PROCEEDINGS

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

HOTEL LA SALLE, CHICAGO, ILL
December 6-8, 1933
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WEDNESDAY MORNING, DECEMBER 6, 1933

The opening session of the thirty-seventh annual meeting of the United States Live Stock Sanitary Association, held at the Hotel La Salle, Chicago, Ill., December 6-8, 1933, convened at 10 a.m., Dr. E. T. Faulder, Albany, N.Y., president of the Association, presiding.

PRESIDENT FAULDER: Members of the Association and Guests: I want to bid you all welcome to the thirty-seventh annual meeting of the United States Live Stock Sanitary Association which is now declared in session. I assure you it is a great pleasure to be with you again, and it is pleasing to see so many in attendance.

I believe we are all fortunate in having the opening address of this meeting delivered by an outstanding member of the medical profession, a scientist, investigator and editor, one who has made many valuable contributions to the medical world, known nationally and internationally. I take great pleasure in presenting Dr. Morris Fishbein (Applause.)

OPENING ADDRESS

By MORRIS FISHBEIN, Chicago, Ill.

Editor of the Journal of the American Medical Association

Members of the United States Live Stock Sanitary Association: The medical profession and, in fact, every other scientific group of any kind is confronted in these times with a picture of life proceeding at a pace far beyond anything that man has ever seen in the world before.

It is valuable, if we are to obtain a realization of the position in which we are today, to look back and to see the differences between life as it is today and as it was perhaps less than a half century ago. It is now safely said of every branch of science that progress made during the past half century is greater than the progress made in all the previous fifty centuries of recorded history of mankind in the world.

It is customary in any address of this sort to go back to the time of the ancient Egyptians or the pre-Biblical period, and to
tell what Hippocrates knew of the relationship of diseases of animals to diseases of man. Unfortunately, the ancients did not know so very much. They did know a great deal about what we today call nature. Hippocrates recommended, which was perhaps the greatest of all his recommendations relative to the care of disease, the importance of letting nature alone when the patient was tending to get well. We have not improved much on that advice in these modern times. He said that when the tendency of the patient is upward and toward recovery, it is the duty of the physician merely to aid in that direction, but that the real work of the physician comes when the tendency is downward and toward death; then he must interfere in the vicious cycle in some manner so as to divert that tendency toward recovery.

As medicine advanced, with it went veterinary science. But it is not until comparatively recent times, in fact within the past twenty years, that the study of veterinary medicine has really begun to assume an aspect in its education, related, perhaps, to some of the progress that is being made in medicine.

The chief advances that have been made in medicine have not been made so much in the reasoning power of man as in an extension of the senses of man and an application of those senses toward the handling of disease. The physician of the period of 1875 had to depend largely on his unaided eye for the diagnosis of disease. He would perhaps listen with a stethoscope, which had been in use for perhaps a century, and he could hear things which he translated to observations that had been made at post-mortem examination.

In addition, he would palpate. He would feel with his hands, and when there were extraordinary things to be felt beneath the surface of the skin, he would realize changes had taken place.

Then he said he could smell disease. You may remember that the doctor of 1875 and '80 would come in and say he could smell typhoid fever, or he could smell diphtheria. It was not difficult to smell typhoid fever because they applied the proverb, “one out of five has it,” instead of four out of five. One out of five might be sick with typhoid fever.

Then came the sudden advance which took place with the discovery of the germ causation of disease. With Pasteur's announcement of that conception, all science took a tremendous advance. Medicine began to be based on a great number of so-called basic sciences, such as anatomy, physiology, pathology, pharmacology, zoology, biology and biochemistry.
It is the development of these basic sciences and the extension through these basic sciences of the senses of man that we have been able to advance to the point which medicine has reached today.

For instance, the eye today is tremendously extended, first of all, by the use of the modern microscope which magnifies tremendously and permits one to study secretions and excretions and germs related to the human body, in the greatest of detail.

In addition, the eye has been tremendously advanced by the use of scopes of various kinds, scopes for practically every entrance and exit of the human and animal body. There are the ophthalmoscope, otoscope, laryngoscope and cystoscope. There is no organ of the human body today which cannot be illuminated and studied directly by the eye of the physician.

When Wilhelm Konrad Roentgen developed the x-ray, it became possible to make the tissues of the body visible. By the expansion of our use of various chemical substances in relationship to the x-ray, by the injection of air into various cavities, by the injection of lipiodol into various cavities of the human body, by the use of dye substances, it has become possible to visualize practically every organ and tissue. When one sees, one has a scientific method available that is far beyond the guesswork of a previous generation.

Of course, what has been done for the eye has been done for practically every other sense in the human body. Marvelous electrical devices transform the movements of organs like the heart and the intestines, and changes that go on in the blood-vessels, into records that can be seen. The electro-cardiograph and all the various devices that actually write down what is going on in the human body have greatly improved the power of the physician to know the changes that have taken place.

Then we come to the applications of chemistry and biochemistry. Instead of guesswork as to the actual content of the blood, we now have measurements to within thousandths of a gram of very minute substances carried within this most important tissue of all in the human body, the circulating fluid that provides nourishment and disposes of waste matter. Within the blood we measure the sugar and various protein constituents. We count the blood-cells and study the nature of the changes of the blood-cells in the blood in relationship to various forms of disease. All these facts are of tremendous importance in relationship to the study of life as it goes on in the living organism.
Some investigators would read back into the history of the past and say that this new knowledge of the tremendous importance of minute amounts of certain substances is really getting back to homeopathy. They argue that this was what Hahnemann really meant when he suggested, about 1800, that infinitesimal amounts of substance are all that is necessary. Actually, of course, there is no relationship between Hahnemannism and minute doses of iodin to prevent simple goiter because of lack of iodin in the soil and in the food taken by human beings or by animals living on that soil.

Consider, for example, our knowledge of allergy, our knowledge of the effect that can be produced by a millionth of a gram of a protein to which a human being is sensitive. Compare our exact knowledge of the measurement of that effect by a small drop of that dose in the eye or the injection of a small amount into the skin, with the guesswork that was associated with the attempt to diagnose hay-fever or asthma or similar forms of sensitivity more than a hundred years ago.

All of this has to do, of course, with the advance of scientific medicine. It represents an entirely different situation from what existed in a previous century. The same advance has, of course, been reflected in every other attitude, in every other phase of life upon the world today. In engineering, transportation, or any phase of human life, the times have changed.

The practice of the veterinarian today is modified by the fact that the knowledge that has been developed for medicine of human beings has been applied to veterinary medicine, and a great deal of knowledge developed in veterinary medicine has been applied to human beings. So this interchange of ideas and knowledge has resulted in advances all along the line.

Whereas the physician of an earlier day and the veterinarian of an earlier day did not worry a great deal about the relationship of veterinary products to health and to life of men, today the intimacy is so great that it is absolutely necessary for both the physician and the veterinarian constantly to keep in mind the obligations and duties of the other.

We begin to hear of the relationship of the encephalomyelitis of horses, possibly, to poliomyelitis or encephalitis that occurs in humans. We begin to see a tremendous dispersion of parasites from the animal world and the piscine world and every other world outside the world of man—we begin to hear of the invasion of the parasites of one world into another.
Some twenty years ago, Warthin, of Michigan, prophesied that the bothriocephalus from the Norwegians and the Swedes, who had come into this country and deposited their excreta into the lake, would be taken up by the fish and would soon become a menace to the people of the United States. We have lived to see that prophecy of twenty years ago come true.

Today we see an epidemic of amebic dysentery, formerly considered a tropical disease, disseminated through hundreds of cities in the northern United States. Because of the development of transportation, because of the development of great barracks in which human beings live instead of homes, because of attendance on sports in thousands and in hundreds of thousands instead of attendance in hundreds and tens as used to be the case, because of the great compactness of modern living and the relationship of human beings to animals, we are seeing the time when any condition that affects any living thing may spread into some other species and sooner or later affect them.

We have begun to learn that diseases change exactly as human beings change. We find that the tubercle bacillus, after adapting itself to a new environment, may change its form.

We find tularemia, a disease which affected man but little, is affecting rabbits and game throughout the entire United States and is constantly a menace in the hunting season to a considerable number of people.

At the same time we must realize that a disease like tuberculosis, which formerly affected many millions of people, and which today affects certainly well over a million and one-half or two million people in the United States, is considered no longer a menace. It is hard to get people excited about tuberculosis today.

To get people excited today, you have to talk about diseases like amebic dysentery and encephalitis and poliomyelitis and epidemics which strike terribly, which ruin the mind, which break down the limbs, because the medical profession, working with the veterinary profession, and working with public health officials generally, has cut the rate for tuberculosis, first into half and then into quarters, and has pointed out the possibilities of early diagnosis and control of this disease. The average human being sits around, and when you start talking about tuberculosis, he wants to sing "Who's Afraid of the Big, Bad Wolf?" He is ready to be astounded by the invasion of a new tropical disorder, but he has so much confidence in his medical profession, he has so much confidence in public health officials, he has so much confidence in what is being done for him in freeing him from the
fear of pain, from the fear of disease and from the fear of death, that it is hard to get him excited about many diseases. I am not sure that this is altogether a good attitude on the part of the public, because more and more we are finding, in medical science, and in other branches of science related to medical science, that new diseases come in, that disease changes its form, and we must be constantly alert to find out all these things.

All of you can remember the time when veterinary medicine was given to a man in an education largely of the same type that medicine was given. The doctor of 1875 was likely to get his medical education in a one-year or two-year course, or six months devoted wholly to lectures, and, traveling about with a preceptor. He studied at the bedside of the sick the practice of medicine. He followed in the ways of his preceptor and occasionally he would advance a little on the knowledge of his time.

Then medicine began to advance, and so the medical curriculum began to advance. Soon we had an advance to two years and then to three years, with dissection and laboratory work. We had an advance to four years. Then we had to insist on a high school education, then on one year of college education, and then two years of college education. Then we began to insist on an internship.

Today we find that the real veterinary colleges that are teaching veterinary medicine are finding it necessary to give a four-year curriculum, and they insist on one year of college education as a preliminary, because the work in the veterinary curriculum is of such a high standard, and involves such highly technical subjects, that a man is simply unprepared for the work unless he has had a certain amount of basic education.

When you have to learn about the importance of vitamin D in raising stock of any kind, when you have to study vitamin A, calcium and phosphorus metabolism and basal metabolism and the effect of the thyroid, when you have to study all of this new knowledge of diet which is a contribution of the last ten or fifteen years, you begin to realize what a tremendous amount of knowledge is actually necessary if a man really wants to give efficient service in any branch of medical science, whether applied to man or to animals or to the fish or to any other living species in this world.

All of these factors have greatly modified our attitudes and have taken all of science and made it highly specialized. You have not reached yet in veterinary science the specialization that has been reached in medicine, but anyone who reads the period-
icals of veterinary medicine knows that specialization is proceeding with leaps and bounds even in your particular field.

There is so much to be known about any single branch of medicine in your field, or any branch of medicine in your field as applied to a single species, that soon veterinary medicine will have to be as highly specialized as is medicine applied to the human being.

We have doctors who are concerned with only one phase of the human body. We have organizations which are concerned simply with the use of the bronchoscope, the Association of Peroral Endoscopists. We have an organization on neurological surgery, an organization on brain surgery, an organization on surgery of the bladder, because the knowledge in each field has advanced so tremendously, that it is more than any one man with his brain can encompass. Of course, that type of specialization is going to go on in your field.

