Lederle Antitoxin Laboratories, Pearl River, N. Y.

Dr. A. Eichhorn read his paper.

PRINCIPLES WHICH SHOULD GOVERN THE COMMERCIAL PRODUCTION OF ANTI-HOG CHOLERA SERUM AND VIRUS

By A. EICHHORN

Pearl River, New York

With the discovery of the cause of hog cholera by Dorset, McBride and co-workers and the subsequent development of the preventive treatment by the same investigators, a new phase of effectively controlling hog cholera has been established.

The early experimental work has definitely proved that the injection of a potent anti-hog cholera serum will produce a high degree of immunity in susceptible hogs and that following vaccination they will resist tremendous infective doses of virulent virus. After this fact had been conclusively established, demonstrations of this effective treatment were conducted before live stock sanitarians. The great advantages which would accrue from the general adoption of the preventive treatment were immediately recognized, not only throughout the United States
but in all other countries where hog cholera constituted the most important of swine diseases. Therefore, the problem of producing this product in a way which would insure its potency at a sufficiently low cost to justify its general adoption was the next step to be considered.

As a matter of fact several states, recognizing the great importance of providing hog cholera serum and virus, immediately took steps to establish laboratories for the production and distribution of these products. The limited output of the state establishments, however, soon proved insufficient to meet increased demand for serum, especially during outbreaks of the disease. Besides, those interested in the development of the hog industry have rightly recognized the great advantages which would come from the general adoption of such preventive vaccination and, following the educational work conducted by the representatives of the Bureau of Animal Industry and state live stock sanitary officials, such a demand for this product resulted that numerous commercial laboratories were established.

Thus the production of anti-hog cholera serum proceeded with very rapid strides and as at that time there were no regulatory measures for the control of the manufacture of this product it is only natural that many inconsistent results followed its use, causing failures in the field due to impotency of the serum and likewise resulting in direct losses from the injection of contaminated material. Recognizing these facts the authorities undertook a survey of the prevailing conditions, with a view to promulgating regulations which would insure a potent and safe product.

SERUM PRODUCED UNDER GOVERNMENT SUPERVISION

The United States Bureau of Animal Industry accordingly prepared regulations which not only embraced the requirement for proper sanitation of the establishments but at the same time provided for an effective supervision over the entire manufacture of anti-hog cholera serum and virus. From time to time it was found necessary to amend these regulations but their fundamental principles are still in effect. The importance of such regulations can be readily appreciated when it is considered that prior to their adoption it was not an unusual thing for an individual to embark upon the manufacture of anti-hog cholera serum in an old barn, without the necessary equipment and without means towards even the fundamental requirements
for proper sanitation. Virus hogs were frequently selected from shipments to stockyards which were considered to be affected with hog cholera. The bleeding of such virus hogs was often conducted in drive-ways or other out-of-door places. No post-mortem was conducted to establish that the animal from which the virus was taken was actually affected with hog cholera. Of course with the inauguration of the regulations these conditions were immediately eliminated and the production of anti-hog cholera serum was placed under control which materially prevented the distribution of impotent and contaminated products.

The effective control maintained by the Bureau of Animal Industry over the production of anti-hog cholera serum and virus was well proved in the recent outbreak. The great demand for the serum soon exhausted the available tested supply and the Bureau authorities, realizing the urgent need for additional supplies of these products, first reduced the time required for conducting the potency tests. The continued shortage, however, necessitated the entire elimination of the potency test during the great emergency. The Bureau, realizing the advantages of releasing the maximum amount of serum in the shortest possible time under the existing conditions, felt that with the control exercised during the entire production of the serum and virus, the potency testing, constituting only one phase in the control, could be eliminated and still a sufficient safeguard given to the users of the serum. As a matter of fact this step was subsequently justified, as a result of which the time required for the serum production and distribution was materially shortened.

PRESENT TEST NOT SATISFACTORY

With the uniform control over the establishments of the Bureau of Animal Industry, it is generally claimed that the serum produced in the various laboratories should be considered to possess the same value. While there is no doubt that all serum manufactured under the control of the Bureau of Animal Industry must be potent, yet one should not lose sight of the fact that there is a possibility of a considerable variance in the products, not only as to their potency but also as far as their purity and general physical make-up are concerned. If a test could be developed which would accurately establish the potency of anti-hog cholera serum on a unit basis, as, for instance, in tetanus or diphtheria antitoxin, it would be possible to determine accurately the immunizing value of a given quantity of
be bled. After defibrination of such blood it should be rapidly chilled to prevent the multiplication of any microorganisms present.

Hogs selected for hyperimmunization should have been vaccinated for at least sixty days prior to the hyperimmunization. The experimental work of Dr. Dorset and his coworkers has conclusively proved that such immunized hogs respond more uniformly to the injection of the virus in producing a potent serum than animals which have been vaccinated for a shorter period of time.

The hyperimmunized hogs should remain in perfect health during the time they are bled. The blood obtained from the hyperimmunes should be handled with as little exposure to the air as possible; likewise all utensils, apparatus and instruments coming in contact with the blood should be clean and sterile. The rapid chilling of the blood is again an important factor, as it is well known that while the phenolization of the blood may retard the growth and kill many of the contaminating microorganisms present, it will not sterilize the blood and therefore there is a possibility of danger to the animals vaccinated with the same.

**RED BLOOD CORPUSCLES VALUELESS**

While the defibrinated blood from the hyperimmunized animal contains all the immune bodies, it is also a well-established fact that the red blood corpuscles therein are inert. Whole-blood serum has certain disadvantages over a clear serum and therefore this product should be discarded in favor of the clear serum. While the manufacturers apparently recognize this fact and the production of clear serum has been greatly increased in the past few years, the whole-blood serum should be entirely eliminated and substituted with the more refined product. Veterinarians should also recognize this fact and if they would impress their clients with the advantages of a clear serum the manufacturers would no doubt cease to produce the product which has many disadvantages and no advantages.

Likewise the so-called built-up serum should also be considered as a product which should not be produced by any manufacturers. There is no advantage in adding salt solution to the clear serum in order to increase the volume which, when carefully considered, can have only one purpose and that is either to reduce the price for commercial competition or otherwise to deceive the user of
anti-hog cholera serum. The test which is now applied, however, can be considered only as a relative test at best, establishing that a certain quantity of anti-hog cholera serum will effectively protect a hog of a certain weight against a fatal dose of virus. Until such a test is developed, the manufacturer is entirely dependent upon the care of selecting virus pigs for hyperimmunization purposes, the technic employed in the various phases of production, and in the proper care in keeping and distributing the serum.

Therefore, it is apparent that while anti-hog cholera serum is recognized as giving excellent results in its application in the field, the scientific development of the production and especially the standardization cannot as yet be considered as completed.

One of the most important factors to be considered by the manufacturer is the procuring of effective virus for hyperimmunization purposes. While the requirements stipulate a definite quantity of virus blood for hyperimmunization purposes, we cannot lose sight of the fact that the quantity of virus in the blood of infected animals must vary considerably. With such variance of active virus in the blood, the stimulation of antibodies in the hyperimmunized animals must be necessarily also affected in the hyperimmunized hogs. It is true that actual experience has shown conclusively that serum produced under the present regulations, when batched, will as a rule protect in the quantities prescribed by the regulations, yet there is a possibility of tremendous discrepancies of immune bodies contained in the different lots.

REQUIREMENTS FOR HYPERIMMUNIZING VIRUS

The potency of the serum accordingly depends in the first place on the amount of virus contained in the blood used for the hyperimmunization. With this in view the greatest safeguard must be placed on the time of bleeding the infected pigs which produced the hyperimmunizing virus, especially so since it has been definitely established that in certain stages of the disease the virus gradually disappears and at such time the secondary infections become predominant. It is likewise essential that the virus-producing pigs should be of a type and size which, upon artificial infection, will promptly and more or less uniformly develop the disease in an acute form. They should show a gradual rise in temperature, reaching its height approximately the seventh or eighth day, at which time they should
the product. Thus it is evident that all manufacturers should aim towards producing only one type of serum and in doing so should concentrate their efforts towards the quality of the product.

The commercialization of the production of anti-hog cholera serum has not been conducted on sound business principles and in the presence of the keen competition which has existed in the past, it is only natural that the high principles which should be followed in the manufacture of such an important product have been disregarded at times.

Anti-hog cholera serum production, which must be considered quantitatively as the greatest industry in the biological line, should never be allowed to suffer on account of lack of confidence in the product. The actual experiences with hog cholera vaccination should impress every hog-owner with the absolute necessity of protecting the hogs against cholera through preventive inoculation. If such practice would be generally adopted, outbreaks as have occurred in the past and especially the present outbreak would have been eliminated. A more or less general practice of vaccination carried out year after year would establish a permanent guide on the amount of serum necessary to supply the demand.

**Systematic Vaccination Desirable**

It is difficult to estimate the total losses which resulted from the present outbreak and it can be safely assumed that the fundamental cause was the great reduction of vaccination year after year, resulting in a higher susceptibility of the hogs to cholera. On the other hand, if systematic vaccination had been practiced, conditions could not have existed for an extensive outbreak of this kind. Besides, the vaccination of small pigs, conducted with regularity, would reduce the cost of the vaccination and for such purposes commercial manufacturers could always have a sufficient supply available. With the surplus which would necessarily always be available, limited outbreaks would always be readily controlled and with the possibility of an intensive production of serum, a shortage as has existed this year would never occur. Thus it behooves veterinarians and livestock sanitarians to impress owners of hogs with the advantages of regular vaccination of pigs, which would not only assure them against losses but would also eliminate the possibility of such shortage of serum as has existed in this outbreak.

There is no product known which can be relied upon to afford
animals such a solid protection as the simultaneous treatment against cholera. It is further known that cholera is by far the most destructive disease of hogs and therefore vaccination against this disease would eliminate the greatest source of danger.

The commercial interests, on the other hand, should aim to maintain the highest standard possible for anti-hog cholera serum and virus, in order that absolute reliance and dependence may be placed in them. At the same time the commercial production of anti-hog cholera serum has made wonderful progress, as the result of which a reputation for the product has been established not only in the United States but also in foreign countries.

DISCUSSION

PRESIDENT MOHLER: You will recall we are now working under the new constitution and by-laws, and the Executive Committee is composed of the ranking representatives of the states in good standing. Dr. Dyson read out the names of those states which paid their dues and which are therefore members of the Executive Committee. In addition, the Department of Agriculture of Canada has a representative, and also the Bureau at Washington. The new by-laws provide that the first vice-president shall act as chairman of the Executive Committee. Unfortunately Dr. Simmons, our first vice-president, is not in attendance, so the acting chairman will be the next vice-president present.

In addition to the names Dr. Dyson read off, two other states have made their payments, so that Colorado and Massachusetts are additional states that will be represented on the Executive Committee:

Proceeding with the program, I wish to introduce Dr. J. W. Connaway, of the University of Missouri, Columbia, Mo., who will speak to us on the subject of "The Function of the State Serum Plant."

... Dr. Connaway read his address.*

DR. J. W. CONNAWAY: Now the point arises, has the state serum plant today any function? Has it any use? Should we close it up? Some states have done that. Some of the states I have mentioned have closed their serum plants. Some of them have done that, but they have adopted a system of buying large quantities from commercial plants, acting as distributing agents for those plants. I think the only states that have serum plants now are Missouri, Kansas, Arkansas, Alabama, New York, and I think Ohio also.

I wrote to several of the men who are in charge, to find out their attitude or what they think about it, and in every case I find that those who are actively operating serum plants and those who are distributing feel that they are doing a good service and possibly an essential service for their particular states, and perhaps, too, doing a service to the serum-production work as a sort of stabilizing influence on prices; though I think the competition between commercial companies is a factor which keeps down prices to as low as they can be kept. No state serum plant can compete with the commercial plants in the cost of production, because they do not produce a large enough amount to do so. But even if they do not, there is in sense a stabilizing agent which helps to convince the man who uses the serum, the farmer who pays for it, that he is not paying too great a price. If he can get that serum from some other concern at a lower price than he can get it from his own state serum plant, he feels he is not being gouged.

As to the future policies along this line, I do not know just what they will be. In my own state I know there are farmers who do not use our

*Manuscript not received for publication. Editor.
serum; they employ their local veterinarian who uses commercial serum because the commercial men can get it for him at a lower price than he can get it from us, yet prays we will not close our plant for fear the commercial interests might raise the price to a point that it would be exorbitant. They all feel that even though these plants do not produce very much serum, there is equipment there that is worth while keeping in operation for the purpose of producing a certain amount of serum to be ready for use in emergencies.

We found that in this emergency we did render a large service to Missouri. We were selling this to veterinarians and to the swine-producers because under the law we could do nothing else. In the establishment of our plant it was specifically stated that this was to be produced and furnished to the swine-raisers at cost. The veterinarian was not mentioned, but we have given a liberal interpretation to that law in assuming that the legislators meant the service that was given to those swine-raisers in the best possible way. We do not discriminate against veterinarians. We had to discriminate a little bit this time in refusing to let some veterinarians have our total quantity at one time. We could have sold out our whole output in a day if we had not been a little prudent; so we cut down our orders to the very minimum so that it would spread and serve those men who were in need. In that way and through our letters to veterinarians and swine-raisers we attempted to prevent the waste of a lot of serum that could have been used to better purpose if it had been judiciously distributed.

In Kansas they have conditions something like those in parts of our state, where there are no veterinarians or where they are a little difficult to get at. They have to distribute very much in the manner in which we do in our state. There is probably this advantage, however, in that serum in Kansas is distributed only to men who are authorized to use it by the State Live Stock Sanitary Board. In our state we send it to men who call for it without any restrictions whatever. Fortunately this has gone to men in sections of the State where it had very little competition with veterinary practice and where men have developed from force of circumstances the ability to use that serum and virus in a satisfactory manner.

There are twenty-six counties in our state that do not have veterinarians; some of those counties do not even have county agents. From that section where we have supplied the greatest amount of our serum and where those men have learned that this is good insurance, we have had less calls for serum than from those sections where the veterinarians have been. I mean there has not been any increase, indicating that consistent practice of trying to take care of their hogs must have been of some value in the immunizing of the hogs in that region. This is one of the surprises. We expected a great outbreak to occur right down to the Ozark counties where we had been supplying the serum, but there was not any great increase. That, I think, is a good demonstration, although it was done by laymen, of the value of the proper use of serum. Perhaps it is not the proper use in the sense that our professional men use it, but the consistent use on certain farms of that very important immunizing product has had some effect.

Hog cholera is an eradicable disease just as much so as Texas fever and tuberculosis. In fact, I think it is easier to eradicate than these other diseases, and with a right organization connecting up the proper use and production of this immunizing agent in connection with proper regulatory measures and proper educational measures, today we wouldn’t perhaps be discussing the matter of this outbreak that we have had.

But we have conditions and not theories to contend with. It is here with us, and the federal government is doing its best to control not only hog cholera but also this serum production. Its biggest job has been in the past the control of the production, and in suggesting ways and means of improvement of production.

I think, however, that lots of credit should be given to the commercial producers for improvements which have been vastly effective in the improvement of the quality and the quantity of this material. Those men who are engaged in this work, who are guided by high ethical principles, are to be commended for the good work they have done. Fortunately, in this work
I believe there are only a few men of the other kind who are disturbing factors in this matter. (Applause)

President Mohler: The next part of the program is the report of the Committee on Diseases of Swine, by the chairman of the Committee, Dr. C. H. Stange, Dean of the Division of Veterinary Medicine, Iowa State College, Ames, Iowa.

... Dr. Stange read the report. ...

REPORT OF COMMITTEE ON SWINE DISEASES

Dr. C. H. Stange, Chairman, Ames, Iowa

Dr. M. Dorset, Washington, D. C.  Dr. R. R. Birch, Ithaca, N. Y.
Dr. H. J. Shore, Fort Dodge, Iowa  Dr. C. H. Hays, Lincoln, Nebr.
Dr. E. A. Cahill, Indianapolis, Ind.  Dr. Adolph Eichhorn, Pearl River, N. Y.
Dr. J. W. Connaway, Columbia, Mo.  Dr. H. C. H. Kernkamp, St. Paul, Minn.

Your Committee on Swine Diseases is restricting its program and report this year quite largely to hog cholera. This is done not because there are no other diseases of importance to the swine industry, but because hog cholera is the most important and has likewise been unusually prevalent during the past year.

The Committee has not attempted an exhaustive study of all of the reasons for this increased prevalence, but we believe that two factors should be given special consideration by the state regulatory authorities.

While complete and satisfactory explanation for the more or less periodical increase in hog cholera is not now available, we recommend that more general vaccination of young swine, as early as practicable during the season, be encouraged as one means of preventing extensive outbreaks.

The insistent demands on the part of swine-owners for the application of anti-hog cholera serum, whenever their herds are in danger, is testimony of the confidence swine-breeders have in this agent as a preventive against hog cholera. It is important, therefore, that an adequate supply be available, more especially in emergencies. In our judgment, a state-operated serum plant would in most cases not solve this difficulty, which was quite acute during the season just passed.

We suggest that one of the methods by which this emergency supply might be maintained is as follows: The larger swine-producing states should arrange contracts or agreements with responsible serum companies, requiring such companies to carry a reserve which would be deemed sufficient to meet emergencies whenever they arise. The states should pay a satisfactory fee for this service. This plan would obviate the necessity of asking legislatures for large sums of money with which to buy a stock of serum, which could not be kept in a satisfactory condition without considerable trouble and expense.

Complications or breaks following vaccination continue to be a source of considerable trouble, and are undoubtedly due to several factors. More care in the feeding and management of the herd, at the time of and soon after being vaccinated, would remove many of such troubles, and we recommend that a greater effort be made by veterinarians generally in the instruction of swine-owners in regard to proper feeding and management, more especially at this time.

The immunization of stock hogs still seems to be in an unsatisfactory condition. It is not readily apparent, however, just how this can be remedied, and we suggest that this question be given further study.

Your Committee believes that hog cholera should be made a reportable disease in all states, and that more accurate data should be gathered and kept by the various states in regard to the prevalence of the disease.

While the cases of profiteering on the part of either the serum companies or the veterinarians during the last emergency were comparatively few, we nevertheless recommend that this Association go on record as condemning such practices, and suggest further that veterinarians patronize such concerns as did not take an unfair advantage of the situation.
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Finally, we believe there should still be a great deal of educational work done in connection with hog cholera. This could perhaps be best accomplished by establishing demonstration areas where not only immunization but sanitation, herd management, etc., could be demonstrated in a practical and impressive way.

These various suggestions and recommendations are respectfully submitted for your consideration.

PRESIDENT MOHLER: Gentlemen, you have heard the report of the Committee on Swine Diseases. What is your pleasure?

DR. E. T. HALLMAN: I move the acceptance of the report and that it be referred to the Executive Committee for their action.

The motion was seconded, put to vote, and carried unanimously.

DR. M. DORSET: I did not get here early enough to hear all of the discussion, but I have heard enough to know that the subject has been very thoroughly covered. I really feel there is very little that I could add to it. One thing that I suppose we have all been interested in is the cause of this sudden flare-up of hog cholera, the sudden wave of prevalence of hog cholera this year, after a period of some twelve or fifteen years had elapsed since the last serious outbreak.