In the field of medicine, in order to enable physicians to keep abreast, we developed, some years ago, and have recently highly developed an index to the medical periodicals of the world, the Quarterly Cumulative Index, which now indexes some 1,400 periodicals in the field of medicine. That means some 300,000 titles each year—300,000 medical articles—written each year.

Of course, anyone who thinks can realize that it is impossible for any one human being to be acquainted with the knowledge that is put forth in 300,000 medical articles.

I saw just two days ago the first number of the new Index Veterinarius, which is published by the Royal College of Veterinary Surgeons in England, edited by W. A. Poole. I was amazed, in looking through the preliminary list of periodicals to be indexed, to find more than 1,000 magazines, bulletins, pamphlets and reports regularly indexed in that publication. Just imagine, the literature of this one field of veterinary medicine contains more than 1,000 periodicals issued each month, with tremendous numbers of titles showing what great advances have been made.

The times have advanced so rapidly, as far as science is concerned, that any man who wants to keep abreast must be alert to the literature of his field. That means that your science is today a sister science to medicine in every sense of the word. It means greater and greater cooperation for the future if we are going to be able to do all that we can do together to stamp disease out of life, to make it possible to grow bigger and better animals, whether they are animals of a lower species or human beings, to make it possible to give them the maximum of life and service upon this earth.
E. T. FAULDER

PRESIDENT FAULDER: I know that you have all enjoyed this most interesting and instructive address by Dr. Fishbein. To show our appreciation, let us give the Doctor a rising vote of thanks.

. . . The audience arose and applauded. . . .

PRESIDENT FAULDER: In accordance with the Constitution and By-laws, it now becomes necessary for your President to deliver his presidential address.

. . . President Faulder read his address. . . .

THE ADDRESS OF THE PRESIDENT

By E. T. FAULDER, Albany, N. Y.

Director, Bureau of Animal Industry
Department of Agriculture and Markets

I deeply appreciate the distinguished honor the members of this Association have accorded me by electing me to the office of President. I thank you all sincerely and hope my efforts to further the interests of this great Association will merit your approval.

This organization has made it possible for state and federal officials, and others, to come together in annual conference to discuss and develop plans for the control and eradication of diseases in live stock. It may be likened to a clearing-house for the exchange of ideas. Since its founding there have been many important and outstanding developments which have served to bring favorable comment and produce great benefits to the cattle industry.

At the present time the Association has fourteen committees, and these committees are in a position to gather unlimited information relative to the prevalence of diseases affecting our live stock industry and to recommend plans to combat them.

Further progress in disease control has marked each annual meeting of this Association, which was named the United States Live Stock Sanitary Association in 1909. The various annual reports of the organization indicate rapid strides in veterinary medicine, in research, and in experiments and their application, all of which tend to improve and protect our great live stock industry. Although much has been accomplished in these various fields, however, we are still confronted with many problems of both scientific and economic importance.

We are at present studying a group of animal and poultry diseases, and formulating and carrying out plans for combating them. I shall discuss as briefly as possible a number of these diseases somewhat in the order of their importance.
The control of the fever tick will be discussed first, due to the fact that the combating of this scourge was instrumental in the creation of this Association. Tick eradication started in the year 1906, at which time a quarantine was placed on 15 states, involving 985 counties. Those engaged in this great campaign have had many obstacles to overcome, one of the most important being the indifference on the part of cattle-owners. However, they have adhered to the belief that it was possible to eradicate the tick, and, in spite of the obstacles placed in their way, have stubbornly stuck by the ship. With better and quicker methods of control now in operation, the death knell has been sounded to the fever tick, and, with increased cooperation on the part of cattle-owners, and strict adherence to quarantine regulations, as well as by following out the important rule of dipping every bovine in a quarantined area every 14 days, cattle tick fever will soon be a thing of the past.

At this time it might be well to point out five essential factors necessary to complete the project of tick eradication:

1. Dipping all tick-carrying animals every 14 days.
2. Ample state appropriations.
3. Adequate state legislation.
4. Cooperation between state and federal officials, cattle organizations and the cattle-owner.
5. Protection of free areas by prohibiting the movement of cattle, horses and mules from infected territory into clean areas.

It appears that the present plan of seizing all animals not submitted for dipping at specified times is a factor which will greatly assist in the early completion of the project. To prevent reinfection, all horses and mules should be dipped at regular intervals.

One annual report of the Association describes in detail the elimination of the tick from the great swamps of Virginia. This accomplishment in Virginia should stimulate those engaged in the remaining quarantined counties to increase their efforts toward completely eliminating the tick without delay.

A forward step in this direction was the amending of the law of 1884, which permitted the interstate movement of ticky cattle. The amended law, effective June 28, 1926, and placed in operation May 1, 1928, requires the dipping of ticky cattle before they are shipped for any purpose, including immediate slaughter. This change in the law removed a most troublesome hazard, since the movement of infested animals from tick-quarantined areas for
immediate slaughter, as permitted by the former law, constituted the greatest deterrent to progressive systematic tick eradication. The people of the North should be proud of this work done in the South under all kinds of conditions, setbacks and discouragements—a project thought impossible at one time. The people of the South should appreciate the benefits of tick eradication, because it places them in a position to market their live stock profitably as well as improving the condition of their live stock generally.

An examination of a report of the U. S. Bureau of Animal Industry indicates that in 1906 a quarantine was laid on 985 counties, involving 15 states. Up to November 1, 1932, quarantines had been released on 896 of these counties, leaving 89 counties under quarantine at the present time. These figures should indicate that, in the face of many obstacles and difficulties, highly satisfactory progress has been made, and I am of the firm opinion that, with the increased interest and cooperation of all concerned, this great project will soon be completed. I understand that federal funds for unemployment are to be used to complete tick eradication immediately. When this is accomplished, those who inaugurated tick eradication should meet at the location of the first dipping-vat and stage a celebration.

While discussing tick eradication, I believe it appropriate to mention briefly anaplasmosis in cattle. Further study should be given to this disease with a view toward its control and eventual eradication.

TUBERCULOSIS

During the meeting of this Association in 1917, plans were made for inaugurating a gigantic undertaking—the control and eradication of bovine tuberculosis under a plan known as “the uniform methods and rules for the establishment and maintenance of tuberculosis-free accredited herds and cattle.”

I know of no disease-control project which has gone forward for so many years with almost complete cooperation on the part of all. Almost perfect team work has been developed and maintained, and, in spite of the fact that in 1917 many wise men predicted that the job could not be done, with others maintaining that it would take fifty years, we are now ready to concede that, in the course of the next two years, the announcement will be made that all of the cattle in the entire United States have been officially tuberculin-tested one or more times, and that a large majority of the states are already in the modified accredited class. There was an early prediction that, if the tuberculosis eradica-
tion plan were carried out, there would be a shortage of cows, a shortage of milk, and that the live stock industry would be wrecked. Just the reverse has happened.

There has been a 60 per cent increase in our human population, the number of milk cows has remained fairly constant during the past fifty years, and still we have too many cows and far too much milk. Part of the answer to this situation is that dairymen have learned, and are learning, that it does not pay to feed, milk and care for diseased animals, and that animals free from tuberculosis produce more milk than diseased animals.

Had this Association failed to take notice of, and to make plans for the eradication of bovine tuberculosis, in another fifty years we would be in the position of England, Scotland, France and Denmark, where tuberculosis exists to such an alarming extent that eradication under our methods would be practically impossible. I am wondering if the cattle-owners in this country will ever be sufficiently grateful to this Association for its creation of a plan, which will surely reduce bovine tuberculosis to an irreducible minimum.

Progress in tuberculosis eradication under the area plan is better appreciated by referring to limited statistics. In 1918, 4 per cent of all cattle in the United States were tuberculous. As a result of intensive testing since that period, the average percentage of tuberculosis has been reduced to 1.2 per cent. In 1918, just a few hundred herds were operating under the accredited herd plan, and on October 1, 1933, this small number of herds had grown to 3,996,470, representing 36,065,970 cattle. This is considerably more than half of the cattle in the various states.

It is encouraging to read reports from the United States Bureau of Animal Industry showing that more than half of the counties, 1,700, are now listed as “accredited,” and that in a group of 1,400 counties tuberculosis exists today to an extent of not more than 1 per cent. It is encouraging to note also the decrease of tuberculosis in swine. This progress, as shown by figures, is a certain indication that in promoting the control and eradication of this disease we are not navigating any uncharted sea.

Early in this organized campaign, it was good policy not to take in too much territory, but now we can all see a successful conclusion of the test, and it would be unwise to permit any let-up until every cow has been officially tuberculin-tested at regular intervals, every state declared modified accredited and all accredited animals retested in accordance with the accredited herd plan. We must be on the alert for any center of infection
that may have been overlooked. When this is done, we have carried out everything that the word "eradication" signifies.

Right at this point it might be well to emphasize the importance of making certain that tuberculin be used only by reliable veterinarians working directly under the supervision of the various state live stock sanitary officials and the United States Bureau of Animal Industry, and that all clean areas be kept clean by strict observance of quarantine regulations.

May I refer to facts pertaining to bovine tuberculosis as it existed in New York State in 1889: At that time 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. Their report 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.

We have followed the advice of this committee as far as it pertains to educating cattle-owners and improving sanitary conditions on the farm. We have gone further, however, by slaughtering more than 700,000 tuberculous animals since May, 1918, which means that 73 per cent of the herds and cattle in New York State are now operating under the accredited herd plan, and that all cattle have been tuberculin-tested one or more times, or testing is under way, in 96 per cent of the townships. Tuberculosis in New York State has been reduced from approximately 40 per cent, in 1918, to about 13 per cent at the present time, and this includes the spread of the disease during this period. In spite of this fact, New York still has too many dairy cows and too much milk and the owners of the remaining untested herds are urging the eradication of tuberculosis from their herds. A large percentage of these dairymen realize, I believe, that there is no specific cure for tuberculosis, such as antitoxin for diphtheria, and no specific preventive, such as vaccination against smallpox.

Along with the rapid reduction of the incidence of tuberculosis in bovines and swine, there is a very remarkable decrease in the human death-rate. The factors contributing to this condition are as follows: The organized veterinary forces of the country are engaged in tuberculin-testing cattle under the supervision of the various live stock sanitary officials and the United States Bureau of Animal Industry. Medical doctors are constantly instructing and training human beings to protect themselves
against the invasion of the tubercle bacillus, and how to care for themselves when they find they have become infected, as well as teaching methods of preventing others from contracting the disease. In addition, health authorities are responsible for pasteurization ordinances. All of these factors combined will lead to the almost complete elimination of bovine tuberculosis and at the same time continue to reduce the incidence of human tuberculosis.

A recent report of a prominent medical doctor, Frederick L. Hoffman, insurance statistician, states that in 59 cities the death-rate from this disease is lower than ever. In 1910 the death-rate from tuberculosis was 174 in 100,000 and last year it was 56 in 100,000. This should be encouraging not only to the medical profession but to all those who have been engaged in stamping out bovine tuberculosis.

In an address delivered by Dr. J. Arthur Myers, of the University of Minnesota, in commenting on the limited number of cases of tuberculous cervical lymph-nodes now being revealed, Doctor Myers stated:

When we do see such cases, frequently they are from small towns and rural communities, where no pasteurization ordinance exists, and where the people have failed to render the milk safe for human consumption by heat or where the veterinarians, through lack of funds or cooperation, have been unable to carry on their work. But, what is necessary for the future? Most certainly we need more health education among the people. They must be taught about the importance of keeping their animals free from disease and this can often be done best, I am sorry to say, by stressing the economic side.

I believe that those listening to this message on bovine tuberculosis will agree that the work of eradication should go forward at top speed in every community in every state, so that the accreditation of the herds of the entire nation may be accomplished without delay.

PARATUBERCULOSIS (JOHNE'S DISEASE)

This disease is an infectious bacterial enteritis of cattle, which so far has been reported as existing in at least fifteen states. I believe this is a disease that is increasing in prevalence, and cattle-owners are in need of advice and help in its control. I am satisfied that splendid progress is being made on the part of investigators and research workers, and the reports show that several important and interesting papers on the subject have been presented before this Association.

At least one state legislature has made provision for indemnifying owners for animals slaughtered on account of this disease. I believe this action should be taken by other state legislatures.
From the knowledge at hand, this is, I believe, a disease that should be attacked along the lines of our bovine tuberculosis campaign and the work done at the same time under the area plan. It has been shown that this disease is more difficult to eradicate with the test now available than tuberculosis. The organism of Johne's disease is more resistant than the tubercule bacillus, and it appears that field workers are in need of a more specific diagnostic agent. I feel confident that this will be forthcoming as a result of further labors by laboratory workers.

Owners of infected cattle should be urged to practice strict sanitation and the segregation of infected animals, and give their full cooperation to sanitary officials in a position to aid them in the control of this disease.

**Bang's Disease**

This is an old disease, having been known in Europe for at least twelve centuries. At the present time, it is causing greater loss than any other animal disease, and is attracting widespread attention in the United States. This Association has made very satisfactory progress in the study of the problem, which I believe will lead to the creation of a uniform plan for the control of the disease such as the plan now in operation for the control and eradication of bovine tuberculosis. It has been reported that a cow suffering from Bang's abortion disease causes a yearly loss of $44 to the owner. Another report indicates that at least 18 per cent of all cattle in the United States are infected, and this represents 50 to 60 per cent of the herds in the United States.

Through the efforts of this Association, 13 states now have plans in operation and 40 states have promulgated regulations pertaining to Bang's disease. A number of states now permit only blood-tested cattle to be exhibited at county and state fairs. This action should stimulate the various states to institute or strengthen their present plans for handling this disease.

It is interesting also to know the progress made in the establishment of abortion-free herds of cattle in various parts of the country. The owners of live stock apparently are ready to accept any sound plan that may be advanced to place this disease under control. It is hoped that ample funds may be provided by states maintaining experiment stations so that the study of the disease may go on without interruptions. I believe that this Association can play an important part in hastening the attainment of a satisfactory plan. The Committee on Bang's Disease has made excellent progress since 1917.
There is evidence that the various states are making satisfactory progress toward creating uniform state regulations pertaining to this disease. While we are engaged in further investigation in the creation of a uniform plan for the control of the disease, the public is protected by pasteurization, and the cattle-owner can do much to prevent the further spread of the disease by practicing strict sanitation and the proper segregation of infected animals. I do not believe it unwise to state at this time that we should encourage investigators, with special reference to those in the U. S. Bureau of Animal Industry, who are studying the problem of immunization.

I am of the opinion that this is a disease that can be handled without taxing the state, or causing serious handicap to the owners. With the knowledge now in our possession this can be done by tests at regular intervals, segregation or disposal of all infected animals, plus thorough and frequent disinfection.

AVIAN TUBERCULOSIS

Surveys have been made to determine the prevalence of avian tuberculosis in poultry, some of which have been based on physical examinations, others on the application of the tuberculin test. As a result of these surveys, it is plainly evident that the disease exists to an alarming extent in the midwestern and north-central states, where it is now causing serious losses to the poultry as well as to the swine industry.

We should all be appreciative of the campaign which has been launched by the United States Bureau of Animal Industry in cooperation with state officials in the territory specified. At least one large poultry packing establishment already has agreed to pay a premium of 2 cents a pound for poultry raised in areas where the disease is practically unknown. This should stimulate other establishments to adopt this plan and should also prompt poultry raisers to cooperate with their livestock sanitary officials and the United States Bureau of Animal Industry by following out plans now under way and plans which will be formulated in the future to control and eradicate this disease.

The presence of avian tuberculosis as a definitely known and recognized disease in our country dates back to 1900. Its recognition as a distinct disease in the Old World is of rather recent origin also, as no authentic reference to it can be found previous to 1868. Those who first studied tuberculosis found that it was not only a disease of mammals but that birds also were affected. It is observed in all counties where fowls are raised.
Much experimental work has been done in the past few years on avian tuberculosis, and we are now in a position to give reliable information to poultry-owners. The tuberculosis eradication forces of the various states should include a plan for the control and eradication of this disease. Avian tuberculosis is a destructive plague and is a potential danger to both the poultry and swine industry as well as to public health.

Sufficient and reliable literature on the subject of avian tuberculosis is now available for distribution by state and federal officials to poultry-raisers, and the latter are in a position to obtain assistance in determining the presence of the disease in the flocks and to take important steps to eradicate it.

The Committee on Transmissible Diseases of Poultry should continue its intensive study of this disease, with a view toward strengthening the present campaign for eradication.

**Mastitis**

Mastitis is a disease that is attracting nationwide attention on the part of health authorities, investigators, veterinarians and cattle-owners. It is known to be quite prevalent and is the cause of great economic losses. This disease should receive continued study and investigation by all livestock sanitary officials who are in a position to obtain valuable help from experiment stations, laboratory workers and investigators. Thought should be given to using the veterinary forces now engaged in tuberculosis eradication to make a careful physical examination of all dairy herds for this disease. They may be assisted further by the use of the thybromol test, the cows being divided into three groups: normal cows, clinical cases and animals revealing high counts. The clinical cases, usually classified as Nos. 3 and 4, should be promptly disposed of by slaughter, further attention being given to the animals revealing high counts. In all cases the premises should be subjected to thorough cleansing and disinfection.

**Hog Cholera**

This Association has devoted a large amount of time and thought to the subject of hog cholera, as well as to other diseases affecting swine. Much has been accomplished but much remains to be done. We have as our greatest weapon serum and virus, but we must realize that this disease cannot be eradicated simply by the use of serum or by vaccination.

The use of serum and virus should be kept in the hands of competent veterinarians and the veterinarians should first make certain that the swine to be vaccinated are in proper condition.
The swine-owner should be constantly advised and required to practice strict sanitation at all times. The making known of an outbreak of cholera to others in a community is a means of preventing the spread of the disease. The swine-owner should be cautioned that cholera often is complicated with other diseases and that losses suffered should not be charged against the use of serum. A swine-owner who thinks sanitation is too costly will sooner or later realize that he is wrong, and it should be pointed out to him that strict sanitation is one of the principal factors in controlling and eradicating any disease. Sanitation is very important in controlling not only hog cholera, but flu, erysipelas, dysentery, pox and necrotic enteritis. Sanitation, as applied to the cleaning and disinfection of premises, is a piece of work that should be done in the most painstaking manner.

With the knowledge pertaining to hog cholera now in our possession, an effort should be put forth by the live stock sanitary officials in every state and by all veterinarians and all swine-owners to strengthen the teamwork, with a view toward reducing hog cholera to an irreducible minimum.

PULMONARY EDEMA OF SWINE

At the 1929 meeting of this Association, Drs. Charles Murray and H. E. Biester, of Iowa State College, presented an excellent paper* pertaining to this disease. This malady is sufficiently prevalent to warrant all veterinarians in swine-raising sections to familiarize themselves thoroughly with the disease. It is also a disease that should be given further thought and study by the Committee on Transmissible Diseases of Swine.

ERYSIPELAS IN SWINE

This is a disease that is causing considerable loss and is attracting the attention of the swine-growers. Methods have been devised for detecting this disease, and with this weapon in the hands of veterinarians, there are reasons to believe that any outbreaks will be checked readily.

FOOT-AND-MOUTH DISEASE

The most recent outbreak of foot-and-mouth disease occurred in California, in April, 1932, where the disease was promptly eradicated. Previous outbreaks of foot-and-mouth disease in the United States occurred in the years 1870, 1880, 1884, 1902, 1908, 1914, 1924, 1925 and 1929.

The knowledge gained from the handling of these outbreaks places the U. S. Bureau of Animal Industry and the live stock sanitary officials of the various states in a position to eradicate the disease promptly and efficiently. We can all rest assured that the U. S. Bureau of Animal Industry has unsurpassed ability in the handling of outbreaks of foot-and-mouth disease. All persons interested in the protection of live stock and in animal disease control should be constantly on the lookout for the presence of foot-and-mouth disease, and should be entirely familiar with instructions on preventing its spread. These instructions may be found on page 69 of the 29th Annual Report of this Association.

Greater protection has been afforded the live stock interests of this country against foreign animal diseases by the order of the U. S. Bureau of Animal Industry, July 1, 1926, which prohibits any vessel entering a port of the United States which has on board as ship stores, cattle, sheep or other ruminants, or swine originating in a region in which foot-and-mouth disease or rinderpest exists; 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. Each live stock sanitary official should make certain that his state has a law embodying power to quarantine, slaughter and disinfect in an outbreak of foot-and-mouth disease.

VESICULAR STOMATITIS

Veterinarians and others engaged in the control and eradication of diseases of live stock should familiarize themselves with this disease and be able to differentiate between it and foot-and-mouth disease.

ANTHRAX

All live stock sanitary officials and veterinarians should be familiar with the dangers of outbreaks of anthrax, and should have rules and regulations at hand for its prompt suppression, for the proper disposal of animals dying from this disease and for the segregation and treatment of infected and exposed animals.

RABIES

This is a disease which should be kept under strict control and all outbreaks promptly suppressed by the use of quarantines, the muzzling of dogs, and by vaccination.
This disease is attracting nationwide attention and is a malady that is causing unknown losses to the rapidly increasing poultry industry. This disease has been increasing in economic importance since 1900 when first reported by Rettger. It now appears to be the most important infectious disease of poultry. It is of special importance because of its transmission through the egg.

The National Poultry Congress reported, in 1925, the value of poultry interests in this country to be $2,500,000,000. These figures should be convincing evidence that nothing should be left undone to prevent the further spread of the disease in domesticated birds.

More than half of the states now have programs making provision for the blood-testing of poultry. Poultry diseases in a large measure are filth-borne and amenable to sanitary measures, and this should be impressed upon the minds of all poultry-raisers.

Considerable time has been spent in the study of this disease by the Committee on Poultry and with the knowledge gained from the work of the various experiment stations throughout the country, with the literature available on the subject, and with the continued cooperation of the poultry-raisers, I believe the live stock sanitary officials of the various states will continue to make satisfactory progress in preventing the further spread of this disease and in eventually bringing about its eradication.

**OTHER POULTRY DISEASES**

Veterinarians come in contact with poultry-raisers, and they are urged to fortify themselves with up-to-date literature on infectious diseases of poultry, thereby placing themselves in a position to give reliable information to the poultry-owner as to control measures for the various diseases and to render efficient service in the control and eradication of these diseases. The veterinarians should at the same time cooperate with the various live stock sanitary officials in carrying out plans and programs for the control of the diseases.

The diseases to which I especially refer are: fowl-pox, laryngotracheitis, the new respiratory baby chick disease reported by Schalk,* fowl paralysis, fowl leukemia, also blackhead and endemic paratyphoid in turkeys. Special attention should be given to

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worm infestation in poultry, six to eight varieties of tapeworms and ascarids being present in all classes of fowls.