I have heard it attributed to a good many things, to failure to immunize, to the flood conditions in the Middle West, and to various other things. Personally I am inclined to doubt all of these explanations. In the fifteen years that have elapsed since the last great outbreak of hog cholera, there has never been a time when more than a very small percentage of the hogs of the United States were inoculated. There may have been fewer treated in the last year or two than previously but there is something mysterious, it seems to me, about the sudden outbreak of this disease after years of quiescence.

We had a great outbreak in 1887; then the records of the Department show the next great outbreak was in 1897. Then there was a long period of quiescence, with another great outbreak in 1915. Then history repeated itself; the losses dropped. We went along, and in 1926 we again have a period of increased prevalence. Of course, we haven’t figures yet to know how serious this present outbreak was, as compared with others. I believe that all hogs properly immunized in the case of a great outbreak like this will be protected, but I do not think enough have been immunized really to affect the situation very materially.

Influenza is another disease that resembles hog cholera. It comes in waves. In studying hog cholera years ago and comparing the losses with those in England where they slaughtered in the case of every outbreak, we found the English prevalence coincided almost exactly with the prevalence in the United States, except the great losses there seem to precede the losses in the United States about one year. Their curve of losses was almost identical with the curve of losses in this country.

I think there is a great deal with respect to the epidemiology of such diseases as hog cholera that we do not know at all as yet. I think we will have to recognize that we cannot expect to eradicate hog cholera by the use of serum or by vaccination. This is not an agency to be used for that purpose; it is not to be used to eradicate it, but to control the losses from it. That is the particular function, as I see it, of anti-hog cholera serum—to control the losses from the disease.

Ten years ago I expressed the opinion that anybody who led the farmer to believe that hog cholera was going to be eradicated by the use of serum was making a mistake, because the farmer was going to be disappointed. We have, however, a means of preventing losses. We can prevent those losses with serum. We can perhaps do something by proper sanitation and quarantine measures.

It seems to me in view of the emergency this fall, the apparent unpreparedness of the officials, of the farmers, of the serum plants themselves to meet this emergency, something should be done to bring about a state of real preparedness to meet such an emergency.
I hesitate to offer a plan. I would suggest a plan only tentatively. Dr. Stange in his report has already mentioned that you will never be able to do much in the way of preventing losses from hog cholera unless the farmer knows the disease. In the second place, unless he is willing to cooperate and to help his neighbor and unless the farming community is so organized that each farmer will feel, when his hogs get sick, that it is his duty to go around the neighborhood and tell his neighbors or to notify them by telephone and to notify the proper sanitary officials immediately, you will not be able to do much. You have to have a community of that sort if you are ever going to get control of the disease. In other words, you have to have the disease reported. When it is reported, if you are going to save the hogs of that community you have to have some serum to give those animals in herds where the disease appears, and it has to be given to them right away. I do not think it would do very much good in the case of an outbreak of hog cholera in southeastern Iowa to have the serum stored in Sioux City, even though there were the greatest abundance of it. I think the farmers' hogs would be dead before you could get the serum there, or if not dead at least so far gone you could do nothing for them.

It seems to me that what is needed is the establishment in some place of serum depots scattered all over the Corn Belt states. They should be maintained and stocked so when the serum is withdrawn by veterinarians (they could obtain their stock from the depots), it should be immediately replaced so that there is a reserve always there. If such a thing had existed in the West this past fall, I am sure the losses from hog cholera would have been enormously reduced. You would have the stock of serum to meet any ordinary emergency. Of course, you have to have the skilled men to administer the serum.

It seems to me we have a means to control these losses and that this past year we did not make very good use of it because of failure to make suitable plans in advance.

To do anything such as I have suggested requires the cooperation of an enormous number of individuals. Of course, such cooperation is very difficult to secure, but I am satisfied that the states of the Middle West have to look forward to, perhaps next year, another big outbreak of hog cholera.

The statistics of this disease show that immediately before and immediately after the peak, the losses are pretty high. Perhaps this year was not the peak and maybe the disease will be worse next summer; at least you have to take that into consideration. You have got to remember that and make such preparation as you can in the meantime. I think it is a question that is worthy of the closest and the sincerest study by the farmers, officials and all veterinarians. (Applause)

DR. CAHILL: Mr. Chairman, it requires quite a good deal of temerity to attempt to discuss so many papers covering one subject. I think there are one or two things one might speak on to good advantage. The first is that it is quite apparent we have been living in a fool's paradise. The rest of the world looked at the United States and said, “You control hog cholera in your country so wonderfully! Tell us how you do it.” I don’t know whether they think we do it, but they did until this year.

The second thing is a comment made by Mr. Felker yesterday following the tuberculosis symposium. He made a plea to carry this thing back to the farmers in New Hampshire, Nebraska and everywhere else. After all these years, after all we have known since Dr. Dorset and his co-workers discovered the products, we have failed to instill this idea into the swine-owning public of the United States so that at a time when they needed protection, the protection was not given, and there is another enormous loss from a preventable disease.

Everybody is concerned with the epidemiological factors of this thing, but that is not the paramount question right now. The paramount question is why it happened and how can it be prevented. After everything else is said and done, I think most of us would agree on one of two factors which largely contributed to this condition. The first is a very large percentage of susceptible animals, which is entirely inexcusable. There is not any
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question that the percentage was considerably larger than for many years. The second is one which I rather hesitate to speak on, and yet which is a vital factor. I have noticed during the past few years the average veterinarian and the average consumer of serum felt that the price at which serum was selling was none of his business unless perhaps it was a matter for rejoicing that it was ridiculously low. Let us analyze that for a moment. The live stock owner and the veterinarian and a lot of poor business men indulged in a price war. What happened as a result of the price war? The majority, if not all, of the producers in this country were selling serum at an actual loss. What was the natural consequence? They were carrying just as little serum as they could carry, in the vast majority of instances. There were exceptions. Why? It cost considerable money to carry serum over a winter. When this thing came along, spring vaccination had been light up until the first of June. Then it started in unusually heavy, and was that way through the summer, so what stock there was was rapidly depleted and then came the outbreak of cholera. There is not any question that the law of economics governs this situation as it does every other situation. If the price of serum were stabilized, if serum sold to the farmer or veterinarian at a price which was fair to him, and fair to the producer, this country never would be faced with a serum shortage. There is not a producer in the country who could not well afford to sell serum at a reasonable price—by that I mean not talking of the inflated prices which existed during the outbreak, but a normal, fair price which could easily be established and maintained. Every serum company in the country would be pleased indeed to carry a good-sized surplus available at all times.

You do not need to have state distributing depots. You do not need, with all due respect to Dr. Dorset's suggestions, serum stuck around in every grocery store all over the country. That, however, was not his suggestion. The serum companies have proved by their past performance that their tendency is to distribute it too widely, if anything. They have not lacked distribution. The all-contributing factor was the question of the price and the question of the enormous number of susceptible animals. We need to preach the gospel of immunizing regularly the spring crop and the fall crop, of establishing fair prices not for the serum-producer but in the interest of the consumer. Your state serum plants never had the prices down ridiculously low; I dare say they never would, because they couldn't; they could not stand the strain.

There is just one other contributing factor I should like to comment on. Dr. Connaway touched on it this morning. I was astounded that with such a policy as this Association has, a member, I presume, since its inception, would get up on the floor of this convention and admit he is violating the policy of the Association and openly admit that he is sending out virus promiscuously to men whose education and training do not equip them to use it. I do not mean that as a personal criticism; it is a criticism of the policy for this Association and for live stock officials generally. The official does not live who can justify sending hog cholera virus promiscuously through this country to the laity. This Association has gone on record as condemning the promiscuous use of hog cholera virus.

A condition exists in Illinois whereby veterinarians are being robbed of practice, and men who by experience and education are trained to control disease are having hard work to eke out an existence, because county agents who are not qualified by experience and training to control these diseases are assuming something they know little or nothing about. These men are contracting and attempting to store serum and virus; these men are attempting to teach John Jones how to dispense with the service of the practicing veterinarian. Gentlemen, so long as that condition continues, you will never control hog cholera or any other infectious disease. (Applause)

DR. CONNAWAY: We have, down in the Ozarks, conditions and not theories to deal with. We have, in Arkansas, conditions and not theories to deal with. Besides, the policy of the company represented by Dr. Cahill is to sell to the veterinarian only. Suppose there is not a veterinarian within fifty miles of you and hog cholera occurs in that territory. Is not a state
which is interested in the swine production of every state, of every section, interested in helping that man, who is unable to help himself, by giving him that instruction in detail, just as thoroughly and well as can be done, so as to meet the emergency, notwithstanding whatever ethical ideals or professional ideals anyone may have? I submit to this Association whether my ethical standards are not equal to those of Dr. Cahill. I think my association with this organization from its very beginning has demonstrated some of these things, and these are policies that we will have to continue until through, not the agencies of the agricultural colleges but the agencies of the livestock sanitary boards. We should create conditions in localities for the improvement of livestock that will justify a competent veterinarian to locate in those sections and give service.

These are conditions that we have to meet, and they cannot be met by the commercial concerns until they abandon their policy to sell to veterinarians only in localities of that kind. Either the state or the commercial concerns have got to find some access to those particular localities. In states like Indiana, Dr. Craig furnishes to veterinarians only, because there they have plenty of service; there is veterinary service in abundance there.

Dr. Bux, way down in Arkansas, would like to have more competent fellows there to help him out. Western Kansas would like them, and all of these places where there is a lack of that expert service would like to have them. We need to encourage the young men to go into that service; we need more young men going into our veterinary schools. It is shameful that the enrollment in those schools is as low as it is.

Dr. J. S. Koén (Bloomington, Ill.): The last suggestion of Dr. Connaway refutes all of his other argument—the deplorable fact that the veterinary schools cannot attract young men, that we will not have an adequate or sufficient number of competent veterinarians to protect the live stock industry of this country.

The condition he refers to in the Ozarks is an exception. This Association last year adopted a policy that surely would mark, if it were applied, a new era in the control of swine diseases, particularly hog cholera. Everyone knows that hog cholera could be controlled and prevented; everyone knows how this may be accomplished. The question is: Why has it not been applied?

The awful loss of 1926 is but the penalty imposed upon the swine industry for the violation of the policy adopted by this Association one year ago. There are reasons for the failure to apply the policy as adopted here. Those reasons have been very well stated by Dr. Cahill. The breaking-down of the plan that formerly was successful in the control of hog disease has been pointed out. In the early days, after it had been demonstrated that this was a positive product that could be applied for the successful control and prevention of hog cholera, this treatment was applied by veterinarians, men who were trained and understood the dangers of virus, and who understood the proper use of virus in conjunction with serum, who understood how to differentiate better than other folks who were untrained and inexperienced between the different diseases of swine, that the application of this treatment might be judiciously applied. As long as that plan was pursued, of the application of the serum treatment in the hands of men who were trained and competent to apply it judiciously, hog cholera was controlled and the losses were reduced to the lowest point in the history of the industry since we have had this agent or this treatment.

Then along came another force, a force that sought to inject itself into the control of animal diseases, for which it was inexperienced and for which it was untrained. It began spreading misinformation that farmers could vaccinate their hogs as well as veterinarians, that farmers knew cholera when they saw it. Through their farm bureau organizations, they began to tell the farmers that they had contracted for large quantities of serum, that they had it and could protect them in case cholera did appear, leading the farmer to believe in that plan, giving him a sense of false security that there was an adequate supply in case an emergency arose, leading him to believe he could get by without his veterinarian, and by depending upon inexperi-
enced, incompetent and untrained men he could reduce his expense by not incurring fees, which should be an investment in veterinary service and not an expense.

This undermined the confidence of the farmer—the man who owned the hog—in veterinary service, and persuaded him in a large measure to attempt to get by, and gave us the largest number of untreated, susceptible hogs that we have had since we have had the hog cholera treatment; that, coupled with the fact that under the old system the veterinarians could get enough serum in large quantities to vaccinate enough hogs and to immunize enough hogs in the territory so if cholera did hit later there would be enough vaccinated that a wide outbreak would be impossible, while now they could no longer estimate or contract for the serum supply or see that the farmers of the community vaccinated their hogs, or, if they would vaccinate them, that they, the veterinarians, would get to do the work. Therefore, the serum companies that had been supplying serum or producing it in large quantities to protect the swine industry and to fulfill the contracts and estimates, were unable to do so because they had no assurance that there would be a sale or an outlet for the product. Consequently, when the outbreak came and when the demand was made, when they were called upon to fulfill the responsibility they had assumed for the protection of the live stock industry, they could not do it. The available serum supply was soon used up, and then some of them could get serum when some veterinarians could not get it. They are going to try to make capital of that fact next year, to discourage further the old system which was successful in the control of cholera.

I should like to suggest, if I may, some things which I think would be helpful in this control.

Experience is a dear teacher, but fools will learn in no other school.

The experience of 1926 emphasizes the necessity for:

1. Restoring the old system that was successful.
2. Immunizing the pigs at or about weaning time, or at least enough of them to make the rapid spread of cholera impossible.
3. Restricting the distribution of virus to graduate veterinarians and holding them strictly responsible for its use in a proper manner.
4. Having county agents retire from quack veterinary service and have them advise their farm bureau members to insure their live stock and the success of the live stock industry by the use of graduate veterinary service.
5. Removing once more the menace of cholera.
6. Restoring profit.
7. Removing friction.
8. Restoring cooperative effort.
9. And letting peace, harmony, good will and prosperity reign.

MR. J. H. MERCER: I want to make an observation or two in connection with this discussion. I have been engaged in sanitary control work for the last six years, and I have had considerable experience in handling cholera outbreaks in our state. It is very easy for a laboratory man or a man engaged in the serum business to come before a body of this kind and tell us what to do and how it should be done. When you come to doing the work in the field, it is altogether different, because there are altogether different circumstances to be dealt with than these men have in mind who have not had the actual experience.

In 1915 we inaugurated a plan of hog cholera control in Kansas in cooperation with a very active, forceful young man of the federal government. We spent a year experimenting in one county. We fully demonstrated that hog cholera could be controlled, not altogether by vaccination, but by sanitary methods as well. We followed that plan in Kansas. It is simply a plan, where there is an outbreak of cholera, to take in charge and quarantine that farm or the community and put someone in charge to enforce that quarantine and require all the hogs within the area to be vaccinated, or on the farm, if it is only a farm that is under quarantine. We require strict observance of sanitary methods, and so forth, and very seldom in Kansas now, for the last ten or twelve years, have we had any scourges to speak of. We
have had a lot of floods in Kansas this year, but we have had security from hog cholera.

In answer to the suggestion of the last speaker, it is all right to come here and make these suggestions, but if the officers representing these states do not go back home and try to get them incorporated into the laws of their states, they are of no consequence whatever.

Your county agents do just what the state in which they reside permits them to do. No county agent in Kansas can use virus unless he is given authority to do it by the Live Stock Commissioner of the State, and I want to say to you there are only two or three in the State that have that authority. We do not give a county agent authority to use the virus for the vaccination of the hogs if there is an accredited veterinarian in the locality. Just as Dr. Connaway says, there are localities in the country, not around Chicago or Minneapolis, probably, but somewhere in the country where there are no veterinarians, and conditions in such communities must have the attention of the sanitarian of the state. Our method is to delegate someone to administer the serum who is not a veterinarian. We send him to the department and train him and drill him, if he is one who wants to use virus in the vaccination of his own or his neighbor's hogs. We give many farmers in our state authority to use the virus on their own herds.

Our records bear me out in saying that few bad results have come from that practice, not nearly so many as come from the practice of the veterinarians in some localities.

Such a person must be endorsed by the banker of his community as being a dependable man, and if we are not acquainted with him we require him, if he wishes to administer this to other than his own herds, to get petitions from the people who wish his services. In that way we can serve a community where there are no local veterinarians, and give the people the service they are entitled to and must have.

As to the suggestion about the price of serum, we have had but little trouble with that in our state. A few plants have sold serum at prices beyond what was reasonable and right. A few veterinarians have made charges for serum they bought on a low level of prices, beyond what was reasonable. We have that to contend with in our state and I presume in all states. That can be regulated by the laws of the state. We have authority under our law to fix the price for the vaccination. We do it under the organized hog cholera control plan. Where we place a man in the community and have him vaccinate hogs where necessary, he is permitted to charge only fifty cents per 100 cc in excess of the cost of the serum, but where, of course, there is just a small bunch to vaccinate and we have no organization in the work he is permitted to charge more. Just a short time ago we had a complaint come to us. We investigated by inquiring of the serum company that sold the serum what they got for the serum. We found the veterinarian charged $1.70 per 100 cc in excess of the cost of the serum.

We have a few county agents who sometimes meddle with things, but if the laws of the state are so drawn that they give the sanitary officer the control, you will not have very much trouble. But all your suggestions here will mean nothing unless that is done. (Applause)

President Mohler: Gentlemen, this is your convention, it is not mine, and I am perfectly willing to stay here as long as you want to stay and discuss the subject of hog cholera. It is an important matter. But we have men who came 2,000 miles to hear other things on the program. I only want to ask your indulgence and your help in getting through the program.

I take great pleasure in introducing Dr. C. H. Hays, State Veterinarian, Lincoln, Nebraska, who will open the symposium on poultry diseases with an address on "Avian Tuberculosis Eradication from the Standpoint of Public Disease Control." (Applause)

. . . Dr. Hays read his paper. . . .
AVIAN TUBERCULOSIS ERADICATION FROM THE STANDPOINT OF PUBLIC DISEASE CONTROL

By C. H. Hays, Lincoln, Nebr.

State Veterinarian

As progress has advanced the national campaign to eradicate bovine tuberculosis, in which campaign the United States Live Stock Sanitary Association has occupied such a prominent and active part, the complexity and extent to which such a program must reach, if tuberculosis as an economic menace to live stock production is destroyed, has been most clearly demonstrated. When the project, having as its specific object the eradication of tuberculosis among cattle, was inaugurated under Congressional action, in 1917, the consensus of opinion and the generally accepted theory at that time was that the elimination of tuberculosis among cattle would result in the elimination of tuberculosis among other classes of farm animals, especially swine. The incorrectness of this assumption, for such it must be classed, has been revealed as our knowledge regarding the avian type of tuberculosis has been added to and correct information regarding the relation such infection bears to the economics of animal hygiene has been obtained.

Van Es and Martin, in Nebraska, through extensive research, were the first to point definitely to the fact that the avian type of the infection of tuberculosis was responsible for a large majority of the retentions on account of tuberculosis among the swine slaughtered under federal inspection at three of our largest midwestern live stock markets. Van Es later graphically illustrated and pointed to the probable morbidity-rate of avian infection, as compared with bovine infection, as a cause factor in the condemnation of pork products because of tuberculosis, accounted for under federal meat inspection service. At the same time that the work of these investigators was being carried forward, the first shipments of swine were being marketed for slaughter from officially certified, modified, tuberculosis-free, accredited areas. A certain percentage of such swine at the time of slaughter were found to be affected with tuberculosis. Possibly the number of swine so affected and the extent of the disease among those affected was not so great as would otherwise prevail, had the tuberculosis eradicated from the
cattle of such areas remained active and not been destroyed, as had been the case. The point is that tuberculosis was found to be present among such shipments of swine. A laboratory study of diseased tuberculous tissues, recovered from swine comprising certain of these shipments, proved tuberculosis to be present and, in a preponderating number, of the avian type. The knowledge thus obtained, the correctness of which has been verified by other investigators, has proved sufficient to support the contention that the eradication of tuberculosis affecting poultry must receive attention as a public problem in livestock sanitation.