PARASITIC DISEASES

Internal and external parasites exact an enormous toll in many of our domestic animals. Much attention has been given to their control, but much remains to be done. Information obtained from Dr. M. C. Hall indicates that in one year almost 1,000 articles on parasitological subjects have appeared in over 400 periodicals.

In the battle against parasites each state should be a fact-finding agency, and careful surveys should be made to determine the extent and variety of parasites. All of this information from the various states should be placed in the hands of this Association and the U. S. Bureau of Animal Industry.

Excellent work has been done by the Committee on Parasitic Diseases of this Association and this is a committee that should be continued indefinitely. Information relative to the many varieties of both internal and external parasites is available for distribution to stock-owners in each state by the live stock sanitary officials and by veterinarians. I believe it highly important that a plan be in operation in every state to control all parasitic diseases with the ultimate aim of eventual eradication.

From information at hand it appears that no plan to control both types of parasites, particularly internal, is keeping abreast of the extensive information now available.

NUTRITIONAL DISEASES

Many excellent papers on this subject have been presented before this Association. It is well for the members of the Association, stock-owners and veterinarians to be thoroughly familiar with these diseases, and this Association should be in a position to place information on this important subject before veterinarians, so that the latter may put such information in practice for the benefit of the stock-owner.

UNIFICATION OF LAWS AND REGULATIONS

The various states protect their live stock industry by means of appropriations, the enactment of suitable laws and the promulgation of rules and regulations. State live stock sanitary officials authorized by law to formulate rules and regulations for the protection of the live stock industry, in the light of our present knowledge, should make and enforce such rules and regulations as to assure safety against the importation or spread of disease. The policy at all times should be to make such rules and
regulations of the various states uniform insofar as possible. Such regulations should be concise, written in understandable language and specific in all details.

I am satisfied that the work of the Committee on Unification of Laws and Regulations is making satisfactory progress along these lines.

MEAT AND MILK HYGIENE

Since the inauguration of the Meat Inspection Act of 1906, meat inspection by the U. S. Bureau of Animal Industry has been developed into the most efficient inspection service in the world. Today approximately 65 per cent of the meat and meat food products consumed are inspected under the federal meat inspection service. The balance of these products undergo inspection in local, unofficial establishments.

It is regrettable that not all of the states have attempted to inaugurate meat inspection systems to serve as auxiliaries to the federal system, thus insuring a high standard of wholesomeness in the national food supply. However, the records show that gradual progress is being made in establishing state and city meat inspection service. State, municipal and town officials should be encouraged to obtain the necessary legislation and then create plans to restrict the slaughtering of food-producing animals and the preparation of meat and meat food products to plants having the proper equipment and kept in a sanitary condition, the inspection to be done by competent veterinarians and practical and experienced meat inspectors working under the direction of the state, city or town officials.

Milk is a product that is being much discussed. Consumers are entitled to demand milk produced from healthy animals kept under strict sanitary regulations. Such a condition can be brought about by periodic inspections of dairies by competent veterinarians working under the direction of the health officials of the community consuming the milk or milk products.

LEGISLATION

Within the past year there has been cleared up, by action of the Supreme Court of the United States, an uncertainty as to our legal power which has troubled this Association for seven years. That uncertainty arose from a decision by that Court in 1926 (Oregon-Washington Co. v. Washington, 270 U. S. 87) to the effect that the federal Plant Quarantine Act took away from states and state officials all right to regulate the interstate movement of diseased and infected plants. The federal Cattle Quar-
antine Act is quite similar in language, and soon thereafter a federal Circuit Court of Appeals decided that the decision about plant quarantines applied also to baby chicks and other shipments under the Cattle Quarantine Act (Must Hatch Incubator Co. v. Patterson, 27 Federal second 447). Meanwhile Congress amended the Plant Quarantine Act to permit the states to continue their regulations under that law, and naturally there was a feeling that a similar amendment of the Cattle Quarantine Act was necessary.

For several years this Association has tried to obtain such an amendment, but without success. A decision by the Supreme Court of the United States, handed down last May, upholding the New York regulation on Bang's disease, now shows clearly that the plant quarantine decision does not apply to the cattle quarantine law, and no amendment to the latter law is necessary.

That decision was in the case of Aaron Mintz and Louis Mintz against Charles H. Baldwin, Commissioner of Agriculture and Markets of New York State. It is reported in 289 United States, page 346. The opinion was written by Mr. Justice Butler, and unanimously concurred in. The following excerpts will indicate its effect:

Plaintiffs have a large and valuable business in the raising, and in the sale and transportation from Wisconsin to New York, of cattle for dairy and breeding purposes. Defendant, acting under state statutes, made and is enforcing an order to guard against Bang's disease, bovine infectious abortion. The order requires that the cattle imported into New York for such purposes and also the herds from which they come shall be certified to be free from that disease by the chief sanitary official of the state of origin and that each shipment be accompanied by such a certificate.

Plaintiffs shipped 20 head from Wisconsin for delivery to one Bartlett in New York. The animals were accompanied by a certificate which was sufficient as to them, but there was nothing to show the freedom from Bang's disease of the herd or herds from which they came. For that reason defendant refused to permit them to be delivered, and so plaintiffs were compelled to take them out of New York.


Their application for a temporary injunction was brought on for hearing before a specially constituted court. 28 U. S. C., section 380. Defendant answered and, upon stipulation of the parties, plaintiffs' motion for interlocutory decree and defendant's motion to dismiss the complaint were submitted upon the pleadings, the affidavit of one of the plaintiffs, the affidavit of defendant and affi-
davits of others in his behalf. Temporary injunction was denied and the bill was dismissed.

The court made special findings of fact which include the following: Bang's disease prevails throughout the United States and is one of the greatest limiting factors, both as to reproduction and milk yield. Undulant fever may be caused by the disease germs when introduced into the human body by drinking raw milk of an infected cow. The disease may generally be diagnosed about 60 days after infection though the time may be considerably longer. Two blood tests are customarily made to detect the disease but they may not disclose it in the incubative state. A substantial percentage of cattle imported into New York under certificate that they have passed tests for the disease are shown to have been infected.

There is a body of expert opinion that such cattle should only be admitted when certified to have come from a clean herd, and that by such a safeguard danger of infection would be greatly lessened. The disease is exceedingly infectious and the defendant concluded that in order to protect herd-owners and milk-consumers he should require not only that imported cattle showed no infection but that they came from herds free from disease. This resulted in the order.

By reason of danger of infection from the disease, many states of the Union have imposed restrictions upon the admission of cattle. The federal Department of Agriculture, Nov. 15, 1932, by letter to defendant, declared that the Department had issued no quarantine or regulations pertaining to Bang's disease and that its policy for the present is to leave the control with the various states.

The order is an inspection measure. Undoubtedly it was promulgated in good faith and is appropriate for the prevention of further spread of the disease among dairy cattle and to safeguard public health. It cannot be maintained, therefore, that the order so unnecessarily burdens interstate transportation as to contravene the commerce clause. Unless limited by the exercise of federal authority under the commerce clause, the state has power to make and enforce the order. The purpose of Congress to supersede or exclude state action against the ravages of the disease is not lightly to be inferred. The intention so to do must definitely and clearly appear.

Plaintiffs lean upon our decision in Oregon-Washington Co. v. Washington, 270 U. S. 87. But, as concerns the question of conflict with state measures, the Act of 1903 is to be distinguished from the Plant Quarantine Act there interpreted. Act of Aug. 20, 1912, 37 Stat. 315, as amended. 7 U. S. C., sections 151-154, 156-165. In that case upon full consideration of the latter we said (p. 99):

"All the sections look to a complete provision for quarantine against importation into the states under the direction and supervision of the Secretary of Agriculture. * * * (p. 101). It (the Act) covers the whole field so far as the spread of the plant disease by interstate transportation can be affected and restrained * * * The state laws of quarantine that affect interstate commerce and this federal law can not stand together. The relief sought to protect the different states, in so far as it depends on the regulation of interstate commerce, must be obtained through application to the Secretary of Agriculture."

Unlike the Act of 1903, the Plant Quarantine Act does not, by specification of the cases in which action under it shall be exclusive, disclose the intention of Congress that, subject to the limitations defined, state measures may be enforced. This difference is essential and controlling.
SANITATION

I have discussed in a brief manner a number of infectious and contagious diseases affecting our livestock industry. I have read carefully most all of the annual reports of this Association, as well as many volumes pertaining to infectious and contagious diseases, and it appears to me that much more should be said and written on the subject of sanitation as it applies to the operation of cleansing and disinfecting premises harboring domestic animals, and especially where infectious or contagious diseases may exist or have been revealed. I grant, however, that it is easier to preach the ideal than to achieve it.

In speaking on Bang’s disease, Pearson recommended thorough disinfection. Dr. Herman Bundesen, Commissioner of Health, Chicago, Ill., at the December, 1927, meeting of this Association,* emphasized the necessity not only of tuberculin-testing the cattle but of cleaning up dirty places. A statement by another prominent person is to the effect that we will get nowhere by evading the proper and thorough cleansing of infected premises. Another sanitarian says: “Leave no lurking germs to impair the milking efficiency resulting in disease and subsequent loss.” Dr. Hagan, in an address on Johne’s disease, also stresses the point that this disease may be lessened by disinfection.

During the various outbreaks of foot-and-mouth disease, cleaning and disinfection were done in the most thorough manner. This was reflected in the prompt manner in which this disease was prevented from getting a foothold, and in the prompt manner in which practically each outbreak was eradicated.

In the control and eradication of tuberculosis the elimination of tuberculous animals is the major factor. A factor of equal importance, however, is the elimination of the source of infection. The less undetected tuberculosis we leave behind in our campaign, the less will be the danger of recrudescence of tuberculosis in the future.

In our tuberculosis campaign there appear to be two operations, namely, the application of the tuberculin test for the purpose of determining whether tuberculosis exists, and, if tuberculosis is revealed, the segregation and prompt removal of the diseased animals, followed by thorough cleaning and disinfection of the premises.

In the early days of our campaign the farmer was instructed to carry out disinfection. This may have been satisfactory in

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some cases, but the work, when done, was done by improper and inadequate equipment. We then reached the time when disinfection was effected by the use of a barrel-spray operated by hand power. This indicated that progress was being made. Then, a few years ago, a power disinfecting outfit was introduced, which again brought about an improvement in disinfection. In the extensive literature pertaining to disinfectants and disinfection, the statement often appears that disinfectants are more effective when applied with water heated to the proper temperature. The fact was brought out that cleansing should be done by the use of boiling water or steam and that it was not possible to obtain steam or boiling water on most farms.

We have now reached the stage where it is possible to have a power disinfecting outfit operating under high pressure with a suitable heater attached, the heater supplying constant boiling water. The heater consists of a series of coils, and low-grade oil is used for fuel. Under such an arrangement the authorized disinfector is in a position to cleanse all surfaces, cracks and crevices with boiling water under high pressure, using lye, soda or soap as a detergent. With such an operation a high percentage of the infection is at once removed. Following this cleansing under pressure, a permitted disinfectant is applied with boiling water, the disinfectant being applied directly to the surfaces, thereby destroying all remaining organisms. No disinfectant is wasted by this method.

In my experience I find that an owner objects to paying for a poor job of disinfection but he rarely complains about paying the disinfection bill if a thorough job has been done.

By carrying out disinfection under the method described there should be a large decrease in the number of reactors found on retest, and this represents a material saving to the cattle-owner as well as a saving in indemnity payments by the state and federal Bureaus of Animal Industry. Fewer tests are required in bringing the herds to the accreditation point and this represents a saving in the cost of testing, including transportation.

By establishing a disinfection service, one or more outfits being maintained in each county and operated by authorized disinfectors under supervision, we will be in a position not only to clean and disinfect following tuberculosis infection, but to disinfect premises where other diseases are known to exist, or are revealed, such as Bang's disease, mastitis, hemorrhagic septicemia, hog cholera, infectious poultry diseases, Johne's disease, etc.
I have given much time to the study of cleansing and disinfection and am convinced that this is a subject that should be given increased attention by every live stock sanitary official, and that should be brought to the attention of every veterinarian who comes in contact with the owners of live stock. I also believe the matter is of enough importance that a committee should be created by this Association for the purpose of formulating ways and means for improving the cleansing and disinfection of premises.

In conclusion I wish to emphasize the necessity of establishing a close contact with all organizations interested in live stock. Each veterinarian, when visiting a stock-owner, should spend as much time as possible in giving the owner full information relative to modern methods in the control and eradication of various diseases.

I am satisfied that excellent progress has been made during the past year in the control and eradication of diseases of animals. We must at all times be ready to adopt newer and better methods, however, as they are brought forward by scientists and investigators. This should result in a better and more profitable agriculture.

I wish to thank the chairmen and members of the various committees who have worked hard in preparing the program for this meeting, those who have so kindly consented to render addresses and papers at this meeting, and the untiring efforts of our genial Secretary-Treasurer, Dr. O. E. Dyson.

In my message to you I have attempted to point out the progress this Association is making and that this has been the result of much study and hard work. It might be well at this time to repeat the words of our late President Theodore Roosevelt:

*The law of worthy life is fundamentally the law of strife. It is only through labor and painful effort, by grim energy and resolute courage, that we move on to better things.*

In conclusion I wish to emphasize the necessity of establishing, . . .

**President Faulder:** Now we come to an important part of the morning program, Memorial Service. I will ask Dr. A. T. Kinsley to take the chair.

. . . Dr. Kinsley assumed the chair. . . .

**Chairman Kinsley:** Gentlemen, according to our custom, we will now pause to express our sorrow in the deaths of those colleagues who have departed during the past year and to extend our sympathy to the families of those co-workers.

May I ask you first to stand for a moment with bowed heads, in silent prayer?

. . . The audience stood in silent tribute to the departed members. . . .

**Chairman Kinsley:** Next Dr. N. S. Mayo will present a eulogy.

. . . Dr. Mayo read a memorial. . . .
Mr. Chairman and Members:

During the past year, two of our active and honored members have crossed the misty river that hides the Great Beyond.

Dr. C. W. Eddy, of Cleveland, Ohio, died on August 13, 1933. Born in Ohio in 1871, he was graduated from the Veterinary College of Ohio State University in 1900, and soon after went to Cleveland, where for more than twenty years he was chief of the meat and milk inspection service of that city. Many of the important regulations covering the inspection of animal food products in Cleveland were originated and put into force by Dr. Eddy.

Dr. Earl M. Pickens was born in New York, in 1888, and was graduated from the New York State Veterinary College in 1911. In 1913, he received his master's degree from Cornell University and remained there as an assistant and later as Professor of Bacteriology and Pathology, under the late Dr. Veranus A. Moore. In 1918, Dr. Pickens accepted the chair of Bacteriology and Pathology in the University of Maryland. He was also Chief of the Biological and Live Stock Sanitary Service Laboratories at the University of Maryland at the time of his death.

These two men were outstanding representatives of the work of this Association. Dr. Pickens, as a research worker, was seeking to wrest from Nature new facts for the benefit of mankind and the live stock industry, and Dr. Eddy was devoted to the practical adaptation and application of such truths.

Our friends and companions have gone from us. We shall miss their fellowship and help. They labored with us; their interests were also ours, and their memory will remain. It is well that we should pause in our deliberations and pay a tribute to their memory, trusting that their lives and their work shall stimulate each of us to greater and more effective endeavor in our chosen field of work to "take up the torch"—

And hold this message for our dead,  
The living will not break the faith  
They once to those who've gone ahead.

We will carry on, and when our time comes to go alone into the Mysterious Future, we can say with the poet:

I do not fear to tread the path  
That those I love long since have trod,  
I do not fear to pass the gates  
And stand before the living God.  
In this world's fight I've done my part,  
If God be God he knows it well  
And will not turn His back on me  
And send me down to darkest Hell  
Because I have not stood and shouted in the market place.  
'Tis what we do, not what we say, that makes us worthy  
of His grace.

DR. MAYO: Mr. Chairman, I move that this memorial be received, and that the Secretary be instructed to send copies to the families of the deceased.

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

President Faulder resumed the chair and the session adjourned at 11:30 a. m. Recess
BRUCELLA INFECTION IN SWINE

By F. M. HAYES, Davis, Calif.

University of California

The title of this paper allows considerable freedom of discussion on Brucella infection in swine. Broad as the title is, it is not the purpose to relate to a group of this kind the details of research upon the many phases of this infection in the porcine species, but rather to review briefly the results of the investigations, upon which there is general agreement, on one of the most important diseases to be considered by investigators and sanitary officials, and that are fundamental to procedures that may at present be applied to its control.

No adequate statistics are available to indicate the distribution and prevalence of porcine infectious abortion in the United States, but it is probable that no state where swine raising is of any consequence is free from it. No survey of sufficient magnitude has ever been made to show the percentage of infected herds nor the average individual herd infection. Johnson and Huddleston\(^1\) found approximately 2.3 per cent of 1,672 hogs in 15 unselected herds in Michigan to react positively in a 1:50 dilution. None of the herds were entirely free of reactors. Weeter\(^2\) found 14.7 per cent of 435 sows, and 5.3 per cent of 190 barrows positive to the agglutination test in 1:50 or above. These were miscellaneous hogs killed in slaughter-houses in Chicago.

Starr\(^3\) more recently reported 3.2 per cent definitely positive and 23.7 per cent suspicious reactions in 1,316 swine killed in abattoirs in five different cities in Virginia. Others have reported similar percentages so that a very rough estimate that 5 per cent of swine are definitely positive to the agglutination test might be made. However, it is significant that a much higher percentage, perhaps reaching to 20 per cent, may react in dilutions from 1:25 to 1:50. Results of studies upon such groups as the latter indicate strongly that many may be carriers, having had at some previous time much higher reactions. This point will be considered later.
Traum, in 1913, seems to have been the first to have isolated the Brucella organism from swine, which he obtained from aborted fetuses. By cultural and serologic tests in vogue at that time, he was not able to distinguish it from Brucella abortus. Although actual abortions were noted occasionally among sows at this period, Good and Smith were the first to prove the infectious nature of an abortus type, which they isolated in February, 1916, from the afterbirth and fetal tissues obtained from a swine herd in which abortions were occurring. In the summer of 1916, Connaway, Durant and Newman tested blood samples from a few aborting sows and found them to be positive to the same tests used in their laboratory for Bang's disease in cattle. Since that time, numerous investigators have confirmed these results, added much to the knowledge of porcine abortion, and definitely identified a specific infectious disease of swine caused by the suis variety of Brucella.

Much has been contributed toward the classification and identification of the several varieties of Brucella and their host relationships. The three main types, abortus, suis and melitensis, are generally specific for their hosts, i.e., cattle, hogs and goats, but there have been exceptions reported. Of particular importance is the now recognized danger of the porcine type to human beings due to its ability to produce undulant fever through direct contact with infected swine or through the use of raw milk from udders harboring the suis variety of Brucella. The weight of evidence supports the conclusion that the undulant fever cases in the United States are most often connected with use of raw dairy products or contacts with infected bovines, but it is probably true that, if an equal amount of exposure to porcine and bovine infection of an equal number of humans occurred, the cases of undulant fever due to the suis type would far outnumber those of the bovis. The frequent isolation of Br. suis from the udders of cows emphasizes the potential danger of the swine infection to cattle and to man.

There is little evidence to indicate that there is any great danger of the transmission of Bang's disease in cattle to hogs; but on the other hand several reports are in the literature describing the invasive character of the suis variety for cattle, to the extent of actually producing abortions and accompanying sequelae, but more particularly recording the isolation of the suis type from bovine udders.

The clinical signs of Brucella infection in hogs is no index of the amount of infection that may exist in a herd, because
many herds and individuals show no apparent physical disturbance. This peculiarity has, to a greater extent than in cattle, permitted unsuspected spread of the disease between herds. While some herds show the characteristic Bang's disease "storm," with a high percentage of abortions and dead pigs, at one farrowing season, these are not the outstanding symptoms as observed in cattle. Nevertheless, premature birth of the entire litter or undeveloped dead pigs in an otherwise normal litter are the most frequent symptoms that cause alarm to the owner and induce him to seek the advice of a veterinarian.

It has been observed that occasionally a large percentage of the pregnant sows will abort, particularly if they are gilts, and the infection recently introduced at the time of or shortly after pregnancy occurs. On the other hand, there may be a high percentage of the herd positive to the agglutination test, with a low percentage of immature pigs born. One herd of 87 hogs, that came under the observation of the writer because five sows aborted, showed 100 per cent of the animals to be positive to the agglutination test in the dilutions of 1:100 and above. In contrast to this herd, another of 264 hogs showed 144 (54 per cent) definitely positive to the agglutination test and many more in the suspicious group, with about 60 per cent abortions in the fall of 1932. It may be stated parenthetically with respect to this herd that some form of vaccination or some patent medicine lost its opportunity to make a name for itself, because practically every sow that farrowed at all the following spring had normal litters. The owner, thoroughly alarmed, was on the verge of using a highly advertised (in California) vaccine, but accepted contrary advice with excellent results.

These examples are cited for the purpose of pointing out the fact, observed by most investigators in this field, that one does not know just what is going to happen to the breeding program in a swine herd with a high percentage of positive reactors. But it is generally agreed that the proportion of premature litters is not so high in swine as abortions in cows, when approximately the same amount of infection is evident by the blood test. Swine may be considered highly susceptible to Br. suis as measured by agglutinin response, but they probably have a higher degree of resistance to its effects than do cattle to Br. abortus. The writer believes, however, based upon a study of swine abortion for several years, that it is a mistake to minimize the physical effects of Br. suis as represented by abortions, dead pigs, sterility and lameness, and to give the impression to the live stock owner that
the disease will "run out" in a short time. This thought is expressed also because of the well-recognized danger of the porcine strain to human beings and because a high percentage of swine remain infected even though the agglutinin content of the blood is low.

In the experience of the writer, the agglutination test is as satisfactory for the diagnosis of Brucella infection in swine as it is for Bang's disease in cattle. Perhaps a higher percentage of infected swine than cattle react in the low dilutions and the suspicious group is comparatively larger. The agglutinin response to infection in swine is generally prompt, but there is a decided tendency for the titre to decline in a few months after known infection is contacted, and for the agglutinins to fluctuate in concentration around positive in the 1:25 and 1:50 dilutions for several months more. But there are numerous exceptions to this tendency and a significant number of those animals that have declined to react or show only suspicious reactions have been shown still to harbor Brucella in some of the glands. On rare occasions, hogs have been encountered in experimental work in which agglutinins and complement-fixing bodies could not be demonstrated after long exposure to infection, although the tissues contained Br. suis when the animals were slaughtered.