**Surveys Show Extent of Infection**

The extent to which the poultry making up the flocks of our farms may be affected with tuberculosis has been indicated, apparently with a reasonable degree of accuracy, by data obtained through surveys made by state and federal field veterinarians, incidental to the examination and testing of cattle for tuberculosis. While the methods which have been thus far employed in making such surveys are insufficient to obtain a complete determination of the presence of tuberculosis in all the flocks which came under observation, the information thus obtained has shown the very common occurrence of the disease and its wide distribution among poultry on the farms in the territory thus covered. Such survey has been sufficient to indicate that avian tuberculosis is a problem within each state, as much so as bovine tuberculosis is a problem common to the livestock industry of all states. Although the percentage of avian infection may be reversed, as compared to that of the bovine type, and available information is sufficient to indicate this as true in certain areas, the eradication of avian tuberculosis must be supported by fully as complete and broad a program as now applies in the fight against bovine tuberculosis. Those engaged in the poultry-producing industry have in some places become alarmed as a result of the information regarding the conditions resulting from the presence and extent of avian tuberculosis, and are expecting relief through a public service similar to that which has been extended and applied in the campaign to eradicate tuberculosis affecting cattle. For economical reasons, relating to the preservation of profitable livestock production, and to safeguard progress in the eradication
of animal tuberculosis, the establishing of such a service would appear to be warranted, and for a public interest justified.

The official certification of areas as tuberculosis-free will not be fully satisfied in the eyes of the public, nor will the ideals which have dominated the assault made upon bovine tuberculosis and the protection thus afforded to animal health be obtained, until tuberculosis affecting poultry is materially decreased. The extension of a service to cope with this situation cannot be long delayed, especially as it applies in those areas where tuberculosis-free certification has been declared. In rendering such an additional service applying to tuberculosis, care will need be exercised that the general program in which we are now engaged does not become disturbed, and the public confidence supporting the present project does not become lessened in any degree through possible confusion, or for other cause. There remain those willing to seize any opportunity to create disturbance and reaction against the work that is now in progress. The most important factor, in our opinion, to maintain such a confidence, will be the promulgation and application of rules and methods equally as effective and uniform as now govern the establishment and maintenance, as tuberculosis-free, individual herds of cattle, or groups of such herds as represented by defined areas.

ON A SOUND FOOTING

The campaign to eradicate tuberculosis was established and has been maintained on a sound and common-sense plan, the reasonableness of which has been readily appreciated by those whose support has so largely contributed to its success. The development has been a gradual unfolding and application of knowledge accumulated through years of careful study by research and observation, as to the nature of tuberculosis and necessary sanitary measures for its eradication. The methods and rules which have been promulgated, in a large measure through the activities of this association of live stock sanitarians and live stock owners, to govern the application of service, have with limited modifications proved sound, both from a scientific and a practical standpoint, and sufficient insofar as the efforts expended were initially intended to reach. The organization of work cooperatively between the United States Bureau of Animal Industry and the several states has provided within each of those states an operative unit, uniform in general outline with
that in every other state as to fundamentals underlying the rules and methods. This is particularly true in one important essential provided to govern the determination and disposal of tuberculous cattle.

Under the plan, a definite contact has been established with all foci of infection as represented by the premises on which tuberculous cattle have been located, and through continued supervised handling, under proper methods, the danger of such centers has been more positively eliminated than would have obtained under the varied plans that could have been expected to prevail under any other arrangement. The official and lawful handling of known tuberculous cattle, in a regular and properly controlled manner for disposal, has insured the destruction of such animals and has discouraged or thwarted the operations of unscrupulous practices which have so often in the past proved costly to live stock owners. These same ideas and fundamentals must be preserved in any arrangement that is to provide a program of service so similarly related as must be the eradication of tuberculosis among live stock, regardless of the species of animals involved.

**INTRADERMIC TEST MUST BE ADOPTED**

The logical order of an attack, on any infectious and contagious disease for its eradication, necessitates in the first place a determination as to where such disease may be present and the live stock affected. In the determination of tuberculosis among poultry, the work that has thus far been completed and the observations that have been made indicate that an application of equally specific methods as have been applied in the determination of tuberculosis among cattle will be necessary. The application of the interdermic method of tuberculin-testing, in our opinion, must become the adopted method for determining the presence of avian tuberculosis and the individual birds affected. It has been demonstrated that such a method can be applied with the accuracy necessary and with sufficient speed for economy to warrant the general application of the tuberculin test in detecting tuberculosis-infected poultry flocks.

The plan of physical examination has not proved sufficiently dependable as a means for definitely determining the presence of tuberculosis, for it is found that the disease may remain hidden within the body of poultry, as in other species of live stock, without physical or other clinical symptoms being evi-
It is true that the physical handling of poultry flocks may prove sufficient in a great number of cases, and for certain purposes in determining the presence of tuberculosis in such flocks. Yet this practice has not been found dependable to a degree to warrant the practice being used alone, as the method of detecting avian tuberculosis, in such a program as will, undoubtedly, be necessary to recommend. In the tuberculin-testing as part of such an official program, the testing of the flocks of a defined area rather than isolated flocks should become the object of such a service, as this will be equally as profitable in the saving of time and expense as a similar practice in testing cattle has proved in the work in which we are now engaged.

While there may be some handicaps in the question of applying methods to determine the presence of tuberculosis, the most confusing and serious handicap is presented in the question of the disposal of poultry definitely determined to be affected with tuberculosis. As is well known, there is at present no established system of inspection under which the disposal of tuberculous poultry may be directed, as is the case in the marketing and slaughter of other species of meat-producing live stock. In view of the fact that human health is apparently not endangered by the avian type of tuberculosis, at least to the degree involved in the case of bovine tuberculosis, and the system of preparing poultry for human consumption as a meat-food product is established along entirely different lines than those which apply in preparing other meat-food products, the most commonly expressed idea has been to discredit the suggestion of a controlled and restricted market for poultry as essential to public welfare.

LACK OF WELL-DIRECTED INSPECTION

The poultry industry, from a disease-control standpoint, is suffering more today from a lack of well-directed inspection rather than an over-inspection, and this is generally true of other classes of live stock. After a careful review of all factors, it is the opinion of those intimately connected with tuberculosis eradication in Nebraska, that the uncontrolled marketing of tuberculous poultry presents an opportunity for the same unscrupulous trading as applied to the cattle industry, and the same dangers will accrue from such practices to the poultry industry as have proved so serious to the cattle industry. It is the further belief that without the restricted and controlled marketing of diseased poultry, the results would prove very
damaging to the poultry industry and possibly seriously disturb
the program to eradicate tuberculosis from live stock.

The Nebraska poultry industry suffered the handicaps of an
embargo. The marketing of poultry under such embargo was
no more seriously affected by the direct economic effect of the
embargo on collections and shipments of poultry than resulted
from refusal of the public to purchase for consumption poultry
reported to be suffering from disease. This disturbed public
sentiment can be easily incited into action, and it is to be feared
as dangerous to progress. The marketing of live poultry must
be safeguarded against the damaging practice of marketing of
diseased poultry.

A department whose duty it is within a state to protect animal
health, cannot on one hand embrace in its program the practice
of marketing without restriction poultry known to be affected
with a specific infectious and communicable disease, such as
tuberculosis, and on the other hand discourage a similar practice
as might commonly prevail in the marketing of poultry of flocks
in which some probably less dangerous disease had been found to
exist. The disposal of tuberculous poultry, in our opinion, must
be under equally as orderly and specific control as has been applied
in the disposal of cattle known to be affected with tuberculosis.
We contend that the time is at hand when a more restricted
marketing must prevail over all species of animals, when such
animals are known to be affected by, or immediately exposed
to, the infection of a disease dangerous to public welfare, as in
tuberculosis.

**TENTATIVE PLANS IN NEBRASKA**

In Nebraska, we have tentatively arranged to establish a
limited service to combat avian tuberculosis. The initial work
will be primarily investigational and to make a field survey to
determine the possible extent of the disease among the flocks in
our state and the practicability of the plans we have in mind, the
fundamentals of which have been herewith advanced in this
discussion. In making such a survey and applying service, a
defined area will be selected which, in this case, will be a precinct
or township of a certain county. It will be required that sixty
per cent or more of the owners of flocks of poultry within such
area will, by agreement, subscribe to certain terms, and thereby
demonstrate their willingness to cooperate with our department
before such work will be commenced. The terms of the agreement in such case are as follows:

The entire flock, or such part as may be deemed necessary by State and Federal Bureau officials assigned to service under this agreement, shall be presented for inspection, examination and test for tuberculosis by a veterinarian officially assigned for such duties by the Department of Agriculture.

Any chicken which shows physical evidence of tuberculosis shall be destroyed by slaughtering and burning on the premises of the owner immediately at the time it is determined that such chicken is affected with tuberculosis; the same to be under official supervision of a Department representative and without compensation to the owner.

Any chicken which reacts to tuberculin test, but which does not show physical evidence of tuberculosis may be marketed for slaughter purposes provided such slaughter shall be under an inspection arranged by the Department of Agriculture.

Premises contaminated by tuberculous poultry, as indicated by physical examination or tuberculin test, shall be thoroughly cleaned and disinfected immediately following removal of tuberculous poultry—the cleaning and disinfection to be in keeping with instructions of the Department and under the direction or supervision of a veterinarian officially assigned for such duties. Such disinfection to be at the owner's expense, except as may be incurred for supervisory service.

In rendering the service under these terms, it is the intention that all birds or flocks on the premises shall be submitted to the tuberculin test. There may be cases where a flock is to be divided and a part of the flock marketed immediately, at the time of or preceding the test, which will reduce the amount of testing that would otherwise obtain. A physical examination will be made at the time of the testing and if, by the results of this, any of the birds show by clinical symptoms that tuberculosis may be present and which have no apparent market value for slaughter purposes, such birds must be slaughtered at the time and burned on the premises under supervision. The individual birds which do not show physical evidence of disease, but which are determined to be reactors to the tuberculin test, must be marketed under an inspection that is to be arranged by the Department.

MARKETING REACTORS A PROBLEM

When we were arranging our tentative plans, the question of marketing tuberculous poultry caused considerable concern. However, when we approached representatives of the poultry-packing industry, we were agreeably surprised to receive the response to our suggestion such as we did. There was an expressed willingness on the part of those engaged in the slaughter of poultry to cooperate in every way, that it might be determined whether a practical plan could be evolved for handling such classes of poultry under inspection. Plans were made
which, though tentative, will apply, whereby known tuberculous poultry can be marketed, and an inspection arranged that will provide a postmortem examination of such infected live stock.

In our opinion, it is not feasible to expect such a plan to be operative in equally as practical a way if an entire flock in which tuberculosis has been found to exist is marketed, as compared to marketing a limited number of known tuberculous birds. The difference would be that on the one hand the examination would need to be made to determine the presence of the disease, and on the other hand the examination would be made to determine the extent to which the bird under inspection was infected, which would affect the speed at which inspection and examination might be conducted. It is regretted that we have had no opportunity to try out this plan prior to the time of this meeting, but we shall be glad to report on our observations at a later date.

The eradication of avian tuberculosis, when viewed as a public problem, may be restricted to the limits of the terms we have heretofore specified, but if such service is to measure up to the expectations of the public in the establishment of tuberculosis-free flocks of poultry, then additional provisions must be added. Under such a program of service as now prevails in regard to establishing herds of cattle tuberculosis-free, we propose the following methods and rules for the establishment of tuberculosis-free flocks of poultry:

A. For the Determination of the Health Status of the Flock Relating to Tuberculosis:

The entire flock (including each bird maintained in the flock on the premises) must be examined and tested for tuberculosis by a qualified veterinarian.

B. For the Eradication of the Infection of Tuberculosis from the Flock:

1. Any bird shown by physical examination or test to be affected with tuberculosis must be isolated from any contact with other poultry except birds which have been similarly classified, which separation should be completed immediately following said examination or test. The diseased birds should be disposed of as follows:
   a. Any bird showing physical evidence of tuberculosis should be destroyed by slaughtering and burning on the premises where located.
   b. Any bird reacting to the tuberculin test, but which does not show physical evidence of tuberculosis, may be marketed for slaughter purposes, provided such marketing is in keeping with arrangements for slaughter under an official inspection.

2. In a flock in which the infection of tuberculosis has been demonstrated, all birds shown by test to be free from tuberculosis should be placed on premises which have been thoroughly cleaned and disinfected as herinafter specified, or such poultry should be removed to premises which have not been previously used for poultry quarters.
Note: This latter procedure is not recommended in the event it is decided to market the entire flock under the plan by which a new flock is to be established from day-old chicks, as it is deemed sufficient in such instance to use the cleaned and disinfected premises, and thus prevent possible contamination of premises needed for the future poultry flock.

3. Premises which have been occupied by tuberculous poultry must be thoroughly cleaned and disinfected; the same to be done in the following manner:

a. Empty all troughs, racks, feeders, or other feeding and watering equipment; remove all litter, manure or other contaminated materials from the houses, yards, or other enclosures which have been occupied by the diseased flock, giving special attention to feeding and watering equipment, and to the area immediate to such equipment. Dirt floors in poultry houses and the ground immediate to feeding and watering equipment used for the flock should be removed as contaminated material to a depth of six inches or more and replacement made with sand or gravel, or earth from a non-contaminated source.

Note: It is recommended that housing, feeding and watering equipment be removed to non-contaminated ground (meaning by this a location where intensive feeding and housing have not occurred). The contaminated surroundings vacated may then be plowed and if possible sowed to a cultivated crop.

b. The manure, litter and other contaminated materials removed in cleaning must be placed where it will not be accessible to poultry or other livestock until burned or otherwise treated to destroy the infection it may contain. On farms the manure may be spread on land to be cultivated, but a sufficient distance from poultry runs to insure against exposure of the flock.

c. Immediately following the cleaning specified, all feeding and watering utensils and the walls and floors of all housing equipment should be saturated with a disinfectant solution composed of saponified cresol solution in proportion of at least four fluid ounces to each gallon of water.

4. Swine on premises occupied by poultry found to be affected with tuberculosis should be tuberculin-tested with avian tuberculin, or a composite tuberculin containing avian tuberculin. In case tuberculosis is shown to be present in said swine, the poultry should be protected against such possible source of infection and efforts should be directed to eradicate the disease from the swine herd.

C. FOR ESTABLISHING AND MAINTAINING THE FLOCK TUBERCULOSIS-FREE:

1. Two plans are offered for handling such part of a flock as remains after the initial removal of the tuberculous birds has been completed and the flock is located as hereinbefore provided. Preference is given to the plan designated as No. 1 as being more practical and certain in the establishment of a tuberculosis-free flock of poultry.

Plan No. 1: All birds of the flock shown by tuberculin test to be free from tuberculosis should be marketed for slaughter purposes; the same to be completed at the earliest date consistent with profitable disposal.

The flock on the premises should be replaced by a flock established by using chicks that have been protected against the infection of tuberculosis from the time of hatching, and placed on a part of the premises not previously occupied as a concentration place in the flock management. The new flock should be at no time associated with the poultry remaining from the flock in which the infection of tuberculosis was found to exist.

At the termination of six months from the date the new flock is established, a tuberculin test should be applied for the purpose of determining the freedom of the flock from the infection of tuberculosis.

Plan No. 2. All birds of the flock shown by tuberculin test to be free from tuberculosis should be again examined and tested for tuberculosis sixty days from the date of the initial test, and repeated examinations and tests applied at ninety-day intervals until no reactors are obtained.
among the poultry tested. Immediately following each examination and test, any bird found to be affected with tuberculosis must be removed and disposed of as hereinbefore specified for handling such affected birds, and the contaminated premises cleaned and disinfected.

When the flock has passed two successive tuberculin tests, at least ninety days apart, without reactors being found, retesting may be restricted to annual examination and test.

2. Examination and test for tuberculosis should be applied annually, after the flock is shown to be apparently free of tuberculosis.

3. Birds added to the flock should be determined to be free from tuberculosis prior to being added to the flock or, more safely, additions should be restricted to day-old chicks protected against the infection of tuberculosis from the time of hatching.

In conclusion, it is not our intention to make a summary of our deductions, as we view this as a question for open discussion. We have attempted to express the opinion that we believe prevails in the state of Nebraska, among those who are in the best position to render an opinion on this subject. We have asserted in a measure personal observations. We do not believe that the work has been carried forward to such an extent but that the adoption of uniform methods and rules could be applied in any state to govern this project of work with an equal success as has applied in the program for eradicating bovine tuberculosis.

PRESIDENT MOHLER: Now may I call on Dr. R. A. Craig, Chief Veterinarian, Purdue University, Lafayette, Indiana, to present his address on "Control of Bacillary White Diarrhea." (Applause)

Dr. Craig read his address.

THE CONTROL OF BACILLARY WHITE DIARRHEA

By R. A. CRAIG, LaFayette, Ind.

Purdue University Agricultural Experiment Station

A few weeks ago I was associated with the chairman of our Committee on Poultry Diseases in the discussion of bacillary white diarrhea at a poultry conference. At that time he invited me to discuss the work that Indiana veterinarians are doing in the control of this disease in breeding flocks. I offer this explanation as my reason for taking part in the discussion of this disease problem.

Infectious diseases are more prevalent and the death-rate heavier in poultry than in any other class of farm animals. This statement is based on our field and laboratory experience in Indiana, and not on poultry-disease statistics. During 1924-25 more than 6000 chicks and older birds from 2200 flocks were received at the Veterinary Laboratory for examination and autopsy. Twenty-eight hundred chicks had bacillary white
diarrhea and 480 had coccidiosis. In the mature birds cholera and fowl typhoid, tuberculosis, roup and coccidiosis, named in the order of their occurrence, were the most common infectious diseases. Similar reports have been made by investigators in other middle western states, and the interest that is given to the investigation and control of poultry diseases shows that animal pathologists and sanitary control officers in these states are interested in the economic importance of this disease problem that has developed so rapidly within the last decade, along with the remarkable growth of the poultry industry.

The prevention and control of poultry diseases have been and are, at the present time, in the hands of poultry-producers. It is generally true that their knowledge of the different infectious diseases is not sufficient to enable them to appreciate fully the overhead cost of maintaining diseased flocks and the economic value of sanitary measures for disease control. Furthermore, poultrymen are confused by the contradictory statements made by commercial organizations, agricultural experiment stations and extension departments, and writers for agricultural and live stock papers. It is well for us to consider the effect of incorrect and untruthful statements relative to the etiology and control of poultry diseases, that make up a large part of the discussion in poultry columns and meetings held by vendors of medicinal mixtures and biological preparations, sold for the prevention and cure of disease.

State departments and practicing veterinarians should be closely associated in the poultry-disease educational work. If poultry-breeder were better informed they would appreciate the economic importance of including, as a part of the plan for the accreditation and certification of flocks, freedom from communicable diseases. Inability to appreciate the disease situation, lack of cooperation, and a type of commercialism that is not conducive to the best interests of the poultry business, are responsible for state associations refusing to give their unanimous support to the eradication of bacillary white diarrhea and tuberculosis as a part of the plan for the accreditation of breeding flocks.

These general statements summarize the poultry-disease situation as we have found it in Indiana, and may serve as an introduction to a brief discussion of the bacillary white diarrhea control work in that state.
DETECT AND REMOVE THE CARRIER

The ultimate source of bacillary white diarrhea is the apparently healthy hen that is infected with *Bacterium pullorum*. The control problem presented by this disease is, first, the diagnosis of the infection in the apparently healthy bird, and second, the removal of this disease-carrier from the flock. Although bacillary white diarrhea is a common disease of breeding flocks, and we have in the agglutination test a diagnostic agent for this disease, only a small percentage of the birds have been tested. However, we feel that a good beginning toward the control of bacillary white diarrhea has been made in the 70,000 breeding flocks in our state.

More than twelve years ago we became interested in this disease through a shipment of several hundred chicks from a New England hatchery. The death-rate in this lot of chicks was about 100 per cent and the prospective poultryman who purchased them lost interest in the poultry business. A few years later the death-rate in hatchery chicks became so serious that several hatchery-men came to us for assistance, and requested that we give them the necessary cooperation in the control of the disease. Our early work was very largely the development of a more simple agglutination test. We finally adopted a one-tube test, and the fowl typhoid organism, *Bact. sanguinarium*, was used instead of *Bact. pullorum* in preparing the antigen. The above test has been used for testing more than 700,000 birds during the past six or seven years and, in the hands of veterinarians competent to use it, has proved satisfactory.

Four years ago we were unable to take care of all flock tests that we were requested to make. We found that this service work was crowding out other lines, especially the investigation work. A large number of poultrymen, who were in no way qualified, wanted to test flocks for bacillary white diarrhea. Veterinarians had shown little interest in this new line of practice. We believed that this, as well as other poultry-disease problems, could not be cared for unless veterinarians engaged in practice became interested in them. In January, 1924, they were invited to attend a poultry-disease conference. This conference or short course was the most successful that the Department has ever held. The sixty or more veterinarians who spent three days in the laboratory and class-room studying poultry
diseases helped pull us out of the most difficult position that we have ever been in.

It is true that all poultry-disease specialists and livestock sanitary officials do not agree on the advisability of encouraging veterinarians to use a serological test in their practice. This large and active group of veterinarians is an important part of the sanitary organization that is directly responsible for the control of communicable diseases of farm animals. It is through veterinary practitioners only, that all poultrymen can be served by state departments. This is especially true in the Corn Belt states, where the major portion of the poultry industry is located, and there is ample veterinary service.

**Veterinary Practitioners Help**

About one-half of the veterinarians engaged in practice have attended conferences or short courses at the University, and received special instruction in poultry diseases. During the past two seasons practitioners have tested about 400,000 birds for bacillary white diarrhea. Flock tests reported to the Department show that 17 per cent of the birds reacted to the first test, and 8 per cent (birds tested the previous year) to the second test. A veterinarian who has a large poultry practice reported 21 per cent reactors the first, 14 per cent the second, and 12 per cent the third year. Only a part of these flocks were tested in successive years. Thirty flocks that numbered about 5000 birds had two annual tests; twenty-two per cent reacted to the first and 11 per cent to the second test. Sixteen of the 30 flocks that numbered about 3000 birds had three annual tests; twenty per cent reacted to the first, 13 per cent to the second, and 9 per cent to the third test.

The low death-rate in chicks from tested flocks gives the best impression of the disease control work that is being done by practicing veterinarians. This low mortality in chicks is generally interpreted by flock-owners to mean freedom from bacillary white diarrhea, and many of these flocks have not been retested.

We try to keep in close touch with veterinarians who are testing breeding flocks. They are confronted occasionally with problems that they can not solve without help from someone who is more familiar with the test than they. This help is mutual, and we have picked up valuable bits of information through this contact with the field work.
FOWL TYPHOID CAUSES REACTIONS

The feeding of infertile eggs from tested flocks to chicks and mature birds has resulted in 30 to 80 per cent of the pullets in these flocks reacting. Three such cases were brought to our attention the past year. Fowl typhoid has also been responsible for a large increase in the number of reacting birds. One flock that passed through a mild outbreak of fowl typhoid, three months before the birds were tested, showed 60 per cent reactors, an increase of 40 per cent over the previous year.

It is not advisable for all practitioners to test breeding flocks. It is very probable that serological tests will be practiced by veterinarians who have a special liking for this work, together with sufficient training and appreciation of accuracy to enable them to avoid indifferent, careless laboratory technic. We feel that it is to the interest of flock-owners to employ veterinarians to collect blood-samples, as through this contact with the flock, practitioners become interested in the treatment of poultry diseases. It is our experience that poultrymen soon learn to appreciate disease-control advice that will help them out of their difficulties and prevent heavy financial losses. In the treatment and control of poultry diseases we must realize that the poultry flock is the unit and not the individual bird.

The character of veterinary practice has changed during the last decade. A broader field is now offered the country practitioner, and the profession is on a higher plane than it was a few years ago. Practice in swine diseases was built around cholera vaccination, and veterinarians are now building a lucrative poultry practice around the test for bacillary white diarrhea.

REPORT OF COMMITTEE ON POULTRY DISEASES

Dr. L. Van Es, Chairman, Lincoln, Nebr.

Dr. V. A. Moore, Ithaca, N. Y. Dr. J. R. Beach, Berkeley, Calif.
Dr. Sivert Eriksen, Kansas City, Mo. Dr. H. J. Stafseth, East Lansing, Mich.
Dr. F. R. Beaudette, New Brunswick, Dr. W. R. Hinshaw, Manhattan, Kans.
N. J.

In the course of the previous meeting of this Association, its Committee on Poultry Diseases brought to the attention of the membership some facts which showed the high state of development of American poultry husbandry and the business enterprises allied therewith. It also undertook to make clear that by the very weight of numbers and their local concentrations, a disease problem
has arisen which demands the serious consideration of this and similar organizations. It recommended that this Association voice its sentiments on the subject of poultry sanitation. This was done by resolution and was made a matter of record in the printed report of the 29th annual meeting.

The year which has since passed has not brought forth many new facts which would justify a different view of the poultry-disease situation on the part of your present Committee. In fact, what was said at the previous meeting might well be stated again with even increased emphasis and this largely because the relative importance of poultry diseases has also grown during the period immediately behind us and a more general interest in the subject has likewise developed.

It is especially encouraging to note that this interest has become most manifest among those actually engaged in poultry-raising. The year has also witnessed an increased interest in the more prevalent and damaging poultry diseases by live stock sanitary officials and even if at this time the veterinary profession on the whole has not fully recognized that it also has a definite task to perform, signs are not lacking that, here and there, veterinary practitioners also are beginning to regard the diseases of domesticated birds as a field which must no longer be neglected.

Many investigators are now devoting their time and energy to problems pertaining to poultry pathology and hygiene. All these forces are at work to bring about the ultimate development and adoption of ways and means of disease control similar to those which now safeguard the other branches of animal husbandry. It must, however, be recognized that progress is bound to be slow and that before success can be attained, there is much to be done in the preparation of the field which is awaiting the efforts of the sanitarian.

It is the opinion of your Committee that while the acquisition of new knowledge is essential or even imperative, for the present, at least, nothing will be more conducive to success than efforts of an educational nature. Without definite enlightenment of the poultry-growers themselves, progress will be impossible and our most fundamental function must be the spreading of the gospel of sound and rational sanitation.

It would be much like carrying religion to Rome for the Committee to enter into details on this point, before a gathering constituted like the one here assembled. Attention must be called, however, to a fact which in a measure materially simplifies the problem which concerns us and that is that a large portion of our most devastating poultry diseases are filth-born and amenable to the same sanitary measures.

This is the principal burden of the message to be carried to our farms. Attention to the sanitary aspects of feeding and of the water-supply, of yards and houses, to the judicious selection of rations, and to care in avoiding infective contacts will do more for the maintenance of poultry health than the many placebos on which flock-owners now waste their money. The simple principles of a safe environment and sound feeding practices should be inculcated and made to replace the archaic notions of a therapy belonging to the pre-pasteurian era.

The position of a poultry flock is not unlike that of a populous city of which the public health largely depends on the functions of an intelligent health officer. The owner, above all, should function as a health officer to his flock and should accept the guidance of whatever trained advisor he may see fit to turn to for counsel.

While your Committee is in position to report that some progress is being made in the dissemination of useful knowledge of a general sanitary import, it must also bring to the attention of this organization that at least two poultry diseases are being proceeded against by a more or less concerted and organized attempt at control. Those diseases are tuberculosis and bacillary white diarrhea of chicks.

**AVIAN TUBERCULOSIS**

The nature of this disease, its growing distribution, its economic importance as well as its relation to the tuberculoses of other species have so frequently been brought to the attention of this organization that its present Committee
COMMITTEE ON DISEASES OF POULTRY

did not deem it necessary to burden its report with a repetition of what has already been said on this subject.

What is of more importance in this connection is the fact that attempts are under way to find a way by which the problem presented by avian tuberculosis may be intelligently solved. These efforts may be more or less tentative, but like those which preceded bovine tuberculosis eradication, they are laying the foundation for a final conquest of the disease.

The tuberculosis eradication organization of the U. S. Bureau of Animal Industry is cautiously proceeding with fundamental survey work and is cultivating a sympathetic attitude of flock-owners in the more heavily infected states. The states of Pennsylvania and Illinois have already definite modes of procedure under way, are followed by Michigan and South Dakota, while Nebraska, in a smaller way, perhaps is endeavoring to find an approach to the solution of the same problem. In other states the subject is also receiving attention.

Your Committee recognizes these efforts as factors most hopeful for the future and in particular sees in the conservative and cautious manner in which the problem is being attacked a promise of ultimate success. It is the opinion of your Committee that the importance of this work and of its continuation are warrant sufficient for whatever support this organization is capable of giving to these attempts.

BACILLARY WHITE DIARRHEA

This disease, to a large extent transmitted to chicks hatched from eggs laid by hens, which in some way or other had become virus-carriers, constitutes a most serious menace to the poultry industry as it is now organized. In the organization of this industry, large hatcheries, using the eggs of a great number of flocks, distribute their output of day-old chicks to a numerous clientele. They thus contribute to the dissemination of disease whenever the eggs of virus-carrying fowls are used in their operations. The hatching industry thus plays a part in its relation to bacillary white diarrhea, comparable with that of the cream-skimming station of a past period in the spreading of bovine tuberculosis. Like the skimming-station in its time, the hatchery is also a valuable adjunct to an important industry and its continuation and further development as such more than justify any effort or combination of efforts having the elimination of the bacillary white diarrhea problem as its objective.

Since it was shown that the virus-carrying bird may be revealed by means of a more or less specific agglutination test, it has become possible to take definite steps toward its elimination from breeding-stock. While allowances must be made for other avenues of infection aside from the egg, the latter, no doubt, is the principal vehicle of mischief.

Your Committee is aware that the test is not strictly specific, that it is apt to cause the discarding of reacting birds producing sound eggs and that it is not free from other disadvantages. In spite of these imperfections, however, the fact remains that on the whole, the eggs produced by non-reacting flocks will yield better hatching results than those derived from reacting birds and that the infection hazard of the chicks will be measurably reduced.

Your Committee is fully agreed that the agglutination test may be made the base of a procedure to eliminate infection and as a means helpful in the maintenance of clean flocks. In various poultry-producing centers efforts are already under way in consummation of this ideal. They are largely voluntary and cooperative, but a demand is developing for regulatory measures.

The promoters of this movement, as well as many others interested in this problem, aware of the many variations in the technic of the agglutination test and the lack of uniformity in the interpretation of its results, have expressed a strong desire for a method of agglutination testing so standardized that the procedure followed in freeing flocks from bacillary white diarrhea may be reasonably uniform throughout all parts of the country.

As a result of this demand, President Mohler, of this Association, requested that your Committee make a thorough examination of the problem and lay its findings, as well as its conclusions, before this gathering. Acting upon this request, your Committee has occupied itself with this question and offers for
the consideration of this body the following conclusions and tentative recommendations:

**GENERAL CONCLUSIONS**

1. Your Committee is in full agreement in regard to the value of the agglutination test as a means of removing from breeding flocks infected fowls or such as may be regarded as potential virus-carriers.

2. That the test, in order to become a factor in a generally applied effort to clean the breeding flocks of the country, must be placed in the hands of qualified persons operating in the field. It is the opinion of the Committee that practicing veterinarians owe it to their clients to participate in this work.

   It is not conceivable that central laboratories will be able to cope with the enormous number of blood-samples to be tested. On the other hand, the test antigen should be prepared by such laboratories, which furthermore should continue to occupy themselves with investigations leading to improved methods and with other questions requiring effort in experimental research.

3. The routine tests should be reduced to the utmost simplicity in technic consistent with good results. Simplicity of testing technic, in the opinion of your Committee, will help to prevent error, will reduce costs to flock-owners, and will make a larger testing personnel available.

4. The testing personnel must have the approval of the live stock sanitary authorities of the states concerned, before their tests can be given recognition as a base for accreditation or other official action.

5. Your Committee, while recognizing the ultimate value of a standard testing method and its uniform application, does not believe that a final standardization is as yet possible or even advisable. It agrees, however, that at this time the first steps in that direction may be taken. Whatever is offered on this subject, or even accepted, should not prevent freedom of action on the part of the various agencies concerned and should by no means stand in the way of the research work still needed for further light on the subject under consideration.

   Any standard which may be adopted should be subject to modification whenever the acquisition of new knowledge should warrant a change in procedure. A final or permanent standard or uniform application of the test can result only from a full evaluation of data accumulated in practice.

   As revealed by data gathered by one of the members of your Committee (W. R. Hinshaw), there exists a wide variation in the test methods of the workers now occupied with this work and much time and effort may be required before a working base acceptable for all can be evolved.

6. Your Committee, while fully aware of these difficulties, offers the following recommendations for your consideration as a base upon which a standard test may be founded. The details are tentative and for the present should not be regarded as otherwise.

**TENTATIVE RECOMMENDATIONS**

1. **Antigen:**

   (a) The antigen used in the agglutination test for bacillary white diarrhea in domestic fowls should consist of a suspension of *Bacterium pullorum* (*Salmonella pullorum*).

   (b) The original stock culture should have been isolated from chicks affected with bacillary white diarrhea, procured from a typical outbreak of the disease.

   (c) The organism must show, at the time immediately following the isolation, the morphologic, cultural and tinctorial characters regarded as peculiar to the species and must be capable of producing acid and gas in media containing glucose, mannitol and levulose and should fail to do so if maltose, lactose and saccharose are present.

   (d) The antigen suspension should be prepared by washing a 48-hour, agar culture with a physiologic salt solution containing 0.5 per cent phenol. Before it is used for the test, it should be diluted with a similar solution of one-half strength mentioned until the suspension
corresponds in density to that shown in the 0.75-1.00 tube of McFarland's nephelometer.

(e) The agglutinability of the antigen should be proven by complete agglutination by not less than six positive sera procured from as many different flocks, when applied in dilutions of not less than 1-100.

(f) There is no objection to use antigen suspension mixtures prepared from different strains of the B. pullorum, provided that each strain meets the qualifications set forth in sections a, b and c and that the mixture meets the requirements named in sections d and e.

2. Blood Samples:
(a) Blood samples should be collected from birds having fasted from 18-24 hours. The collection should be done in the cleanest manner possible and while the operator is not restricted in his collection technic, preference should be given to syringe-aspiration, provided that before each collection the syringe is washed out four times with a 0.5 per cent solution of phenol in physiologic saline solution.

(b) The use of sodium hydrate as a means to remove cloudiness from the serum is permissible provided that not more than 2 cc of a 2 per cent solution is added to 100 cc of the antigen suspension, immediately before use.

3. The Test:
(a) One or more serum dilutions may be used for testing. A one-tube test is preferred for the sake of simplicity, but there are no specific objections to tests in several dilutions. When a one-tube test is used, a serum dilution of 1-25 is deemed acceptable.

(b) In the choice of dilutions, individual workers may be given latitude, inasmuch as it is not yet certain that the presence of infections by other colon-typhoid intermediates may not exercise an influence affecting the indications of the test in different localities.

(c) The use of incubation is preferred, but there is no valid objection to keeping the tubes at room temperature, if the final reading is not made before the termination of the 24-hour period.

(d) All agglutination tests made by a given worker on a given day must be adequately safeguarded by negative and positive serum-controls.

4. Interpretation:
(a) Both complete and incomplete agglutinations must be interpreted as positive results.

(b) Tubes containing a fatty, cloudy or contaminated test-mixture should either not be interpreted at all and a second test made or be interpreted as a positive test result. They should never be adjudged as negative results.

5. Flock Application:
(a) Eggs from fowls of which the blood-serum showed a positive reaction should not be used for hatching.

(b) Such fowls should be immediately removed from the flock and from the premises.

(c) The disposal of such birds by slaughter is recommended.

(d) If no reacting fowls are found in a flock after two annual tests or after three semi-annual tests, the flock may be regarded as free from bacillary white diarrhea.

(e) The maintenance of the disease-free status of the flock must be made dependent on annual tests showing no positive reactions.

(f) Flock-testing without the prompt elimination of all reactors as breeders is a useless waste of effort.

6. Recommendation in Conclusion:
(a) Your Committee recommends that the United States Live Stock Sanitary Association address itself to a representative group of
workers engaged in bacillary white diarrhea and to request that a limited number of flocks be tested in accordance with the standards here tentatively proposed and that the results be placed at the disposal of the organization, accompanied by such comments as may be relevant to the subject so that a definite opinion may be formed as to the practical value of the proposed testing technic.

DR. VAN ES: I move the report be received and referred to the Executive Committee.

The motion was seconded and carried.

DR. REICHEL: I should like to have the Committee state definitely how long the agglutination test should be held in the incubator and also in the ice-box. I think setting up the test and keeping it at room temperature over night might be accompanied by growth of other organisms if the test is crudely done, and that would be safeguarded against if it were kept in the ice-box twenty-four or thirty-six hours. How short a period can it be kept in the incubator?

DR. VAN ES: The report implies that all readings may be made at twenty-four hours.

MR. WHITTLESEY: In the management of your flock did you recommend thorough cleaning and disinfection of the premises from which reactor birds were removed?

DR. VAN ES: The function of the Committee was to report on the method of standardization. While the sanitary measures in connection with bacillary diarrhea are customary, the Committee thought it would unduly lengthen the report by paying attention to that at this time. What we tried to do was to lay before this organization a tentative plan of standardization in an attempt to begin to bring a little bit of order out of the chaos we are in now on this subject. We had not taken into consideration disinfection or any of those sanitary methods, but we take it for granted that anyone engaged in the eradication of a communicable disease would assume that that is one of the things that goes with it.

MR. WHITTLESEY: That is one of the requirements in our system in connection with the work in Connecticut. It seems to be working out better without the authority of removal of the reactors. Under Dr. Retger's advice, we had always recommended entire removal of the flock if as many as ten per cent reactors were found. I am not altogether certain that it is advisable in some cases to eradicate the whole flock, even if a smaller per cent were found. We are finding this year flocks that were clean last year are clean this year, flock that were accredited last year are accredited this year—quite an encouraging situation.

PRESIDENT MOHLER: Dr. Olitsky of the Rockefeller Institute is with us. He has about fifteen minutes to talk. If you want to listen to him now he will be very glad to present his address at this time. What is the pleasure of the convention? (Motion carried to hear Dr. Olitsky.)

We are indeed fortunate to have with us a gentleman who is outstanding in the line of bacteriology and particularly filtrable viruses. He was chairman of the Bureau Commission that was sent to Europe in 1925 for the study of foot-and-mouth disease. I take great pleasure in introducing Dr. P. K. Olitsky, of the Rockefeller Institute, who will discuss a "Summary of Observations of the Committee to Study Foot-and-Mouth Disease." (Applause)

Dr. Olitsky read his address.
SUMMARY OF OBSERVATIONS OF THE COMMISSION TO STUDY FOOT-AND-MOUTH DISEASE

By Peter K. Olitsky, New York, N. Y.