The complement-fixation test has no advantage over the agglutination test, considering the complexity of the former, and should be recommended only in doubtful agglutinin reactions or where special experimental methods are involved. Variations in the quantity of both agglutinins and complement-fixing bodies on repeated tests of positive swine occur but for the most part these run parallel in the two tests. Under experimental infection, agglutinins are the first to be demonstrated, and the complement-fixing bodies decline or disappear one or two months later than the agglutinins.

Skin tests for diagnostic purposes have been given little attention by investigators on porcine abortion and at present no "abortin" or "brucellin" can be recommended. The writer, after a great many intradermal injections with eight different types of brucellin, on both negative and positive swine, has concluded from unpublished data that there is not sufficient correlation, when compared to the agglutination and complement-fixation results, to recommend any one of the preparations tried. Known negatives to the two serological tests did not react to the brucellin, but on the other hand known positives and suspicious animals showed no uniformity of reactions.
The results of culture and animal inoculations of the tissues of infected swine show a wide distribution of *Br. suis* in the body, particularly in the glandular tissues. The reproductive organs of sows carrying agglutinins and complement-fixing bodies appear on the basis of published data to be singularly free of the organisms except at the time when an abortion occurs or when undeveloped fetuses are shed at the normal termination of pregnancy, unless the infection has been acquired recently. *Br. suis* can be isolated with ease from the placenta, uterine exudate, and fetuses in practically every infected sow that aborts. In contrast to the *bovis* variety, *suis* grows readily under aerobic cultivation directly from the tissues.

The discharge of the organisms from infected sows that farrow normally has been found by most investigators to occur rather infrequently, unless the infection has taken place for the first time close to the time that pregnancy has occurred. Sows that have carried the organism in the body, as measured by continued positive serological reactions, past one pregnancy, rarely shed *Br. suis* at the following farrowing unless the pregnancy is terminated by abortion. Sufficient evidence is not available on this, however, to compare to this form of shedding in cattle.

The extensive distribution of Brucella organisms in the bodies of infected swine is of considerable interest in view of the probably opposite condition in Bang's disease of cattle, although it has been shown by blood cultures that there may be more of a general infection in cows than bacteriological work on this species has demonstrated in the past. In a study of the location of *Br. suis* in the tissues of swine, it has been the routine practice in this laboratory to make cultures and guinea pig inoculations from the following tissues of swine that have been proved to have been infected and that have given serological reactions for varying lengths of time: submaxillary, prescapular, prefemoral, superficial inguinal, bronchial, gastro-hepatic and mesenteric lymph-glands, and spleen, liver, bile, urine and male and female reproductive organs or the products of gestation.

The results of slaughter and laboratory work on these tissues from 67 swine killed during the past two years have shown about 2 per cent carriers in a group killed when the agglutination titre was not above 1:50; on the other hand, 75 per cent of those showing 1:100 or above were proved to be carriers. Among these 67 head, four had long exposure to pen infection without the development of agglutinins and complement-fixing bodies. From one of these, *Br. suis* was isolated from the submaxillary and gastro-
hepatic lymph-glands. Also among the 67 head were four young infected boars, of breeding age, all of which were shown to carry the organism in their reproductive organs as well as in several other parts of the body.

The tissues in which *Br. suis* has been found most commonly in our own series have been the submaxillary, preascapular and gastro-hepatic lymph-glands, spleen, and male and female reproductive organs. This agrees generally with the findings of others, particularly Johnson and Huddleson¹ and Graham, Boughton and Tunnicliff.⁷ The frequency with which *Br. suis* has been found in the submaxillary lymph-glands, often to the exclusion of other tissues of hogs in our own experiments, is interesting and the reason speculative. It may be due to skin contact through the snout, or mouth contamination possible from the well-known rooting and eating habits of the hog.

This brief discussion of some of the characteristics of Brucella infection in swine has been offered for the purpose of emphasizing the importance of the disease from a public health and economic standpoint and to form a basis for suggestions for methods of controlling it. There is no doubt but that it slowly is spreading over this country, even though its spectacular effects may not be so evident as in the disease in cattle and the monetary losses not so great to the swine industry. However, this is counterbalanced certainly by the danger to human beings and by its effect upon the programs for controlling Bang's disease in cattle that are now in progress.

It has been found by most of those engaged in the experimental and practical eradication of swine abortion that it is possible to free swine herds from this disease more economically than can be done in cattle herds, by frequent blood-testing and removal of reactors or by raising pigs from an infected herd. The sooner a program is suggested to swine-raisers and its importance stressed by practicing veterinarians and sanitary officials, the less loss will occur to the industry and fewer cases of undulant fever will develop.

In the practical application of these methods of control and eradication it is recommended that:

1. Agglutination tests should be made at least once a month as long as reactors are found and as often as every two weeks if the number of reactors has not materially decreased after two monthly tests.

2. All swine from near breeding age that show a complete positive agglutination test in the dilution of 1:50, with an antigen
concentrated to a Gates 4.0 or McFarland 2.5, should be considered highly suspicious and probably reactors or at least tested again within two weeks. Too high a percentage of hogs reacting in this dilution have been proved to be carriers for it to be practical to spend much effort in trying to retain them in the breeding herd.

3. The decision to dispose of completely or practice segregation of the reactors depends upon a number of factors, such as percentage of reactors, physical equipment, coöperative ability and intelligence of the owner, etc.

4. When the plan of raising the offspring of infected sows free from infection is practiced, the pigs should be segregated after weaning or shortly thereafter. Experience has shown that no elaborate facilities and no great distance from the infected herd are necessary. Nor is it necessary to place the groups under different caretakers, if simple sanitary procedures are kept in mind.

5. When the segregated offspring have reached breeding age, they should be tested and the negatives retained.

Under this general plan several groups of weanling pigs from infected sows have been raised to breeding age during the past few years in connection with swine abortion experiments at the University of California. These results have been accomplished with very unfavorable physical equipment, which was no better than that found on the average farm. The last group raised in this manner, consisting of 41 head, was kept in a pen adjacent to sows and boars that continuously showed serological reactions, some of which when killed were proved to be carriers of *Bv. suis*. The same caretakers handled both groups.

Under the plan of complete removal of all positive and suspicious reactors, the University herd has been free of any reactors since July, 1931, after an original incidence of 42 per cent positive and 6 per cent suspicious on the first test in November, 1929. Many swine-raisers in California are voluntarily working out and have brought to a successful conclusion their swine abortion problem by these methods.

It would seem that methods for the control of Brucella infection in swine have now developed to a point where swine, as well as cattle, could be included in plans for the official recognition of disease-free herds. On account of the fact that agglutinins in swine have a tendency to fall more quickly than has been observed in cattle, and frequently fluctuate between 1:25 and 1:50, it is recommended that tests with swine serum showing agglutination
at 1:50 be considered as positive, if the antigen used has a concentration of 4.0 Gates reading, or greater.

REFERENCES


PRESIDENT FAULKER: I know we have all enjoyed this paper by Dr. Hayes.

Now we come to an important paper entitled, "The Status of Vaccination Against Bang's Disease," by Drs. W. E. Cotton and J. M. Buck, of Bethesda, Md.

... Dr. Cotton read the paper. ...

THE STATUS OF VACCINATION AGAINST BANG'S DISEASE

By W. E. Cotton and J. M. Buck

Experiment Station, U. S. Bureau of Animal Industry
Bethesda, Md.

When Professor Bernhard Bang¹ announced, in 1897, that he and his associate, Stribolt, had discovered the causal agent of what is now called "Bang's disease," he suggested the possibility of artificial immunization as a means of combating it. At that time he wrote:

Inasmuch as epizootic abortion belongs to the diseases which leave behind them at least a relative immunity, the possibility of conferring such immunity by prophylactic injections of a vaccine or an abortion serum naturally suggests itself. To the future must be left the task of accurately investigating this question as well as that of serum therapeutics. Perhaps nothing can be done in this way. Fortunately, however, it will be possible to successfully combat the plague by circumspect use of the old approved means, isolation and disinfection.

Nine years later, Bang² reannounced his discovery, submitted further proof to substantiate it, and described further experiments made in artificial immunization. In these, suspensions of both living and killed Brucella abortus were tried as immunizing agents on cattle, goats and sheep by giving repeated injections, both subcutaneously and intravenously, before conception. His results with the killed cultures were disappointing, but those obtained from the living ones were encouraging and at this time Bang wrote:

I am far from pretending that I have solved the question of vaccination against abortion, but I think that my experiments have
made it probable that it will be possible in this way to get efficient results and I hope to continue the experiments in a somewhat modified form. Whether in the future vaccination will be the chief weapon against contagious abortion or not, time will show.

EARLY RESEARCH ON VACCINATION

Vaccination has received much attention since then from many of the foremost investigators who have studied this disease. Among these are Zwick,3 M'Fadyean and Stockman,4 Jensen,5 and Klimmer,6 abroad; and Smith and Little,7 Huddleson,8 Hart and Traum,9 Hadley,10 Fitch and Boyd,11 and Lubbehusen,12 in America. The results of experiments reported by these workers though lacking in uniformity, have often been encouraging.

In some of the earlier work the administration of enormous amounts of vaccine, either in a single massive dose or in repeated smaller ones, was considered essential in order to render the method successful. The idea seemed to prevail that Br. abortus-infected animals would receive as much benefit from vaccination as those not infected and the impression was created that a saturation tolerance rather than a true immunity accounted for such beneficial results as were derived. There is, therefore, little cause for wonder that vaccination received much adverse criticism under these circumstances, even previous to the discovery that Br. abortus has a significance for human health. With our present knowledge of the microorganism, its tendency to localize in the udders of cattle which acquire the disease and its elimination in their milk, any method of control based upon a saturation tolerance would obviously be most illogical and objectionable.

The U. S. Bureau of Animal Industry researches on vaccination against the disease began in 1917, with experiments both in the field and with a comparatively small group of selected stock kept under close observation at the Experiment Station. The results of these investigations were reported by Buck and Creech.13 While in the field trials over a thousand animals were used, it was not possible to conduct the necessary bacteriological studies in connection with them to render the results definite. With the selected stock, however, that could be subjected to uniform Br. abortus exposure and in connection with which it was possible to make frequent serological tests and bacteriological studies of uterine material and colostrum at times of calving or aborting, more reliable information as to the efficacy of the method was secured.
EFFECTS OF VACCINATION ON ABORTION RATE

In one herd in which 772 unbred cows and heifers were vaccinated, 13.1 per cent subsequently aborted. Of 369 animals in the same herd which were reserved as controls, 17.7 per cent aborted. Two hundred and sixty-six of the vaccinated animals and 130 of the controls were virgin heifers giving negative results to the agglutination test. The abortion rate in this vaccinated group was 7.9 per cent and in the control group 13.6 per cent. The abortion rate in 292 vaccinated unbred negative cows in the herd was 10.3 per cent and in 128 negative cows left unvaccinated 13.4 per cent. Heifers or cows giving positive or suspicious results to the agglutination test at the time of vaccination appeared to derive practically no protection from the vaccine. The abortion rate was 25.3 per cent in a group of 214 vaccinated cattle of this character and 27.6 per cent in a group of 111 positive or suspicious controls.

The field trials which were conducted in another herd at about the same time yielded more encouraging results. For ten years it was the practice in this herd to vaccinate about two-thirds of the heifers two months before it was proposed to breed them. During this ten-year period, 149 heifers were vaccinated and 83 were left unvaccinated as controls. The abortion rate in the vaccinated animals was 5.1 per cent and in the controls 17.9 per cent.