Rockefeller Institute for Medical Research

The Commission to Study Foot-and-Mouth Disease was formed by the United States Department of Agriculture, and comprised Dr. Harry W. Schoening, of the Bureau of Animal Industry; Dr. Jacob Traum, of the University of California, and Dr. Peter K. Olitsky, of the Rockefeller Institute for Medical Research. Dr. Louis Boëz, of the Institut d'Hygiène, Strasbourg, France, where most of the work was done, acted as collaborator. We owe many thanks to the Director of the Institut, Professor A. Borrel. The carrier problem was studied at Alfort, France, with the generous and helpful assistance of Professor Vallée.

The work of the Commission will be presented in detail in a forthcoming publication by the Bureau of Animal Industry. A preliminary article has already appeared in the Journal of the American Medical Veterinary Association, 1926 (November), lxx (n. s. xxiii), 147, in which were reported comparative studies on vesicular stomatitis and foot-and-mouth disease.

A survey of the conditions in Europe showed that the continent is saddled with the disease. We, on the other hand, are comparatively free. We owe this freedom to the eternal vigilance of the personnel of the Bureau of Animal Industry, directed by Dr. John R. Mohler, in keeping the virus out of the country and in limiting epizootics by efficient methods, notably that of slaughter. In our letter to the Chief of the Bureau, quoted in Circular No. N 251.52, of October 20, 1925, we stated, furthermore, that European officials, with whom control measures were discussed, agreed that the methods employed in America are not only the most effective, but in the end the most economical.

A summary of the more important observations of the Commission will now be given.

TRANSFER OF THE VIRUS TO GUINEA-PIGS

Guinea pigs can be successfully and regularly inoculated with the virus by scarifying and tunneling the epidermis of the hairless posterior pads with the virus. The disease in these rodents is
FOOT-AND-MOUTH DISEASE

almost a counterpart of that in bovines. Primary vesicles appear at the point of inoculation, within twenty-four to forty-eight hours after injection, which are followed in a day or two by secondary vesicles in the uninoculated mucosa of the mouth, or in the tongue, or in the anterior pads. Several bovine strains were transferred to guinea pigs, and of these one was propagated in the latter animals for 261 passages, during about one year. Thus the guinea pig offers an aid to diagnosis and laboratory studies on the virus, and is suitable for its propagation. Furthermore there is no difficulty in inducing foot-and-mouth disease in cattle and hogs with guinea-pig virus (Strasbourg, Riems and Vallée A strains) by either local or intramuscular inoculations of cattle and by intravenous injection of hogs. The disease so induced is a counterpart of the natural affection. However, while in nature the disease is most contagious, among guinea pigs there is practically no communicability.

**Plurality of Types of Virus**

Of greatest importance to the efficacy of control measures, to epidemiological conditions, and to investigations on immunity is the presence of more than one type of the virus. We have found that there are at least two types of foot-and-mouth disease virus corresponding to Vallée's types O and A. These do not cross-immunize, as noted by tests on cattle, hogs, and guinea pigs, nor do they induce a clinical picture by which one can be distinguished from the other. The Strasbourg virus, with which most of our work was done, was of the type O.

**The Presence of the Virus In and Outside the Animal**

The virus is contained in the blood during the initial febrile stage of the disease. It is also present in the fluid, and in the coverings, of the vesicles. In the vesicles of cows and hogs, the virus was active for guinea pigs for not longer than seven days after the first appearance of symptoms. In most instances, however, such materials were inactive after the fourth day. We found the virus in the saliva, but not in the urine from two cows. Bielang reports the absence of virus from the feces of three cattle and five hogs, tested from 24 to 120 hours after artificial infections. These tests are too few in number to permit generalizations, but the repeated findings of others, however, indicate that the virus may be present at one time or another in practically all the secretions and excretions. Whether this is due to admix-
ture of these materials with vesicular contents or coverings is immaterial; the practical bearing on epidemiology and on control measures is important, and that is, that the secretions and excretions should be considered as harboring the virus at least in the early stages of the disease. Furthermore, we have found that cattle contain virus in the oral secretions before the first symptoms of the disease are made manifest.

With respect to the viability of the virus outside the body, the conditions under which it is kept determine in a large measure its resistance to destruction. In the laboratory, at 37° C., the active agent dies within twenty-four to forty-eight hours. This has given rise to an impression that the virus is quite fragile. But it is merely an extraordinary phenomenon, still inexplicable, and does not indicate the true character—the remarkable resistance—of the virus. For at room temperature we have kept the virus alive for longer than 69, but shorter than 100 days. In the cold, in 50 per cent glycerol, it is preserved indefinitely. Under field conditions, we have noted that in hay or in garden soil the virus remains living for at least 25 to 30 days. That the active agent is not rapidly destroyed after leaving the animal is substantiated by the American instance in which the incitant persisted in the field for one year. Hence, we conclude that it is of utmost significance from the standpoint of epidemiology and control, to regard the virus as resistant, and not as fragile, as some others believe.

CARRIERS

The presence of carriers was studied experimentally. In one series of tests, twenty selected, recovered Swiss cattle, presumed to be possible carriers of foot-and-mouth disease virus by the Swiss federal veterinary officials, were placed in contact with twenty-eight normal cattle and four hogs of French origin, and seven normal cattle from Switzerland, believed by the local authorities to be more susceptible. About one month before this experiment was terminated, the hoofs of the suspected carriers were pared and scraped so as to make the test more rigid. After three months' contact, no disease occurred in the normal animals, although at the end of this period they were all successfully inoculated with both "O" and "A" types of the virus.

This experiment, performed under the most elaborate conditions and carefully controlled, failed. But a negative result under the circumstances means nothing. The questions arise
as to whether sufficient animals were employed, or whether the

time of contact was long enough for an unequivocal test. In the

next series of experiments, somewhat different results were

obtained.

The hoofs of twenty-two cattle and one hog were examined at

postmortem twenty days to six months after the onset of the
disease. The hoofs were sectioned with a saw, and pockets,
double soles, and the tissues generally were scraped. The

scrapings were then inoculated into guinea pigs. The material

from only one of these animals, slaughtered thirty-four days

after inoculation with the foot-and-mouth disease virus, was

positive. It appears, therefore, that one of twenty-three animals

harbored active virus thirty-four days after infection.

After consideration of both tests, one may conclude that, in

a very small number of cases, a recovered animal may carry the

virus. Actual experimentation reveals that the number is much

smaller than that believed by the Swiss authorities. On the

other hand, it may explain in part the isolated outbreaks due to

carriers reported by the Italians, British and Swiss officials.

At this point we may state that we have failed to implicate

the earthworm as a carrier.

IMMUNITY

This problem was studied in guinea pigs. The limitation of

our time prevented us from studying the duration of protection,

but we have found that a solid immunity, but only against the

homologous type either "O" or "A," is present for at least three
to four months after infection. Gins reported a case in which

resistance to infection was maintained for 387 days. More work

is necessary on the problem of duration, since it is now known

that there are more than one strain of virus.

The immunity in experimental foot-and-mouth disease is of

an extraordinary type. Serum from recovered animals, either

from cattle or guinea pigs, or hyperimmune serum, does not

prevent the occurrence of primary lesions; it inhibits the develop-

ment only of secondary vesicles. This results if the serum is

injected in the guinea pig either subcutaneously or locally by a

puncture-scarification method. On the other hand, if a proper

inoculation of virus was given, no natural resistance was found
to exist in guinea pigs, thus confirming the observation of the

investigators of the British Commission and others.
SITE OF INOCULATION

Our experience with inoculation of the virus in sites other than the hairless pads of guinea pigs may yield some information concerning the epidemiology of the disease. After a proper injection in the pads, all of over two thousand guinea pigs showed the typical experimental disease within one to two days. In those, however, which were injected intramuscularly, intraperitoneally, subcutaneously, or intracutaneously in the abdominal skin, from 20 to 65 per cent failed to react. In the guinea pigs which did yield typical lesions, but only in pads or in the tongue, the latter were very mild and were noted from two to six days after inoculation. In none were changes seen at the site of injection. The indication is that the virus is peculiarly epitheliotropic and probably has a limited portal of entry into the animal's body.

TITRATION OF HYPERIMMUNE SERUM

In view of the fact that immune serum, even in amounts of 10 cc, fails to prevent the primary lesions in guinea pigs, the protective value of such serum is measured by the quantity needed to prevent secondary lesions. The serum-titration as practiced at present is not satisfactory, and is due to the failure to regulate the infecting dose and inability to prevent the constant primary lesions. It appears that comparative serum-tittrations, employing graduated doses of virus, injected intradermally in sites other than pads, subcutaneously, intramuscularly, or intraperitoneally, may yield more satisfactory results, for by these methods the inoculation, or primary lesion, is suppressed.

ARTIFICIAL IMMUNIZATION

Attempts to hyperimmunize cattle and a horse by repeated injections of virus failed to produce more potent serum than that of convalescent animals. Indeed, serum from the horses was absolutely of no protective value. That from hyperimmunized guinea pigs and rabbits yielded the greatest protection (0.01 to 0.1 cc neutralized the average infecting dose against generalization). In addition, comparison with hyperimmune serum obtained elsewhere (two samples from Riems—Löffler type) has shown no greater protective value in the latter than some sera from recovered foot-and-mouth disease cases—either our own material, or that sent us from Denmark or Sweden.

IMMUNITY AFTER ARTIFICIAL IMMUNIZATION

In a limited study, we found that following injections of immune serum, plus virus, if guinea pigs failed to yield secondary lesions
they lost their resistance more rapidly than those animals which had passed through the experimental disease, or than those which showed secondary lesions even when immune serum was employed. Furthermore, immune serum plus virus injections in varying proportions, allowed to be in contact from one to several hours, either induced the disease in some instances or failed to protect in others. Finally, single or repeated inoculations of avirulent blood, that is, blood containing active virus, kept for forty-eight hours at 37° C., did not protect guinea pigs. If we may make any conclusions from our limited experience, we should state that immunity in an animal results only after it has shown manifestations of the disease.

Susceptibility of Horses

Five horses inoculated with foot-and-mouth disease virus, both "O" and "A" types, by scarification of the mucous membrane of the mouth, failed to show the disease. In addition, a horse injected intramuscularly also failed to do so. The horse is evidently not susceptible.

Intradermal diagnostic tests: Employing various antigens, no practical intradermal diagnostic test was revealed, either in guinea pigs or cows. We found, however, a slight sensitiveness of the skin to the antigen in some animals at the height of the disease.

Complement-fixation tests: Employing different antigens and immune or hyperimmune serum from cattle, horses, hogs, guinea pigs and rabbits, we were unable to disclose any complement-fixing bodies.

Comparative Studies of Vesicular Stomatitis Virus and Foot-and-Mouth Disease

The similarity of the clinical picture of vesicular stomatitis and of foot-and-mouth disease in cattle is so strikingly close that, in the interests of epidemiology and of control of epidemics, we devoted considerable time to a study of the comparison of the two conditions. We found that vesicular stomatitis can be readily transferred to guinea pigs, to cattle and to swine. In these animals, while there may be at times certain clinical differences, there is generally great difficulty in distinguishing the natural or the experimental disease from foot-and-mouth disease induced by one or another strain of the virus of the latter. In these animals, however, no evidence was detected of cross-
immunity between vesicular stomatitis and foot-and-mouth disease virus, either "O" or "A" type. Horses, however, are resistant to foot-and-mouth disease, but are quite susceptible to vesicular stomatitis infection. Hence this animal can be regarded as the best test animal for a differential diagnosis. For further details of other methods of differentiating the two viruses, the article in the Journal of the American Medical Veterinary Association* should be consulted.

We have also found that the virus of vesicular stomatitis is filtrable through Berkefeld V and N candles, through Seitz' asbestos discs, and through Chamberland bougies, sizes L 3 and L 7. As is the case with the virus of foot-and-mouth disease, to be mentioned later, the virus of vesicular stomatitis is not filtrable under ordinary conditions through Chamberland L11-type bougies, and shows the same tendency to adsorption in the walls of denser, electronegatively-charged filters.

**Physical and Chemical Properties of Foot-and-Mouth Disease Virus**

*The incitant:* There is no confirmatory evidence that the various kinds of bacteria of the ordinary species, which have been advanced to the present as the inciting agents of the disease, actually play this part. It is now universally accepted that the incitant is a filter-pass which has eluded artificial cultivation by others and ourselves. The most promising efforts in the direction of culture were those of Frosch and Dahmen, but the results of the German, British, this American Commission, and others could not confirm their findings. Hence, at this moment, the causal agent may be regarded as non-cultivable by means now available.

*Titration of the active agent:* We have found that the active agent can induce the experimental disease in dilutions of 1:10,000,000, and that generally the period of incubation and the severity of the experimentally induced disease are proportional to the concentration of the incitant. The marked activity of the virus, as manifested by pathogenicity in very high dilutions, has, therefore, an obvious connection with the difficulty of controlling epidemics, and may indicate the minuteness of size of the incitant. We have delimited the size, by a series of molecular filtration tests, to 20 to 100 μ in diameter, and by similar means and by cataphoresis experiments we have demonstrated

*Loc. cit.*
that the virus is particulate. We cannot subscribe to the opinion that the virus is of a fluid character, or a *contagium vivum fluidum*.

**Cataphoresis:** The electric charge carried by the active agent is positive, as determined by cataphoresis. Its isoelectric point is at pH—about 8. This explains, among other phenomena, certain filtration reactions to be described.

**Centrifugalization:** The virus could not be sedimented at 2500 to 3000 r. p. m. for two hours. Nor did we succeed in removing, by this method, the so-called "inhibiting" bodies of Frosch and Dahmen. The inability to depose the virus supports our other experimental findings on its minuteness.

**Filtration:** We found the virus to be regularly filtrable through Seitz' asbestos discs and through Berkefeld-V candles. In Berkefeld-N candles, however, there was some adsorption of the electropositive virus in the electronegative filters. Through Chamberland bougies (sizes L 1 to L 5) the virus passed regularly; but in the denser bougies (L 7 and L 9) only occasionally and in the still more dense (L 11) filter, it was completely retained. Here again adsorption was due to oppositely charged materials. Through L 11 Chamberland bougies, however, the virus passed freely when the charge of the latter was changed to negative.

Supporting the conclusion of the British Commission, we failed to obtain active filtrates through various types, thicknesses and densities of collodion membranes, which are also electronegative. We did, however, obtain positive filtrates with Bechold's ultra-filters, but then only with the most porous of the series.

**Chemical properties:** The minuteness of size and the electropositive charge indicate the possibility of the virus entering into firm combination with proteins, ordinarily electronegative, or its capability of being protected by larger colloidal agglomerations. Indeed, we have shown that the colloidal protective action is quite marked and explains the abnormal resistance which the virus shows to such antiseptics as alcohol, acetone, bichlorid of mercury, cresol, etc. Sixty per cent alcohol, for example, kills staphylococci in one minute, but not the virus until after at least twenty-six hours.

In laboratory tests these antiseptics are added to pure cultures of ordinary bacteria. The action is then direct. In the case of the virus, on the other hand, the active agent is non-cultivable and is therefore admixed with tissue or exudate. The chemicals, in consequence, cause a more or less heavy coagulation of proteins. These coagula protect the virus. If coagulation is prevented, as
we have done, and the virus is placed directly in contact with the reagent, then it is more sensitive to the destructive effects of the chemicals than are staphylococci. As a corollary, such reagents as sodium hydrate or antiformin (which is prepared with alkali) that do no coagulate proteins, are highly virucidal. Sodium hydrate (1 to 2 per cent) or antiformin (1 per cent) can kill the virus within one minute.

CULTIVATION EXPERIMENTS

No multiplication of the virus in vitro was observed. We have found, however, that the optimum conditions necessary for the preservation of the virus in artificial media are as follows:

The hydrogen-ion concentration of the medium should be 7.5 to 7.6, not only at the beginning, but, and more important, at the conclusion of the period of observation. A strict anaerobic atmosphere is also favorable, as is a temperature below 37° C. A semi-solid structure of the medium appears to be advantageous and this can be effected by the use of 0.25 per cent agar, or 10 per cent gelatin. Of the two, gelatin is more desirable, and of the latter the most effective preparation is gelatin prepared after the manner of Loeb and adjusted to the proper pH with potassium hydroxide. In this medium the virus survived longer than 69 but shorter than 100 days. Gelatin is the simplest of protein media available and its use is in keeping with the principle that the virus requires only a simple material for life; the addition of organic substances or of proteins caused destruction of the active agent.

From the standpoint of technic, it was found necessary, when comparing two or more media for their effectiveness, to employ all of them in a parallel experiment with the same sample of virus, for the factors of potency of the active agent, contamination, and changes in pH, if variable, may give rise to faulty interpretations. Furthermore, activity in three successive sub-plants may be regarded as mere preservation but not multiplication of the virus.

We have consistently failed to confirm the results of Frosch and Dahmen in respect to their reported artificial cultivation of the active agent. In this failure of corroboration, as well as in many other experimental results, we are in complete accord with the workers of the British Commission, and others.

Finally, in our forthcoming report, we shall discuss the fact that nothing has as yet been presented to show that the virus of foot-and-mouth disease is of an inanimate character.
PARASITE PROBLEMS

President Mohler: If anyone would like to ask Dr. Olitsky questions on this topic, I am sure he would be glad to reply. We all appreciate the time and trouble taken by Dr. Olitsky in coming to Chicago, solely for the purpose of appearing before you this morning. I suggest we show him our appreciation by a rising vote of thanks.

A rising vote of thanks was extended to Dr. Olitsky.

The meeting adjourned at 12:45 p.m.

ADJOURNMENT

FRIDAY AFTERNOON, December 3, 1926

The sixth session convened at 2:00 p.m., President Mohler presiding.

President Mohler: We will hear from Dr. Maurice C. Hall, on "Parasitic Problems of the Live Stock Industry in the United States and in Central America." (Applause)

Dr. Hall presented his paper.

THE PARASITE PROBLEMS OF THE LIVE STOCK INDUSTRY IN THE UNITED STATES AND IN CENTRAL AMERICA*

By Maurice C. Hall, Washington, D. C.

Zoological Division, Bureau of Animal Industry

MISTAKEN CONCEPTS ABOUT THE TROPICS

The writer spent last summer in Central America, and after making as comprehensive a survey of the parasitic diseases of live stock along the Pacific side in Panama, Nicaragua and Salvador as was possible in three months' time, he came to the conclusion that so far as conditions in those parts of Central America were representative of tropical conditions, the major problems in connection with parasites of live stock were not in the tropics and were in the United States.

Before considering this matter in detail it should be said that the word tropics should be used with caution. If one means the portion of the earth's surface lying in the equatorial belt between the Tropic of Cancer and the Tropic of Capricorn he is safe in speaking of this geographical entity, but if he has the impression that climatic, topographical, floral and faunistic characters throughout that area are likewise an entity or characterized by any great degree of uniformity, he has laid the foundation for coming to some highly erroneous conclusions. I can speak feelingly on this subject, because I realize that I have entertained some very hazy and erroneous ideas about the tropics. In general I had regarded the tropics as areas characterized by the pre-

*The survey of parasites of live stock in Central America was made on an expedition financed by the International Health Board of the Rockefeller Foundation and under the auspices of the School of Hygiene and Public Health of Johns Hopkins University.
valence of heat and moisture, and therefore presenting conditions ideal for parasites. This is a concept commonly entertained by parasitologists and it required a trip to Central America to disabuse me of the idea that this was quite generally true.

It does not follow that parasitologists are loose thinkers or poorly informed as to tropical conditions. In the first place these things are true of part of the tropics and, in the second place, it is generally true that human parasites are very prevalent in the tropics and most of the work on parasites there has been done on parasites of man. Parasites of live stock in the tropics have had comparatively little attention, partly because in the past there have been very few veterinarians, and still are very few, in the tropics, and partly because there has been and still is but a very small amount of live stock in the tropics in comparison with the live stock of the temperate zones.

WHAT THE TROPICS ARE

One feature of the tropics which constitutes an outstanding characteristic is that of heat. Turning now to Castellani and Chalmers, we find that if one adopts Supan's classification of climates, the tropical climates are defined as those areas bounded by the mean annual isotherms of 20° C. or 68° F. If we substitute these isotherms for the Tropics of Cancer and of Capricorn, we find our tropics bounded by wavy lines instead of the parallels of latitude 23° 27' from the equator. The reasons for these wavy lines are found in the effects of hot and cold ocean currents, of bodies of water, of altitudes, of prevailing winds, and other factors influencing climate.

If we define the tropics on the basis of temperature, however, we find that we have in the tropics very varying conditions as regards the important factor of rainfall, and the tropics may be defined on the basis of rainfall as well as on heat. Close to the equator lies the belt of calms called the doldrums, while north and south of this are the regions of the trade winds, but these belts are not stationary affairs; they move northwards in our summer and southwards in our winter. As a result of this movement only limited zones lie entirely in any one of these belts at all times, the borderline areas moving in and out of the doldrum and trade-wind zones. The doldrum belt close to the equator may have a persistently wet climate, or two wet seasons and two dry seasons every year. The borderline areas may have six months of drought and six months of rain, or annual wet and dry seasons
of varying lengths. In the trade-wind belt there may be excessive
drought, with only infrequent showers, throughout the year.
Other factors may lengthen or shorten the wet and dry seasons
and there are annual variations which may give rise to excessively
wet or dry years in parts of the tropics.

CLIMATIC CONDITIONS IN CENTRAL AMERICA

On the Pacific coast of Central America the dry season may
last, as a rule, from two to six months. The past year was an
exceptionally dry year, and in parts of Columbia thousands of
cattle perished from thirst. During the dry season no rain falls,
the vegetation is brown and dry, and there is a large amount of
dust with which to contend. In the wet seasons the rains are
torrential, but they usually occur in the afternoon of each day
and last for only a few hours. These things have an important
bearing on our findings in the survey of parasites of live stock.

THE PARASITES OF LIVE STOCK IN CENTRAL AMERICA

The survey of parasites of live stock in Central America was
made for the most part on cattle, swine and goats in the abattoirs
at Panama City and Penonomé, in Panama; at Granada, Managua
and Leon, in Nicaragua; and at San Salvador in Salvador, with
incidental observations on parasites of dogs, cats, horses, poultry
and wild animals at these and other places. The writer had the
courteous assistance and cooperation of Dr. Schapiro, Dr.
Paredes, Dr. Mattatall and Dr. Hopkins, at Panama City; of
Don Jeronimo Almillatique, at Penonomé; of Dr. D. L. Augustine,
Dr. Malloy, Don Bernabe Rosales, Mr. Magoon and others, in
Nicaragua; of Dr. Augustine, Dr. F. W. Taylor and Dr. Kern, in
Salvador, and of various alcaldes and other officials at all of
these places, and is correspondingly indebted to them. The
parasites collected were brought back to the United States and
will be identified and reported on, for the most part, by the staff
of the Zoological Division. However, field identifications were
made of a number of the parasites found and these identifications
are sufficient to warrant certain tentative conclusions in regard to
parasitism of live stock on the Pacific Coast of Central America.
More definite findings will depend on future investigations.

As was said at the outset, the writer went to Central America
with certain preconceived notions as to what was to be found
there. On the basis of twenty years' experience in parasitology
in the United States, he expected to find an abundance of para-
sites, exceeding all his experiences in this country. It was, therefore, surprising and almost incredible when he failed to find the common stomach worm of sheep and cattle, *Haemonchus contortus*, in the fourth stomach of cattle at Panama City, but the almost complete absence of this parasite from cattle in the Pacific region of Central America had to be accepted as true and an explanation sought when it failed to show up at Penonomé and in the abattoirs in Nicaragua and Salvador, and only came to light finally in a goat in San Salvador, and then in a light infestation. Accompanying this failure to find *H. contortus* was the failure to find in the digestive tracts of these cattle any other nematodes, the only worm found in the digestive tract of cattle being an amphistome in the cecum of one cow at Penonomé, in Panama.

These findings had to be explained in the light of the fact that in the countries visited there was a high rate of infection of man with such parasites as hookworm, ascarids, whipworms and pinworms, and that poultry, dogs, cats, swine and horses showed a fairly high degree of parasitism, although we saw no cases so excessive, as a rule, as we have seen in the same animals in the United States. The explanation called for a sorting of the parasites involved into groups, a sorting of the hosts on the basis of conditions surrounding them, and a consideration of the factors present under the varying conditions. In the following discussion the groups as sorted out are discussed separately.

**Monoxenous (Single-host) Nematodes of Range Animals, Especially Cattle**

The extraordinary absence of *H. contortus* and of related trichostrongyles and strongyles in general from cattle in Central America is the first feature calling for special consideration. These nematodes have been classified among the monoxenous nematodes, those having a simple life-history not involving an intermediate host, and are outstandingly important as parasites of sheep, goats and cattle in the United States and generally throughout the Temperate Zone. While it is probable that they are represented among the parasites of cattle in certain localities favorable to their development in Central America, it is clear that they are of no general importance on the Pacific Coast, and that generally speaking they are not present over much of that area. Other monoxenous nematodes include the ascarids and oxyurids and their relatives.
The explanation for this state of affairs is to be sought in two outstanding factors, with other factors as possibly present but not evident and not considered here. These factors are as follows:

1. The distribution of the rainfall into (a) a wet season of prevailing torrential rains, and (b) a dry season of prolonged heat without rain, instead of a general precipitation of moisture throughout the year in the form of rain or snow, which occurs throughout the Temperate Zone in such countries as the United States.

2. The abundant range and the consequent absence of concentration of parasitic infection on the pastures as a result of overstocking.

From two to six months of dry tropical heat and sunshine, absolutely unrelieved by any precipitation, must serve to desiccate the worm eggs and larvae exposed to such conditions, so that, practically speaking, the pastures are sterilized. Warmth and moisture are favorable to parasites, but heat without moisture is deadly. In the dry season, the Central American tropics under discussion constitute an arid region, and the monoxenous nematodes do not flourish under arid conditions.

Even during the wet season, it is probable that conditions are not altogether favorable for parasites. The rains are torrential, and on the oblique topography of western Central America these rains would tend to wash parasitic material—eggs and larvae—off the pastures and down into some of the numerous water-courses, where most of this material is probably destroyed without a chance to get back to host animals.

So far as data on the subject are available to the writer, it appears that in the temperate zones infestation of sheep with stomach worms falls off very decidedly in winter, which is our season unfavorable to worms, suggesting that these parasites are actually rather short-lived in the sheep and depend on constant reinestation for their maintenance. Apparently the prevention of reinestation by the sterilization of pastures with dry heat for two to six months is sufficient, under present live stock conditions in Central America, to result in the dying-out of stomach worms and such related gastro-intestinal parasites as have been introduced into that country. Here and there local areas may be favorable to the survival of these parasites, but in general monoxenous nematodes are unable to cope with the conditions.
The abundant range and consequent avoidance of overstocking in Central America is undoubtedly a very important factor in controlling parasites. Many gastro-intestinal nematodes apparently have a comparatively short life and depend for their persistent existence on reinfection. They produce in some cases thousands of eggs daily and if suitable host animals are concentrated on limited areas the law of chance favors the likelihood that these hosts will be constantly reinfected. If, however, the host animals range over a wide area, the chances against the parasite become increasingly greater as the range widens.

As time elapses between the deposition of the infective material in the manure on pastures, this material is subjected to the unfavorable influences of adverse temperature and moisture conditions, the eggs and larvae die in the course of time as they fail to enter suitable hosts, and the likelihood of the survival becomes remote. Ultimately all perish or the few favored parasites prove inadequate to supplying sufficient infective material to carry on the species, since the odds become greater as the initial infection in the host also decreases.

A striking illustration of the importance of this factor of overstocking has recently come to the writer's attention in finding that a sheep which had ranged over a large area with a few companions was apparently absolutely free from parasites, while a sheep from a heavily stocked small pasture on the same farm was full of parasites in spite of persistent treatments. This latter sheep had many young stomach worms, apparently taken in since it was dosed, less than two weeks previously, and so far as we know, young stomach worms might do substantially as much damage as the same number of mature worms. The writer has found the range sheep in eastern Colorado very lightly infested with stomach worms, *Haemonchus contortus*, and has been inclined to regard this light infestation as the result of unfavorable climatic conditions, the dry air and hot sunshine of Colorado tending to desiccate the eggs and larvae and the cold nights tending to retard the development of the eggs and larvae. At the present time, he is inclined to think that the wide range of these sheep is possibly an equally important factor.

Range conditions in Central America are comparable in a general way to the old range conditions, now rapidly disappearing, in the United States. There is plenty of cheap range land, a scarcity of fencing, and the consequent scattering of herds of cattle over large areas. In parts of Panama the poor quality of
the grasses necessitates wide range purely as a feeding proposition. In some parts of Nicaragua, notably in the provinces of Chontales and Rivas, the grasses are excellent and the pastures have a high carrying capacity, but they do not appear to be overstocked, so far as could be learned, and the fine condition of the cattle shows that the factors controlling worm parasites are operative at present in these areas.

**Monoxenous (Single-host) Nematodes of Animals Kept Up Near Dwellings**

As regards the monoxenous nematodes of the animals kept up near dwellings, the situation is different from that in the case of range cattle. The horses have an abundance of *Strongylus* spp., cylicostomes and pinworms; swine have kidney worms, nodular worms, lungworms and the small red stomach worm; dogs and cats have hookworms and ascarids; and chickens have Ascaridia and cecum worms. We were told that sometimes swine and the calves of milk cows had ascarids, but we never saw any of these parasites. The failure to find ascarids in swine suggests that they are decidedly scarce at least, and apparently there is in Central America an even more remarkable prevalence of ascarids in man (we found them in 84.4 per cent of our army patients at Managua, Nicaragua) and scarcity of ascarids in swine than Schwartz (1922) found in the Philippines where approximately 50 per cent of the people have ascarids and only about 25 per cent of swine have these worms. Schwartz has not attempted to explain this phenomenon and our knowledge of the subject hardly seems to warrant the attempt at this time.

The explanation for the prevalence of monoxenous nematodes other than ascarids in animals kept about dwellings appears to be due to the following facts: Dwellings are typically surrounded by shady areas of relatively level contour and there is a concentration of infection following from the restraint of the animal’s movements. Riding-horses are kept up in sheds or corrals, pigs are kept in a thatched sty or a pen or tied to a tree or allowed to run about the yard or street; and dogs and chickens range about the house and yard. The occasional heavy infestations found indicate that under favorable conditions these parasites will do more or less harm and must therefore be regarded as of importance in these parts of the tropics.
The heteroxenous nematodes are those having an intermediate host in which the worm occurs as a larva. Sometimes the intermediate host swallows the worm eggs in the manure, and the dung beetles and cockroaches, acting as intermediate hosts of such spirurids as the gullet worm (*Gongylonema*), are examples of hosts of this sort. Sometimes the intermediate host swallows the larval worms in sucking the blood of the first host, and mosquitoes, acting as intermediate hosts of filarids, are examples of hosts of this sort. We found worms of this sort in Central America as follows: Swine have two such heteroxenous worms in the form of spirurids in the stomach, and another worm, not a nematode, in the form of the thorny-headed worm with the white grub as its host. Cattle have a heteroxenous nematode, *Setaria labiato-papillosa*, in the body-cavity. Dogs have such a worm, *Spirocerca sanguinolenta*, in tumors which are usually in the esophagus. Chickens have one, *Cheilospirura hamulosa*, in the gizzard. Horses have several species of such a worm (*Habronema* spp.) in the stomach.

The occurrence of these worms will be influenced, among other things, by (1) the occurrence and abundance of intermediate hosts and (2) climatic and topographic factors and local conditions.

As regards the occurrence of intermediate hosts, there is abundance of intermediate hosts, such as suitable insects, in the tropics, though whether they are more prevalent than in the United States is a matter that would need consideration for each insect group, if not for each species involved.

As regards climatic and topographic factors and local conditions, the effect of these factors would not always be the same as for monoxenous nematodes. In the case of worms carried by biting flies, climatic and topographic factors would be of minor importance except as they influenced the occurrence of the intermediate host, since there is no free stage of the parasites outside of one of its hosts. In the case of worms carried by such insects as dung beetles, these factors would be operative to some extent. Dung beetles commonly work over and feed on fresh manure and thus swallow the eggs of heteroxenous nematodes while the eggs are still viable and before desiccation or washing away of the manure can occur. However, desiccation probably serves to shorten the period during which the manure is in suitable
condition for the insect’s requirements and thus aids in diminishing infection.

**TAPEWORMS**

The tapeworms which we found in Central America include *Dipylidium* sp. of the dog and cat, species of the genus *Davainea* and *Hymenolepis* in chickens, and the larval forms, *Cysticercus tenuicollis* and *C. cellulosae*, in pigs. The occurrence of *C. tenuicollis* shows the presence of *Taenia hydatigena* in dogs in these countries and the occurrence of *C. cellulosae* shows the presence of *Taenia solium* in man. The occurrence of *T. saginata* in man in these countries shows the concomitant presence of *C. bovis* in cattle. Dr. Mattatall finds *C. bovis* to be very rare at Panama City. These parasites are all heteroxenous forms and what has been said about the factors influencing the occurrence of heteroxenous nematodes applies in general to these tapeworms.

There are also other factors here that are of major importance. The occurrence of *T. saginata* and *T. solium* in man depends for one thing on the eating of raw or insufficiently cooked beef or pork; it also depends on a lack of adequate sanitary measures in the disposal of human excreta. Improvement in food habits is a matter calling for educational measures, and some control of the parasites is already achieved by a limited amount of local meat inspection in places and by mass treatments for hookworms which incidentally remove tapeworms. In connection with the hookworm campaigns there is a constant campaign for sanitation and the construction of privies, and a large amount of work along this line has already been accomplished by the field force of the International Health Board or the governmental agencies which have taken over their work or supplemented it. As one by-product of that work, it might be mentioned that following the hookworm campaign of treatment and sanitation in Panama the incidence of *C. cellulosae* in swine at the Panama City abattoir dropped from 15 per cent to 5 per cent, according to the inspector, Dr. Mattatall. This ten per cent reduction in condemnations resulted in an annual saving of $40,000.00, a very valuable by-product of a hookworm campaign. This incidence of *C. cellulosae* in swine in Central America is astonishingly high, the parasite occurring in from 5 to about 30 per cent of swine, usually in gross infestations.
FLUKES

The only flukes found in domesticated animals in Central America were some amphistomes in the cecum of a cow in Panama. These flukes are not yet studied and we do not know whether they are new or a known species.

The occurrence of flukes depends as a rule on the occurrence of such intermediate hosts as snails and these in turn on such wet areas as are suitable for their development. There are in the western part of Central America some wet areas suitable for snails, but much of the country has a scarcity of such wet areas and the annual dry season serves to impose decided limits on such areas. The general scarcity of flukes, is, therefore, not very surprising.

ECTOPARASITES AND OTHER ARTHROPOD PARASITES

Ectoparasites are very common in Central America and include such forms as ticks, mites, lice, fleas and screw worms, in addition to numerous biting Diptera. Ticks are of outstanding importance. Gross infestations of all sorts of animals are very common and the ubiquitous *Amblyomma cajennense* attacks domesticated and wild animals and man most persistently and successfully. The writer was attacked by this tick on three occasions. *Boophilus annulatus* is widely distributed and carries tick fever there as here. Dipping is practiced only to a limited extent and is only a local procedure. When this part of the world takes up the problem of tick eradication it will have a rather large task, especially with ticks having such wide host ranges as has *A. cajennense*. The fact that cattle are owned for the most part by men with large numbers may simplify the problem if the cooperation of these owners is secured. Another favorable factor is the degree of control which these governments, unhindered by such state governments as we have in this country, may exercise and enforce. We found no ox warbles and no horse bots, although screw worms and *Dermatobia* take the place of the former pest to some extent.

PARASITE PROBLEM IN THE UNITED STATES

So far as the hastily studied conditions in Central America can be compared with the much better studied conditions in the United States, it would appear that with the exception of ticks, swine kidney-worms and swine measles, the parasite problems of the United States are decidedly greater than those of
Central America. The sheep stomach-worm, found once in Central America after prolonged search in three countries, is ubiquitous in the United States and is known to cause serious losses in the North, South, East, Middle West and West Coast; it seems to be of little importance only in such areas as the ranges of the Rocky Mountain states and of such dry areas as may be found in Arizona in the Southwest. The swine ascarid, never found by us in Central America, could not be missed in almost any part of the United States and has been shown to be a very serious pest in the Middle West where it has been most studied. In addition we have such widespread and serious parasites as sheep and cattle hookworms and nodular worms, the many small trichostrongyles of ruminants, the liver flukes of sheep, cattle and swine, the very common tapeworms of sheep and cattle, not found by us in cattle in Central America, such strikingly pathogenic forms as the salmon-poisoning fluke, *Nanophyetus salmincola*, of dogs, gapeworms of chickens, and quite as many of the heteroxenous nematodes as are present in Central America.

The factors which are favorable to parasites are present quite generally throughout the United States with the exception of such areas, already mentioned, as the range country of the Rocky Mountains and the dry areas of the Southwest. Precipitation in the form of rain, snow, fog or dew occurs throughout the year and favors the maintenance and development of parasite material on pastures. Freezing temperatures evidently afford our live stock a respite in winter, but in the warmer months, the time when susceptible young are usually born and put in contact with the infected areas, conditions are extremely favorable. Between the Alleghenies and the Rockies is an extensive area of relatively level contours, suitable to the propagation of parasites, and in this area is concentrated, with all of the dangers incidental to concentration and overstocking, the bulk of the live stock of the country. Coupled with all this is the existence of innumerable transportation facilities for the transfer of live stock from place to place, with its accompanying distribution of parasites. The very limited transportation facilities in Central America serve to restrict the movement of live stock and of live stock parasites and diseases.

There has been in the past fifteen years a growing appreciation of the importance of parasites and parasitic diseases of live stock in this country. A comparison of our parasite problems with
those of the Pacific portion of Central America and a consider-
ation of the factors influencing the occurrence, spread and im-
portance of parasites leads us to the conclusion that our problems
are, for the most part, greater than the heretofore supposedly
greater problems of these tropics, and that so far from over-
estimating them, there is reason to think that our problems are
greater than we had supposed. In this connection, your Com-
mittee on Parasitic Diseases is asking for a cooperative action
in surveying this situation as a preliminary to further studies
and control measures. What has been said here may afford
further reason why we should enlist all available and interested
agencies in a consideration of this problem.