The selected stock, that was kept under experiment station conditions, comprised 19 animals, of which eight virgin heifers and three cows were vaccinated and eight heifers were reserved for controls. Pronounced agglutination reactions were promptly induced by the vaccine in the eight heifers, which were of breeding age, but the intensity of the reactions gradually subsided until at the expiration of five or six months they had either disappeared or were of very low titre. It thus seemed reasonable to conclude that the heifers were no longer carriers of the infection. Following the vaccination of three unbred cows, similar agglutination results were given by two, but one cow continued to react in high titre. That she was made a carrier by vaccination, therefore, seemed evident and this was readily proved by the isolation of the infection from her milk.

EVIDENCE OF INCREASED RESISTANCE

All the vaccinated and control animals became pregnant and were given uniform Br. abortus ingestion exposure. The results definitely indicated that the resistance of the vaccinated animals
to the infection had been increased, for seven of the eight vaccinated heifers continued to give negative results to the agglutination test and produced vigorous calves, while seven of the eight control heifers acquired reactions and aborted. Guinea-pig inoculation results indicated the absence of the infection in placental material from the seven vaccinated heifers and its presence in the seven controls which aborted. One vaccinated heifer, following the *Br. abortus* exposure furnished during pregnancy, again acquired a strongly positive agglutination reaction and aborted and one control heifer produced a vigorous calf, although it was proved that *Br. abortus* was present in her placenta at time of parturition.

The two vaccinated cows which appeared to overcome the vaccinal infection, as indicated by their agglutination reactions, did not acquire sufficient immunity to enable them to resist the *Br. abortus* exposure furnished during pregnancy, for although they produced vigorous calves and guinea-pig inoculation results indicated the absence of *Br. abortus* infection in their uteruses, its presence was demonstrated in their milk.

In 1925, Hart and Traum⁹ reported the results of carefully conducted vaccine experiments which yielded results not unlike those obtained by the Bureau but more conclusive because of the greater number of animals used.

That greatly increased resistance to *Br. abortus* was conferred by these investigators through vaccination seems to have been shown definitely by their experiments, for 16 of 17 vaccinated heifers, upon being bred, dropped calves at the termination of normal gestation periods during which they received *Br. abortus* exposure of sufficient severity to cause six of ten controls to abort. Although guinea-pig inoculation results indicated the absence of *Br. abortus* in the placentae of all the 16 vaccinated heifers which calved normally, its presence was demonstrated in the placentae of seven of the ten controls.

When, however, the vaccine was administered to 16 open, lactating cows instead of virgin heifers, it was found that ten were caused to eliminate the infection in their milk for a period of months, a feature that caused these workers to conclude that "vaccinated animals may become spreaders of the infectious agent and therefore cannot with safety be moved into uninfected herds."

While these vaccine experiments, conducted respectively by the Bureau and by Hart and Traum, seemed to indicate that for unbred heifers vaccination was not only effective but free from seriously objectionable features, it was nevertheless proved by
both experiments that in unbred cows the vaccinal infection could become implanted in their udders and be eliminated in their milk.

METHODS OF PREPARING VACCINE

It should be borne in mind that up to the time these vaccine experiments were being made, the matter of virulence of *Br. abortus* strains used for preparing vaccine had received but scant attention. Some investigators were of the opinion that the use of virulent strains might be necessary to produce a reasonably substantial immunity. A practice was commonly made of selecting several, and often many, *Br. abortus* strains in preparing vaccines. Some investigators even went as far as to utilize both bovine and porcine strains in the preparation of bovine vaccines, a procedure which we now know would be seriously objectionable. If vaccination were confined to virgin heifers, there is some question as to whether even virulent bovine strains would, except in possibly rare instances, become localized in the vaccinated animal. That such strains, used as vaccine, often localize in the udders of open, lactating cows has, on the other hand, now been demonstrated repeatedly.

At about the same time that the vaccine experiments of the Bureau and Hart and Traum were published, Huddleson⁸ reported the results of vaccination studies he had made, which attracted no small degree of attention because of the fact that instead of making use of a number of *Br. abortus* strains of unknown virulence for vaccine preparation he had used a single strain avirulent for guinea pigs and pregnant cattle. In 1929, Huddleson¹⁴ made a second report, giving additional data. One of the conclusions in the earlier report stated that "23 animals in the experiment herd and 118 animals in five other herds indicated that the culture had lost its disease-producing properties for the bovine and that some degree of immunity follows its inoculation." A conclusion of his later report was that "the breeding data and a few bacteriological data indicate that a high percentage of the animals were protected against *Br. abortus* infection."

If avirulent strains are as effective as strains which still possess a low degree of virulence or are even reasonably efficient as immunizing agents, their use would obviously be decidedly preferable, not only because they would naturally be expected to eliminate any evil effects resulting from the localization of the vaccinal infection in the udders of lactating cows but also because their use would render it unnecessary to restrict vaccination to unbred stock, a feature of no little importance from a practical
standpoint. It does not appear to have been definitely determined, however, that the immunity-producing power of strains of *Br. abortus* is likely to be retained in a large measure after their pathogenicity has completely disappeared.

**Experiments with an Avirulent Strain**

An avirulent strain of *Br. abortus* used at the Experiment Station during 1926 appeared to afford only slight protection when administered to cattle from three to five and one-half months before conception. When given during the early months of pregnancy, to cattle which later were subjected to *Br. abortus* exposure, it seemed merely to retard the disease processes. About two years later, the same strain was administered to ten pregnant cattle that were subsequently subjected, with nine controls, to *Br. abortus* exposure. Four of the vaccinated animals resisted the exposure furnished, whereas eight of the nine controls contracted the disease.

In an experiment made a year later, in which three groups of unbred heifers were vaccinated, respectively, with this avirulent strain, another so low in virulence as only rarely to cause slight lesions in guinea pigs, and a third strain regularly lesion-producing for guinea pigs, the avirulent strain gave evidence of possessing very little, if any, virtue as an immunity-producing agent, whereas the two other strains afforded almost perfect protection against a degree of *Br. abortus* exposure that caused a high percentage of abortions in the control group. The low immunizing power of this particular avirulent strain appeared to have become lost gradually. It is possible that avirulent strains differ from one another from an immunizing standpoint and that the one that has been used largely in our experimental work, although typical of *Br. abortus* (bovine) in all respects, with the exception of virulence, may not possess average immunizing power for such strains.

The Bureau has given increased attention to vaccination during the past few years. It has seemed highly important that more definite knowledge of the subject be gained and that either safe and effective ways of artificially immunizing cattle against the disease be perfected or that use of abortion vaccines be discouraged. These investigations have included studies of calfhood vaccination, of avirulent *Br. abortus* strains as immunizing agents for both bred and unbred cattle, and of strains of low virulence as well as those of normal virulence for comparative purposes only, as immunizing agents for unbred stock. Experi-
ments sometimes have been repeated in an endeavor to eliminate, as far as possible, the danger of drawing erroneous conclusions. While it does not appear that the disease can be conquered speedily by artificial immunization alone, the information gained through these investigations leads us to believe that vaccination can be made to serve a very useful purpose in combating the disease, even if used only in herds where testing programs are recognized as being impractical or unprofitable or where they have been abandoned as a result of discouragement on the part of stock-owners.

Calfhood Vaccination Studied

Calfhood vaccination has been unusually promising as a means of conferring immunity. It is true that immediate results from the use of the method cannot be expected. However, if the results which have been obtained with experiment animals are suggestive of what may be accomplished in infected herds in the field, it should be possible by vaccinating calves to reduce greatly or eliminate abortion losses and at the same time enable stock-owners to develop herds resistant to the disease, a feature of no little importance in connection with a disease of such wide prevalence as infectious abortion, and at the same time, through intelligent use of the agglutination test, free them from the infection.

Calfhood vaccination was investigated primarily with the object of determining if immunity to the disease could be imparted to calves and retained to the end of their first pregnancy. The first experiment in this connection, made by Buck,16 with a small number of calves, seemed rather definitely to indicate that immunity was established and persisted during the long period between vaccination and artificial exposure during pregnancy. A second experiment of a similar nature, making use of a larger number of calves, has yielded results which have been even more encouraging than those obtained from the earlier experiment. Eight of the principals in the second experiment were vaccinated with a virulent Br. abortus strain and nine with a low-virulence strain, with the object of determining if there were a marked difference in the immunizing value of the two strains. Five months after vaccination, the principals were either negative to the agglutination test, or their titres, except in one instance, had subsided to 1:25 or 1:50. The one exception had received the virulent strain and continued to react in a titre of 1:200 for seven months although it, thereafter, promptly dropped to 1:50.
When breeding of the animals was commenced, about one and one-half years after the principals were vaccinated, eleven of them gave negative results to the agglutination test, two showed partial agglutination in a titre of $1:25$ and one complete agglutination in a titre of $1:50$. The vaccinated animals and controls were exposed during pregnancy, via the conjunctiva, to a virulent strain of *Br. abortus*. Sixteen of the vaccinated animals produced vigorous calves and one a weak calf. *Br. abortus* was present in the uterus and colostrum of the heifer which produced the weak calf and in the colostrum of one heifer which produced a vigorous calf, indicating that in these two instances the immunity induced was insufficient to protect wholly against the degree of exposure to which they were subjected. Of the controls, seven aborted and three produced weak calves. *Br. abortus* was proved to be present in the uterus and colostrum of each of eight of these ten animals. Two of the heifers aborted unobserved, consequently no bacteriological studies were made of these animals. Of the six controls which produced vigorous calves, *Br. abortus* was proved to be present in the uterus and colostrum of one and in the colostrum of another. We were unable to prove the presence of *Br. abortus* in the uterus or colostrum of the four remaining controls.

**ADVANTAGES OF CALFHOOD VACCINATION**

The immunity conferred by vaccination during calfhood has given indication of being lasting. Many of the vaccinated calves were carried through two or three pregnancies and in nearly every case successfully resisted the degree of *Br. abortus* exposure to which they were artificially subjected. Although it is realized that the immunity exhibited during the second and third pregnancies could not be ascribed entirely to vaccination but may have been in part due to the exposures given, it seems reasonable to infer that vaccinated calves in infected herds would also be subjected to more or less *Br. abortus* exposure and that their artificially induced immunity might likewise possibly be reinforced.

The vaccination of calves from four to eight months of age appears to have several advantages over the vaccination of older virgin heifers or open cows. It seems rare for vaccine, even when prepared with virulent *Br. abortus* strains, to remain for long in the bodies of calves as judged by agglutination tests of their blood sera. Strains of low virulence, which have appeared to be about equally efficient in inducing immunity to more viru-
lent ones, naturally reduce the danger of the vaccine becoming localized. In our experience, the agglutination reaction caused by the vaccine injections in calves subside more rapidly and disappear in the course of a few months more regularly than the agglutination reactions of vaccinated virgin heifers of near breeding age or open cows. Calfhood vaccination naturally eliminates the danger of vaccinating pregnant animals by mistake.

**Stability of Degree of Virulence**

Our experience has led us to believe that the degree of virulence possessed by the *Br. abortus* strains used in vaccination is a highly important factor in determining whether the vaccine becomes implanted in the udder and is eliminated in the milk of vaccinated, open cows. Virulent strains which have been used in making comparisons between the degree of immunity induced by them and by low-virulence strains have frequently become established in the udder. Low-virulence strains, when subcutaneously injected, have not shown this objectionable feature and yet have given indication of retaining, with but little, if any, impairment, their immunity-inducing power.