DR. HALL: Dr. Mohler has asked that I present at this time the report
of the Committee on Parasitic Diseases.

. . . Dr. Hall read the report. . . .

REPORT OF COMMITTEE ON PARASITIC DISEASES

DR. M. C. HALL, Chairman, Washington, D. C.

Dr. C. G. Lamb, Denver, Colo. Dr. Edward Records, Reno, Nev.
Dr. A. W. French, Cheyenne, Wyo. Dr. R. P. Marsteller, College Station,
Dr. C. H. Case, Akron, Ohio. Tex.
Dr. M. W. Ray, Pierre, S. D. Dr. Harry Morris, Baton Rouge, La.
Dr. W. H. Lytle, Salem, Ore. Dr. E. W. Price, Washington, D. C.

Your Committee wishes to present the following report and recommendations
for your consideration: There are a large number of problems in connection
with parasites which could be solved to better advantage with a larger degree
of organized cooperation. There are also certain policies which we believe
might be stated to advantage in a report of this sort. With these things in
mind we would bring to your attention the following propositions:

1. At the present time the precise or even the approximate distribution of
parasites of live stock in the United States is not at all well known. This
information that is necessary or desirable in determining the objects towards
which research and control measures should be directed. The enormous scope
of the field is such that an attempt to map the distribution and estimate the
importance on the part of one man calls for a concomitant enlargement of the
time factor beyond the reasonable period in which this information should be
available. It would evidently expedite matters materially if a large number of
men undertook the work and covered limited and mutually exclusive areas.
As a tentative working plan, we would suggest that this Association select a
committee to organize such a survey, the committee to select one person or
several persons known to be interested in the parasites of live stock from each
state, their individual reports to be forwarded to the Zoological Division of
the Bureau of Animal Industry for compilation and coordination, as a report
of this larger committee on the distribution and importance of parasites of
live stock in the United States. If the necessary cooperation can be secured
it will be possible to accomplish, in a matter of years, a task which will other-
wise require decades.

2. As regards control measures for parasitic diseases, your committee
would submit the following recommendations: The treatment of parasitic
diseases should be regarded as the field of the veterinarian, rather than of the
stockman. We believe that the diagnosing of diseases and the administration
of potent drugs are matters calling for the training of the veterinarian and are
unsound, undesirable and often dangerous and expensive procedures in the
case of untrained persons. If this policy is to prevail it is necessary that the veterinarian give to the subject of parasitism in the colleges and in practice the attention necessary to qualify him as a man competent to handle these cases, and that he undertake to treat such cases when he is asked to do so.

Of late years the veterinarian has shown a vastly increased interest in parasitism and a growing inclination to handle cases of parasitism. It is recognized that in the absence of competent veterinarians the stockman himself must assume the risks of diagnosis and treatment, but as a practice we regard such diagnosis and treatment as unprofitable to the stockman and detrimental to the veterinary profession, a profession which is primarily responsible for our present large measure of control of animal diseases in this country and the resultant general good condition of the live stock industry.

On the other hand, the field of prophylaxis is primarily the stockman’s field, and here the veterinarian is and should continue to be valuable in an advisory capacity. Officially or unofficially the veterinarian is a public health officer in the field of animal health and should do all in his power to foster such prophylactic measures as sanitation, pasture rotation, special care of young, enforcement of reasonable quarantines, and other measures of prevention of diseases and their spread.

3. In connection with prevention of parasitic diseases, your Committee would again emphasize what has been said from time to time in regard to the importance of protecting young live stock from parasitic diseases. Young animals are usually much more susceptible to parasitism and to its bad effects than are older animals. To protect these young animals it should be a general practice, whenever possible, to keep them from the time of birth away from animals other than the mothers, and from the areas used by older animals, and if possible to hold them on clean areas, such as forage crops, until they have reached the age of six months to a year, and have acquired the relative immunity of the older animal to parasitism. The results of the swine sanitation system developed in the Bureau of Animal Industry is an excellent illustration of the benefits to be derived from the special care and protection of young animals.

4. In the control of parasitic diseases we have a field in which legal measures are frequently inapplicable. This is not a misfortune, as experience indicates that the fewest laws consistent with necessity and reasonable enforcement are better than many laws not enforced or unenforceable. The process of education on the subject of live stock parasites may seem slow, but it is a matter of healthy growth and accompanied by the goodwill that comes from cooperation. In this matter of education many agencies play a part, and this Association should have a prominent role. If the Association sees fit to institute a survey of live stock parasites, as recommended here, it will function in a decidedly educational way.

PRESIDENT MOHLER: The Chair will entertain a motion to receive the report and refer it to the Executive Committee for their action.

A motion was regularly made, seconded and carried that the report be received and referred to the Executive Committee.

PRESIDENT MOHLER: The next report is from the Committee on Meat and Milk Hygiene. Chairman Iverson is not here, but I understand Dr. Koen has a copy of the report.

. . . Dr. Koen read the report.

REPORT OF COMMITTEE ON MEAT AND MILK HYGIENE

DR. J. P. IVerson, Chairman, Sacramento, Calif.

Dr. V. S. Larson, Madison, Wis.
Dr. Hadleigh Marsh, Helena, Mont.
Dr. J. S. Koen, Bloomington, Ill.
Dr. H. W. Turner, Harrisburg, Pa.

Dr. E. M. Pickens, College Park, Md.
Dr. R. F. Leslie, Cleveland, Ohio.
Dr. W. G. Hollingworth, Utica, N. Y.
MEAT HYGIENE

The value of meat inspection, it appears, is estimated from two main aspects, one economic, and the other protection of public health. The importance of the latter is recognized by everyone, and since meat is so universally used as a food, the consumer should be assured of its wholesomeness.

From the economic viewpoint, meat inspection is likewise of great value. By the examination of live stock centralized for slaughter, the existence of unsuspected transmissible disease may be detected early, thus affording information which frequently permits sanitary authorities to undertake necessary eradication measures before heavy losses have been experienced. Permitting producers to market a larger number of animals increases the available meat supply. The larger volume lowers production cost, thereby establishing a condition desired by producer and consumer.

As an example of the economic importance of adequate inspection may be cited an instance, when, if this service had been provided, an extensive invasion of foot-and-mouth disease might have been averted in this country. After the discovery of a recent outbreak, investigation disclosed the startling information that animals with lesions of the disease had without doubt been slaughtered for some considerable period at a certain packing-establishment and the disease apparently was not recognized. Unfortunately this establishment, while operating under a system of meat inspection, was served by lay inspectors only, who failed to recognize the lesions of foot-and-mouth disease. Infection was spread from this place and eradication was not accomplished until enormous losses had been experienced. The belief is expressed in the official government report that had veterinary inspectors been assigned to this work, doubtless the disease would have been discovered earlier and extensive spread avoided. This unfortunate occurrence demonstrates that the value of meat inspection is of great importance, not only from the viewpoint of protecting public health, but as a means of early discovery of a transmissible disease.

The Bureau of Animal Industry maintains a most effective system of meat inspection, probably a national system unequaled by any other country in the world. However, the federal law limits its application to abattoirs and packing-plants engaged in interstate or export business.

It is regrettable but unfortunately true that few of the states have attempted to inaugurate a meat inspection system to serve as an auxiliary to the federal system. Your Committee believes sanitarians and health workers in the various states have been backward in promulgating meat inspection regulations necessary to ensure a high standard of wholesomeness in this important part of our national food supply.

Three methods of operating meat inspection are in vogue; namely, federal, state and city. The federal system is too efficient to need comment. On the contrary, state meat inspection, as a hygienic measure, has lagged far behind the trend of the times. Few states have attempted any work which justifies the term "meat inspection." In many states nothing of consequence is being done toward the enforcement of sanitary regulations in country slaughter-houses. In such sections, butchers are permitted to slaughter and sell meat with little or no supervision of any kind. Filthy and insanitary premises are used in which to prepare animals for human food, and a considerable portion of the meat supply in some states originates from these sources. This is a startling condition of affairs and demands the attention of health authorities. Unfortunately apathy seems to be the apparent attitude in many states when necessity for a wholesome meat supply is suggested.

Most of the large cities maintain local meat inspection departments, many of which operate a satisfactory system of inspection. In smaller cities and in country towns the lack of meat inspection is the rule and not the exception. Throughout the country districts in many states, little supervision, if any, is maintained over the meat supply.

Thus it will be seen a decided gap exists between federally inspected meats and those coming under municipal supervision. It is evident, therefore, that a considerable proportion of this product originates from a source devoid of supervision. Such a situation is not economical as well as deplorable, and your Committee believes steps should be taken to protect the public to a greater
Conclusions drawn from the information at hand enable your Committee to make the following recommendations:

1. A wholesome meat supply should be afforded the public and the economic value of such service alone justifies the effort.
2. Sanitary workers and health authorities should attempt supervision of meats at present marketed without inspection.
3. State authorities should exercise supervision over sanitary conditions of slaughter-houses at present not operating under inspection and should plan for future postmortem inspection.
4. This branch of hygiene requires a special scientific training in relation to animal diseases and therefore the work should be in charge of persons with the requisite training, namely veterinarians.
5. If inspectors lacking such qualifications are employed, their work and final postmortems should be directed by veterinarians.
6. Cities not engaged in meat inspection should assume this responsibility.

Milk Hygiene

The health of this nation demands the purest milk supply obtainable. A food consumed raw in considerable quantities should attain a high standard of wholesomeness. At this advanced age the practice of permitting the sale of raw milk without adequate supervision is intolerable. However, it is regrettable but true that in many sections unpasteurized dairy products from diseased animals are permitted public distribution with little if any restriction.

Your Committee believes the lack of adequate supervision and regulations required to ensure wholesomeness in our milk supply to safeguard the public health results from the lack of information rather than the opinion that such safeguards are unnecessary. Since this appears to be the case, it behooves progressive sanitary organizations to disseminate information of value in the protection of health and urging the sanitary production and marketing of dairy products.

Our larger cities give considerable attention to their milk supply. Nearly all require the pasteurization of this product before distribution. In addition, some progressive communities require their milk supply to be produced by cattle known to be free from disease.

In the opinion of the Committee, this appears a logical procedure and one which presumably will be extended. Pasteurization, however, is not a perfect process and the supervision of this important function appears to be inadequately provided for in some instances. From the information developed by the Committee, it appears there are states which may lack regulations of value to safeguard the health of consumers of dairy products.

In some states the sale of raw dairy products is prohibited for any purpose, unless the animals producing the same have been officially tuberculin-tested by the state sanitary officials. To ensure this the law requires owners to make application to the state office for such tuberculin tests and they are prohibited from selling raw products until a tuberculin test is applied. Tests are repeated at regular intervals. To avoid hardship in the sale of dairy products, persons may choose between the sale of raw milk from tested cows or pasteurized milk from tested or untested cows. Pasteurization, however, is conducted under state supervision with approved pasteurizing equipment, including self-recording thermometers. So-called home pasteurization with improvised equipment is not permitted. This statute includes family cows from which milk is sold to neighbors, small retailers and persons located in country districts.

In other states somewhat similar regulations are in effect. However, in these the requirements as to who shall conduct tuberculin tests are not so specific, but the application of tests is left mainly in the hands of local practitioners. In some states, as previously stated, raw dairy products produced by any animal, healthy or diseased, may be offered for sale to the public. No
matter how unfortunate this condition may be considered, it is nevertheless
ture that some states fail to give proper official recognition to the tuberculin-
testing of cattle to safeguard the consuming public or to resort to proper pas-
teurization of dairy products. This situation is inexplicable by the Committee.
Conclusions based upon the information at hand prompt the Committee to
make the following recommendations:

1. Unpasteurized dairy products should not be permitted to be marketed
   unless produced by tuberculin-tested cows.

2. Such tuberculin tests should be applied at regular intervals by official
   veterinarians, or veterinarians acting under state supervision, and reactors
   should at least be removed from the premises.

3. Official supervision should be maintained over pasteurization of dairy
   products. None but approved types of pasteurization equipment with self-
   recording thermometer should be permitted.

4. The sale of unpasteurized dairy products produced by diseased cows
   is believed to be a violation of the principles essential to the protection of
   public health.

5. Pasteurization of dairy products is recognized as an effective measure
   to protect consumers against the spread of milk-borne diseases. However, if
   all milk could be produced by healthy cows, greater protection would be
   afforded.

DR. BUTLER: I did not quite understand whether the Committee, in its
recommendations, would permit the sale of milk from untested or tuberculous
 cows. The report said they should be removed from the farm. What would
you do with them?

DR. KOEN: I am hardly able to answer questions that might arise relative
to the report, for this reason: Dr. Iverson sent out a questionnaire to all
members of the Committee. Replies were submitted to him and the report
was made up by him. I received it after reaching the meeting here, so I
can not tell what the consensus of opinion was.

DR. BUTLER: The report shows a great deal of work on the part of the
Committee and I heartily approve of their efforts, but I did not quite under-
stand their recommendations. Probably I did not hear it correctly, but as
I understood, the milk from reactors could be sold if it was pasteurized, and
I am against that. There is no specific mention made, but that is the inti-
mation I got.

. . . Dr. Koen reread the conclusions in the report. . . .

DR. BUTLER: That does not answer it. It is evaded. You say in that
report that the sale of unpasteurized milk from reactors should be prohibited,
but you do not say the sale of pasteurized milk from reactors should be pro-
hibited. That point is evaded, Mr. President, and after the splendid address
we heard last year by Dr. Bundesen and the action taken by the city of
Chicago in requiring the milk sold in Chicago to be from cows tested and
found free from tuberculosis, I do not think we should go on record as evad-
ing that particular question.

I move you, Mr. President, that we add to that report a provision pro-
viding that the sale of milk, either pasteurized or unpasteurized, from tuber-
culous cows should be prohibited.

DR. KOEN: I certainly agree with that, and I think the Committee would,
too.

. . . The motion was seconded, put to vote, and carried. . . . It
was then moved to receive the report and refer it to the Executive Committee.
Seconded and carried.

PRESIDENT MOHLER: The convention is ready to receive the report of the
Committee on Unification of Laws and Regulations, by Dr. William Moore,
Chairman.

. . . Dr. Moore read the report. . . .
REPORT OF COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

DR. WILLIAM MOORE, Chairman, Raleigh, N. C.

Dr. U. G. Housck, Washington, D. C.
Dr. H. A. Wilson, Jefferson City, Mo.
Dr. Robert Prior, Olympia, Wash.
Dr. D. H. Udall, Ithaca, N. Y.

Dr. E. T. Faulder, Albany, N. Y.
Dr. T. E. Robinson, Providence, R. I.
Dr. W. B. Lincoln, Nashville, Tenn.
Dr. W. H. Hendricks, Salt Lake City, Utah.

By referring to the reports of this Association you will find that this Committee is the former Committee on Interstate and Intrastate Shipments of Swine, which within the past two years has been renamed, enlarged and given additional duties.

Those of us who are engaged in livestock disease control work can appreciate the desirability of having more uniformity in laws and regulations governing the interstate movement of domestic animals, but whether or not we have uniform regulations depends upon the action of the livestock sanitary authorities of the states. This Committee and this Association can only make recommendations. The various regulations issued by the several states following the outbreak of foot-and-mouth disease, in 1924, were very confusing and totally lacking in uniformity. Following this your Committee went into the matter very thoroughly and at the last meeting submitted a very complete and exhaustive report, which was adopted by the Association. This report included an outline of regulations as a suggestion to the state in the event of another outbreak of foot-and-mouth disease. Since we have had no outbreak of foot-and-mouth disease during the past year, it remains to be seen just how far the states will go in following this outline. It would seem that these regulations, together with the regulations of the U. S. Department of Agriculture, should protect any state.

We wish to call your attention to a decision of the Supreme Court of the U. S., No. 187, October term, 1925, styled “Oregon-Washington Railroad and Navigation Company, plaintiff in error v. State of Washington.” This case involved the right of a state to issue quarantine regulations covering plants, seeds, etc., which might come into or pass through the state. Briefly stated, it was decided that a quarantine issued by a state to protect itself from the introduction of a plant disease from another state was invalid because of the fact that Congress had enacted the Federal Plant Quarantine Act of August 20, 1912, to prevent the spread of plant diseases among the states. Congress thereupon amended the Plant Quarantine Act, on April 13, 1926, so as to give the states the right to establish and enforce quarantines for plant diseases until the Federal government establishes a quarantine under its act.

This decision probably would have some effect on the validity of a state quarantine against the introduction of animal diseases from other states, inasmuch as the act of March 3, 1905, has given that authority exclusively to the federal government. In view of the decision of the Supreme Court of October, 1925, it is the opinion of your committee that steps should be taken to place the states upon the same basis with regard to animal disease as in the case of plant disease. This can be accomplished with the amended Plant Quarantine Act.

We are all more or less familiar with the rapid growth of the poultry industry during the past few years, and with the poultry disease problems that have arisen. Many states have adopted a plan of control and eradication of diseases of poultry, especially bacillary white diarrhea, which seems to be very prevalent. In some states this work is not under the supervision of the livestock sanitary authorities, but is being conducted by various other agencies. There has been considerable lack of uniformity in the regulations covering this work, the terms used in one state meaning something entirely different from the same terms used in another state. The use of the term “accredited” is confusing, because so closely associated with tuberculosis work. If this term is used it should be preceded by a qualifying term.
The American Poultry Science Association has adopted a uniform plan, but it is not known at this time how many of the states will accept this plan. This is a disease control problem and it is felt that it should be under the direction of the live stock sanitary authorities of the states who are charged with the control and eradication of diseases of farm animals. If this work is attempted by other agencies and fails—and it seems likely that it will—through lack of experience, the confidence of the poultry-owner will be lost and disease eradication made more difficult. It would seem that a plan similar to that used in tuberculosis eradication would be effective. This is a matter of interest to our Association.

DR. BUTLER: I move that the report be received.

. . . The motion was seconded, put to vote, and carried unanimously. . . .

PRESIDENT MOHLER: The convention will now be pleased to hear from the Committee on Miscellaneous Transmissible Diseases, Dr. A. W. Miller, Chairman.

. . . Dr. Miller read the report. . . .

REPORT OF COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES

DR. A. W. MILLER, Chairman, Washington, D. C.

Dr. L. H. Howard, Boston, Mass. Mr. J. D. Jones, Jr., Madison, Wis.
Mr. E. S. Bayard, Pittsburgh, Pa. Dr. George Hilton, Ottawa, Ont.
Dr. R. W. Smith, Concord, N. H. Dr. B. J. Killham, Lansing, Mich.
Mr. S. J. Stanard, Springfield, Ill. Dr. Jacob Traum, Berkeley, Calif.

This Committee is the former Special Committee on Foot-and-Mouth Disease. As heretofore, its primary function is to submit data and recommendations with respect to that disease. In addition, its scope has been extended to include other transmissible diseases of live stock not specifically assigned to other committees of the Association.

Although there are a great many diseases which might be discussed, we shall make no attempt to cover this field in its entirety, but shall limit our report to a consideration of the following diseases: anthrax, hemorrhagic septicemia, dourine, rabies, foot-and-mouth disease and vesicular stomatitis.

ANTHRAX

To obtain accurate data concerning this disease, inquiries were addressed to the officer in charge of live stock sanitary control work in each of the states and Canada. Replies were received from all except one of the states. These show that no outbreaks occurred this year in 25 states, i. e., Alabama, Arizona, Colorado, Connecticut, Florida, Georgia, Idaho, Iowa, Indiana, Kentucky, Maine, Maryland, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oregon, South Carolina, Virginia, Wisconsin and Wyoming. The other 22 states reported outbreaks as follows: Illinois, 1; Kansas, 1; Missouri, 1; Montana, 1; Nevada, 1; Oklahoma, 1; Massachusetts, 2 (2 years); Utah, 2 (2 years); Washington, 2 (2 years); Tennessee, 3; Delaware, a few cases; Pennsylvania, 4 cases; New York, 6; Vermont, 6 (2 years); Louisiana, 1 parish; North Dakota, 7; Mississippi, 9 localities; Arkansas, 10 townships; Nebraska, 33 premises; California, a few outbreaks; South Dakota, 25 counties, 156 premises; Texas, 5 counties. During the year there was one outbreak in the province of Ontario, in Canada, which resulted in seven fatalities. The total loss in all the states was comparatively small except in South Dakota and Texas. In the former state about 800 animals died and in the latter approximately 5,000. The state veterinarian of Texas reports that in one county deer were extensively infected.

Several states having what are known as anthrax districts require yearly vaccination of susceptible live stock on previously infected premises. In some instances this service is performed at the expense of the state. It seems to be the general opinion of the officials in such states that this method has given excellent results as a control measure.
Minnesota not only insists on yearly vaccination of live stock on previously infected premises but has a law which provides that indemnity shall be paid for animals that die as a result of preventive treatment, provided vaccination is performed or ordered by the State Live Stock Sanitary Board. Indemnity, however, is not paid unless the diagnosis is verified by laboratory findings. During the fiscal year ended June 30, 1926, the owners of 2 cattle and 2 horses that died as a result of such vaccination were reimbursed for their animals.

Your Committee considers the prompt and proper disposal of the carcasses of animals that have died of this affection to be of paramount importance. This may be effected either by deep burial or by burning. The latter method is preferred, especially when suitable facilities are available. In either case carcasses should not be opened and body-openings should be plugged with cotton soaked in formalin.

Live stock sanitary officers entertain varying views concerning the value of anthrax vaccine. Some oppose its use altogether. Others favor general vaccination of all susceptible animals in infected localities. It is our opinion that only trained sanitarians should be permitted to use this product and that treatment should be limited to animals on infected premises and to those on other premises where there is imminent danger of exposure.

**HEMORRHAGIC SEPTICEMIA**

The letter sent to the state and Canadian officials requesting data in regard to anthrax also asked for information concerning hemorrhagic septicemia. Practically no losses were reported in 9 states and in Canada, slight losses in 23 states, and serious losses in 15. With a few exceptions it was stated that the disease is observed chiefly in recently imported cattle and sheep. A number of instances were cited in which infection had been transmitted from such imported animals to native live stock with disastrous results. Bacterins and aggressins were reported as being quite generally used in the treatment of animals in infected herds, and most of the state officials who expressed an opinion in regard to these biologics ascribed some virtue to them.

The U. S. Bureau of Animal Industry has conducted experiments with both of these agents under stockyards conditions. The one with bacterins consisted of the vaccination of 151,457 cattle at public stockyards before shipment to country points. Returns made on 57,946 of these animals showed deaths of 662 head, supposedly from hemorrhagic septicemia. This death-loss of 1.14 per cent was about the same as for untreated cattle shipped from the same yards.

Selected lots of cattle were used in the experiment with aggressin. Approximately one-half of the animals in each lot received aggressin and the other half as a check went forward untreated. The death loss in the treated cattle was 40 out of 708 as compared to 17 out of 700 untreated.

These experiments indicate that little or no immunity is conferred by these agents on animals in the incubative stage of the disease. Other experiments, however, by that Bureau have shown that either of these products will produce high-grade immunity if treatment is applied sufficiently in advance, that is, at least a week or ten days, of the time the animals are exposed.

**Dourine**

This disease, which at one time was quite prevalent in a number of states and also in certain sections of Canada, is no longer a serious problem. It was found to be a comparatively easy task except in very difficult range areas to stamp out the disease in two seasons by means of the complement-fixation test.

During the period from 1913 to 1926, inclusive, approximately 400,000 stallions and mares were tested for this disease in the United States. Of this number about 12,000 reacted. These reactors were appraised and slaughtered, the owners being indemnified 50 per cent by the federal government and 50 per cent by the state concerned.

The Veterinary Director General of Canada reports that dourine has not been detected in that country in many years. In the United States infected animals were found this year only in Montana and Arizona. In the former the number of diseased animals was 17; in the latter 394.
Rabies

Incomplete reports that we have been able to obtain indicate that this disease has been unusually prevalent this year. Michigan found it necessary to quarantine ten entire counties in addition to a number of townships in various parts of the State. The quarantine of the Department of Agriculture of that state provides for waiving quarantine restrictions when dogs have been properly vaccinated by qualified veterinarians. Other states in which extensive outbreaks occurred during the year also combated the disease by quarantine and single vaccination.

Canada has been free from rabies for many years but an outbreak was discovered just after the shooting season last fall in the province of Quebec. The outbreak extended to the Ottawa Valley and infection was found in several counties in Ontario. Later another outbreak which could not be connected with the previous one occurred on the Island of Montreal. This outbreak is still being dealt with but the special restrictions imposed on all the other infected territory have been removed.

The recommendation of the Committee with respect to this disease is that a uniform plan of procedure for combating outbreaks be worked out and put into effect by the federal and state authorities. As a preliminary step in such an undertaking field and experimental data on the value of the various kinds of vaccination of dogs should be gathered and critically analyzed.

Foot-and-Mouth Disease

Control and eradication of this disease and the recent outbreaks in California and Texas were covered in such detail in the 1924 and 1925 reports of this Committee that we have nothing further to offer concerning the domestic situation except to call attention to the fact that the United States has been entirely free from foot-and-mouth disease since October 15, 1925, at which time the last diseased herd in the Texas outbreak was destroyed.

Conditions in foreign countries, however, show no improvement. In fact on the whole they are worse than a year ago. The extent of the disease in several European countries is shown in the following table:

<table>
<thead>
<tr>
<th>Country</th>
<th>Outbreak Period</th>
<th>Number of Premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>July 1, 1926</td>
<td>2,039</td>
</tr>
<tr>
<td>Denmark</td>
<td>January 1, 1926 to June 30, 1926</td>
<td>45,716</td>
</tr>
<tr>
<td>France</td>
<td>January 1, 1926 to September 30, 1926</td>
<td>31,250</td>
</tr>
<tr>
<td>Germany</td>
<td>March 31, 1925</td>
<td>12,740</td>
</tr>
<tr>
<td>Poland</td>
<td>September 1, 1926 to September 15, 1926</td>
<td>15,681</td>
</tr>
<tr>
<td>Sweden</td>
<td>January 1, 1926 to June 30, 1926</td>
<td>2,500</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>August 1, 1926 to Aug. 31, 1926</td>
<td>13,644</td>
</tr>
</tbody>
</table>

In spite of the vigorous efforts that have been made by the British authorities to free England from this disease, occasional outbreaks continue to occur in that country. Scotland, after entire freedom for two years, also experienced an outbreak, the disease having been introduced by infected pig carcasses originating either in Belgium or in the Netherlands or possibly in both countries. It seems from a statement issued by the British Ministry of Agriculture that infected pig carcasses shipped from the Netherlands and Belgium arrived not only at one but several destinations in Great Britain. During the first 44 weeks of this year there have been 195 outbreaks in Great Britain as compared with 255 for the whole of the calendar year 1925.

Sweden and Denmark report a recrudescence of foot-and-mouth disease involving an especially large number of herds which had been infected in the outbreak of the preceding year. The authorities of Sweden state that with the assistance of the American Commission which was in Europe studying foot-and-mouth disease, it was definitely ascertained that a different type of virus was causing the new outbreaks and that a new serum is necessary in order to obtain any definite results in combating the disease.

Early in November an outbreak was reported in Norway, a country which has been entirely free for a great many years. This outbreak occurred not a great distance from the border between Norway and Sweden and it is believed that the infection was introduced from the latter country.
VESICULAR STOMATITIS

This disease apparently made its initial appearance in the United States in 1916. Since then outbreaks have occurred nearly every year, largely in the Middle West. In several instances, however, infection has manifested itself in animals shipped from that section after their arrival at destinations in other parts of the country. This year an outbreak of the disease was discovered in New Jersey.

This affection is especially important owing to the fact that the disease in cattle may at times closely resemble foot-and-mouth disease. Horses, however, which are practically immune to the latter disease, are very susceptible to vesicular stomatitis. In fact, with our present knowledge of these diseases, inoculation of horses and cross-immunity tests in guinea pigs and other animals afford about the only satisfactory method of differentiating these diseases. Veterinarians are urged to report to their state veterinarian or to the federal Bureau of Animal Industry any outbreak with lesions suspicious of either of these diseases in order that an expert diagnostician may be sent to aid them in determining the true nature of the affection.

MR. J. M. WHITTLESEY: I should like to ask the chairman of the Committee what his information is regarding the situation on glanders in the United States. I was under the impression it might be safe for us to have the regulations lessened in the states.

DR. A. W. MILLER: We secured data on that disease, but we felt we could not cover the entire world. Many states report that they have not had glanders for one, two, three or, in some cases, a great many more years. I think Dr. Killham reported they had no glanders in Michigan for as long as he could remember, and we hear of only an occasional case of glanders in any state. I think during the past year we have probably heard of small outbreaks in four or five states.

A motion was regularly made, seconded and carried that the report be received.

PRESIDENT MOHLER: I wish to apologize for the omission made in our program which does not include the Committee on Policy and the Committee on Tuberculosis. I guess the printer ran short of space. At any rate, these two committees have not been included on the program, but I see Dr. Munce is in the room, and as chairman of the Committee on Policy I am going to ask him to report for his Committee.

Dr. T. E. Munce read the report.

REPORT OF COMMITTEE ON POLICY

Dr. T. E. Munce, Chairman

Dr. M. Jacob
Dr. W. J. Butler

During the annual meeting of this Association held in Chicago, December 2, 1925, a policy was adopted carrying with it the following provision:

"This Association is opposed to the use of biologics capable of reproducing disease, tuberculin and anti-hog cholera serum, by persons other than veterinarians, and is further opposed to the enactment of any legislation that will legalize the use of such products by any persons other than veterinarians."

The experience of the Middle West during the rather recent outbreak of hog cholera has created a most forceful demonstration as to the merit and soundness of judgment in the adoption of such a policy and we wish again to reiterate its importance with the hope that every agency will accept it as a guide for the future safeguard of our live stock industry.

Dr. Munce: I move the report be received.

The motion was seconded, put to vote, and carried unanimously.

PRESIDENT MOHLER: I shall now call for the report of the Committee on Tuberculosis from Dr. Bruner acting for Chairman Jacob.

Dr. Bruner read the report.
Amendment to Modified Accredited Area Plan

DR. M. JACOB, Chairman, Knoxville, Tenn.

Dr. W. F. Crewe, Bismarck, N. D. Dr. C. E. Cotton, St. Paul, Minn.
Dr. J. A. Kiernan, Washington, D. C. Dr. S. E. Bruner, Harrisburg, Pa.

Modified accredited areas in which on the original test of all cattle in said areas the extent of infection did not exceed one-half ($\frac{1}{2}$) of one per cent, may be reaccredited if less than one-half ($\frac{1}{2}$) of one per cent react as the result of retesting all previously infected herds, at least one herd in each township and such other herds as the state veterinarian and federal inspector-in-charge may designate and which shall include so far as possible all herds to which cattle from other than accredited herds or modified accredited areas have been added.

It is recommended that the Secretary of Agriculture be requested to amend the federal regulations governing the interstate movement of cattle intended for dairy and breeding purposes, so as to provide that when cattle from modified accredited areas or other cattle that have been tuberculin-tested in accordance with federal regulations governing the interstate movement of cattle, are unloaded in public stockyards, en route to destination, they be placed and held in cleaned and disinfected pens set aside exclusively for such animals.

As there is great danger of disseminating the infection of tuberculosis by the handling of feeder and stocker cattle through pens previously used for the handling of reactors, the Association recommends that the Secretary of Agriculture be requested to promulgate and issue regulations that all reactors moved to public stockyards be segregated in pens set apart for that class of cattle.

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DR. MILLER: There is one question I should like to ask the Chairman. Does it mean that after each movement you must disinfect and clean the pen, or that you set aside a section, clean and disinfect that section, and then use it for this one class of cattle?

DR. BRUNER: The understanding of the Committee was they would set aside and use certain sections for that class of cattle only.

The motion to receive the report, duly seconded, was put to vote and carried.

PRESIDENT MOHLER: The convention is ready to receive the report of the Committee on Resolutions. Is Chairman Mayo here? Has he left his report with any of the other members of the Committee?

The next order of business comes under the head of New Business. Is there any new business to come before the convention this afternoon?

If not, the next order of business is the election of officers for the ensuing year. As you know, according to the new constitution and by-laws there will be one president and only three vice-presidents this year. The secretary-treasurer is not elected from the floor but is selected by the Executive Committee. Therefore, we have only four officers to elect this afternoon. Nominations for president are in order.

DR. C. P. FITCH: The purposes of this organization are well known; they do not need any lengthy explanation on my part. After having sat through the sessions of this organization for the last three days, I think it is quite apparent to all of us that there is a basis which this organization can well afford to recognize, and that basis is research work. It is comparatively easy to control the infectious diseases if we have the necessary information and providing that information is satisfactorily based upon conclusions drawn from work which will always prevail.

It has been customary, in past years, to have in the office of president of this organization a man whose primary interests are in the control of animal diseases. It is my purpose today to present the name of a man for this high office whose primary purpose is research. This individual has brought
ELECTION OF OFFICERS

before you, during the past few years, information which is making it possible for us more effectively to control an infectious disease of animals which is interesting us all, namely, tuberculosis.

It gives me great pleasure and a very distinct honor to nominate Dr. L. Van Es, of Lincoln, Nebraska. (Applause)

Dr. J. I. Gibson: I take pleasure in seconding the nomination, and in so doing I concur in all the remarks made by the gentleman from Minnesota. In past years I have been closely connected with the work done by Professor Van Es. As I am working in that territory and considerable of my time is spent in the state of Nebraska, I am familiar with that work. It will be useless for me to undertake to elaborate on the virtues and the qualifications of this man. As a gentleman he stands in class A; as a citizen there is none better; as a scientific man he possesses knowledge. We are reminded of the great quotation that he who merely is may be a dull insensitive, while he who knows is in himself divine. Therefore, there is no greater qualification than knowledge, and this gentleman possesses that knowledge of the affairs of this Association to the highest possible degree.

I take pleasure, in behalf of the great state of Missouri, in seconding this nomination. (Applause)

Dr. W. J. Butler: The range state of Montana feels it owes a great deal to Dr. Van Es. We have loved him for many years. We have gone to him for counsel. It is with honor as well as pleasure that I also second the nomination of Dr. Van Es.

Dr. C. A. Cary: Alabama used to have Dr. Van Es. We have missed him ever since he has been gone. We are awfully sorry we can not get him back. I want to second the nomination in behalf of Alabama and move that the nominations be closed and we elect Dr. Van Es by acclamation. (Applause)

The motion was seconded and carried unanimously, and Dr. Van Es was elected President.

President Mohler: It gives me great pleasure, Dr. Van Es, to announce in behalf of the Association your election to the presidency of this Association. Nominations are in order for vice-presidents.

Dr. W. F. Crewe: At the request of a number of the southern members of this Association, I wish to present the name of Dr. C. A. Cary, of Alabama, as a vice-president of this Association for the ensuing year.

Dr. J. A. Barger: I wish to present the name of Mr. Martin G. Thornburg, of Des Moines, as a vice-president.

Dr. P. Bahnensen: I want to nominate Dr. R. A. Ramsay as vice-president.

I move the nominations be closed and the President decide who shall be first, second and third.

The motion was seconded and carried.

President Mohler: As a result of the motion I will select the gentlemen in the order of their nominations: Dr. Cary, first vice-president; Mr. Thornburg, second vice-president; Dr. Ramsay, third vice-president.

Dr. Wm. Moore: The Executive Committee today elected Dr. Dyson unanimously as Secretary-Treasurer for the ensuing year.

President Mohler: Will Dr. Bahnensen and Dr. Connaway escort the newly-elected President to the chair.

In turning the gavel over to the new President, I would indeed be unappreciative if I did not extend my hearty thanks to you, fellow-members, for the support given to me during the past year, and especially do I want to thank the essayists and the members of these various committees, and particularly our Secretary, Dr. Dyson, for their assistance, loyalty and consideration.

Dr. Van Es, I have the utmost confidence in the future of this office during your tenure and believe that in the coming year the Association will extend the outposts of knowledge regarding comparative medicine to a further degree than ever before. The Association is to be congratulated for its admirable selection and I congratulate you, Dr. Van Es, on the attainment
ELECTION OF OFFICERS

of this honor. Gentlemen of the convention, your new President, Dr. Van Es. (Applause)

PRESIDENT VAN ES: Friends, it is rather difficult for me to express my sentiments on an occasion of this kind. I think that the promoters of my election as president of this magnificent organization started out to see how bashful they could make me. I do not propose to let them get away with it. I want to tell you that I appreciate the honor and hope to be able to live up to your expectations which may have been aroused by those remarks that were made, and that I will have in the conduct of the affairs of this Association your thorough cooperation.

I thank you. (Applause)

The First Vice-President is called upon to make a few remarks, and I wish that Dr. Crewe and Dr. Healy would conduct him to the throne.

DR. CARY: I want to say to you that I can add nothing except that I certainly am pleased. I am happy that we have such a good man at the head of this organization for another year. I know it will go on just as Dr. Mohler has led it, and that we will have one of the best years we ever had. (Applause)

PRESIDENT VAN ES: I should like to hear from the Second Vice-President. I will ask Dr. Case and Dr. Butler to bring him forward.

MR. THORNBURG: I think the President should introduce me to this audience, for I presume that nine-tenths of you do not know me. As just an ordinary farmer and layman I am particularly appreciative of this honor. In my connection with this work, which has been for only a few years, it has been very helpful to me, and I am sure with the efficient, hardworking President that you have for another year, that work will continue.

I thank you. (Applause)

PRESIDENT VAN ES: The Third Vice-President likewise has some very encouraging remarks to offer. I will ask Dr. Fitch and Dr. Lincoln to conduct Dr. Ramsay to the platform.

DR. RAMSAY: I want to thank you for the honor you have conferred upon me today. It brings to my mind some regrets that I have not been giving this Association as much attention as I probably should have, in the past few years.

It is especially gratifying for me to serve in this capacity at this time and under the gentleman whom you have seen proper to elect as President. When I was first detailed by the Bureau to take charge of a field station, it was my great pleasure and to my profit that I was placed beside Dr. Van Es, at Fargo, North Dakota, and he is the first state veterinarian I ever cooperated with. You have the right man in the right place. I know you are going to have success for the year and the Association is going to grow and develop. (Applause)

PRESIDENT VAN ES: Is there any further business?

There is yet the newly elected Secretary-Treasurer; we have never seen him before. (Applause)

DR. DYSON: I want to acknowledge my election by making a request of each and every member of this Association, and that is that every member appoint himself a committee of one to hustle for new memberships at $2 per annum. Thank you. (Applause)

PRESIDENT VAN ES: Is there any further business to come before the convention? If not, the meeting will stand adjourned.

. . . The meeting adjourned at 3:40 p.m. . . .

ADJOURNMENT