Whether low-virulence strains are reasonably stable in virulence and immunity-inducing effects is somewhat problematic. However, one strain that has been extensively employed in our immunization experiments has appeared to remain fairly constant in virulence during the last three or four years, as indicated by repeated tests on guinea pigs. When guinea pigs have been injected subcutaneously with 0.25 cc of suspensions prepared from 72-hour transfers and adjusted to a density ten times that of tube 1 of the McFarland nephelometer, occasionally they have shown slightly nodular and slightly enlarged spleens when killed two months later, but no other lesions. The titre of agglutination reactions of their blood sera averaged about 1:300. Our experience has indicated that the virulence of strains can be estimated with reasonable accuracy through the use of guinea pigs.

In order to ascertain whether the low virulence of this particular strain might become enhanced as a result of the sojourn of the microorganisms in cattle, a pregnant heifer was injected subcutaneously with a heavy suspension of the strain. She subsequently produced a living calf which died shortly after birth. The strain was recovered readily from the carcass of the calf and 24 guinea pigs were inoculated with a suspension of it. The same number of guinea pigs were inoculated with a suspension
of the same density prepared from a transfer of the original strain.

As far as could be determined by the autopsies and agglutination tests of the guinea pigs, the strain had acquired no additional virulence. Two pregnant cows then were injected subcutaneously with a heavy suspension of the strain after passage through the first injected cow. One of these animals produced a vigorous calf. *Br. abortus* could not be recovered from either the uterus or colostrum. The second cow aborted and while *Br. abortus* could not be isolated from the fetus, it was recovered from her uterine exudate. Suspensions then were prepared from 72-hour growths of transfers of the original strain, after its passage through one cow as well as after its passage through two cows, successively, and 18 guinea pigs were injected with equal doses of each suspension.

When the guinea pigs were killed the postmortem findings as well as the agglutination tests of their sera indicated no variation in the virulence of the microorganism as a result of its passage through two pregnant cows. It thus appears that the danger of strains of *Br. abortus*, which have lost much of their virulence, regaining it by long sojourns in cattle, may be slight.

**EFFECT OF VACCINATION ON REACTIONS TO AGGLUTINATION TEST**

Though experiments have proved that increased resistance to *Br. abortus* can be imparted to calves, older virgin heifers, and open cows through the use of vaccines and that danger of the vaccine localizing in the udder can be eliminated or reduced to a minimum by making use of avirulent or low-virulence strains, vaccination continues to have one objectionable feature, viz., that of causing the treated animals to develop marked reactions to the agglutination test. If the reactions induced in the vaccinated animals continued in high titre indefinitely, this feature would indeed constitute a serious fault. But, since the reactions caused by avirulent or low-virulence strains usually either disappear or subside to low titres after a time, the seriousness of this shortcoming is much reduced. Although it is customary at present to regard animals reacting in titres of 1:25 and 1:50 as suspicious, our occasional use of such animals as controls in vaccine experiments has led us strongly to suspect that these titres may indicate arrested infection and some degree of acquired immunity with more frequency than they denote the presence of active infection, especially in connection with unbred stock.

Although the vaccination of calves and older unbred stock with
low-virulence *Br. abortus* strains has proved to be reasonably successful in protecting against artificial exposure, and the danger of the vaccine localizing in the udders of unbred cattle following its subcutaneous administration has given evidence of being remote, when use has been confined to low-virulence strains, some doubt naturally arises as to whether equally favorable results may be obtained in infected herds under natural *Br. abortus* exposure. There is also some cause for doubt as to whether it may be possible, with commercial vaccines, to duplicate regularly results which we have obtained through the use of vaccines prepared by suspending in physiological salt solution 48- to 72-hour growths of the microorganism on potato-agar slants, adjusting to a density ten times that of tube 1 of the McFarland nephelometer and using them not later than 24 hours after being prepared.

Sufficient care has not always been exercised by some biological firms to insure the dispensing of viable and uncontaminated abortion vaccines, and several months readily may elapse after their preparation before they are used. However, since present regulations of the Bureau require that abortion vaccines be prepared from *Br. abortus* (bovine) strains only, and that they be of low virulence or avirulent, important steps with reference to vaccine standardization, as regards safety, have already been taken. It seems reasonable to believe that it may also be possible further to bring about more uniformity in their manner of preparation, densities, viability, etc.

Although the *Br. abortus* exposure to which vaccinated animals would be subjected in infected herds could hardly be expected to operate as uniformly as the artificial exposure methods through the mouth or conjunctiva used in our experiments, it does not seem unreasonable to believe that at times certain cattle in infected herds may receive *Br. abortus* exposure of such unusual severity that artificially induced immunity would not protect them.

**LOGICAL USES OF VACCINATION INDICATED**

While, during recent years, great faith has sometimes been reposed in biological prophylaxis against a number of infectious diseases of man and domestic animals, Bang's disease does not appear to be one of those in which it has inspired an unusual degree of confidence. If we had decided to wait until perfect biological methods of preventing some of the other diseases had been developed before making use of them, few diseases would be combated along these lines.
It is fully realized that vaccination against Bang's disease, as at present developed, is far from being a perfect method of dealing with the affection and possibly should never be used except in badly infected herds or where testing programs are considered impractical or have utterly failed. We are not certain, however, but that knowledge of this method has now been advanced to the point where it can reasonably be expected under certain conditions to provide a logical plan of combating the malady and to be capable of enabling stock-owners gradually to obtain relief from its evil effects and, in conjunction with the agglutination test, materially aid in the eradication of the disease from many herds.

REFERENCES

THE HANDLING OF BANG'S DISEASE IN THE FIELD*

With Records of Reproduction of Clean Cattle, Recent Reactors and Chronic Reactors Covering 5,074 Cow-Years

By R. R. BIRCH, C. H. MILKS and H. L. GILMAN†

New York State Veterinary College
Ithaca, N. Y.

This report summarizes work that was begun in 1928, hence it is based on data that have been accumulating for approximately seven years. It was undertaken in order to develop and improve specific methods of control based on the use of the agglutination test; to establish blood-testing programs in representative dairy herds in New York; to inquire into various economic phases of the disease and its control; to obtain accurate records regarding reproduction in animals that do not react to the agglutination test, in comparison with records of recent reactors and chronic reactors; to learn whether herds once freed from Bang's disease can be kept clean for a period of years; and to provide herds free from Bang's disease in which a systematic study of breeding failures brought about by other causes could be made.

METHODS

The first step was what we have termed an original survey of the herd. The owner employed his local veterinarian to draw the blood samples, to do all the emergency work in the herd, and to guide the program after it was well charted. The laboratory tests were made free of charge and aside from our personal visits to the herds, this was the only gratuitous service rendered.

The local veterinarian drew the blood samples in all animals more than ten months old, following in most instances the technic described by Birch.1 An original survey chart was left with the breeder after he had been assisted in filling out the records of a few cows. He thus was able to complete the chart while the laboratory tests were being made. We were then ready to visit the herd in company with the local veterinarian, copy our test

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*A grant from the U. S. Bureau of Animal Industry, which has given substantial financial support to the project since 1929, has made it possible to increase greatly the scope of the work, and has hastened the time when data sufficiently extensive to be of statistical value could be published.

†A. G. Gierke and W. M. Thomson, U. S. Bureau of Animal Industry, each participated in the routine for a period of one year, but neither had a part in planning the work or in assembling and interpreting the data.

‡A more inclusive report, including individual herd histories, will be published in the report of the New York State Veterinary College, 1932-1933.
records into the original survey chart, and suggest a plan of control suited to the circumstances encountered. Each herd presented its own individual problem, and careful inquiry into details was necessary in order to lay out a plan that would protect the clean cattle and cause the least possible inconvenience to the owner.

Our second step in all herds was to go over the chart carefully and cull out all poor cows that reacted. The number of reactors that remained and the equipment at hand were the chief factors in determining the choice of a method. The choice lay among three methods: (1) sale of reactors, (2) complete segregation, (3) partial segregation. In actual practice the methods were not always entirely distinct, as one method sometimes was merged with or followed by another, but in general terms the designations we have applied accurately describe the methods.

Plan 1 (sale of reactors) was advised principally when the number of reactors was limited and when there was a high value attached to the clean cows associated with them. In this state the sale of declared reactors is permitted by law, and breeders took advantage of this provision in disposing of good individuals. The poor individuals were slaughtered.

Plan 2 (complete segregation) was advised when a considerable number of reactors that were good individuals survived the first culling, and when there were facilities for maintaining two or more separate units. The reactors were placed apart from the clean cattle, their calves were raised with them in the usual way, and added to the clean units not less than a month after they had taken their last milk. The calves from the clean cows remained in the clean groups from the time of birth, or else they were reared, following weaning, on young-stock farms.

Plan 3 (partial segregation) was employed when a considerable number of reactors survived the first culling and when only one set of buildings was available. Its essential points included stabling reacting and clean cows in separate groups in the same barn, keeping reacting cows entirely apart from the clean group during calving time and for a month afterward, raising the young stock apart or with the clean group, and the rule that reacting and clean cows should not at any time be at liberty together. As in plan 2, the calves from both groups were raised as clean animals, and no calf taking milk from a reactor was allowed to associate with clean cattle until weaned, or for a month afterward. The requirements were not always easy to meet, but
very frequently minor changes in management, involving almost no inconvenience to the owner, proved to be sufficient.

The earlier tests were made according to a technic described by Gilman, but as the work progressed a slightly different technic involving the use of killed antigen was employed. In both, interpretations were made according to the following chart, copies of which were left with the breeder and his veterinarian:

**Chart I**

*Please Read Carefully*

<table>
<thead>
<tr>
<th></th>
<th>Negative</th>
<th>Positive</th>
<th>Suspicious</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:25</td>
<td>1:50</td>
<td>1:100</td>
<td>1:200</td>
</tr>
<tr>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>+ P</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Important

1. Usually there is fluctuation in the blood agglutination titre in consecutive tests of the same individual. Negatives fluctuate in dilutions of 1:50 or below, positives in dilutions of 1:100 or above.

2. It is necessary to report exact agglutination titres because some states demand it as a basis for admission of cattle. The breeder makes better use of the charts when exact dilutions are reported and their significance explained.

3. A few animals recover. Most recoveries are among animals which have shown temporary or consistent low reaction. Unbred heifers showing low reactions recover most frequently.

4. Pregnant animals, and those that recently have calved, that show a suspicious reaction should be kept away from clean cattle and retested in about 30 days. Holding them in a stanchion in the main barn pending the retest is much better than allowing them to run with the herd.

5. Non-pregnant animals that show a suspicious reaction should be retested. If they have not recently calved, there is no great danger in leaving them with the main herd pending the retest. They should not be bred in the meantime.

6. A few cows that acquire Bang bacillus infection abort before they react. All aborting cows should be kept away from clean animals until a clean test is obtained at least 30 days following the abortion.

The brief explanations included in chart I served to prevent the confusion that frequently occurs in the mind of a breeder when there is a change in the agglutination titre of an individual in succeeding tests. Also they cleared away some of the doubt that often exists regarding the handling of suspicious cases.
If a good system of keeping breeding records, satisfactory to the owner, was already established in a herd, we did not suggest changes. Otherwise we suggested a looseleaf system used first by Metzger, later modified and described by Derrick. This without exception was welcomed by the breeders; it encouraged the keeping of accurate records, and was highly convenient to us in compiling data.

Retesting was advised according to conditions observed in the individual herds. Evidence of recent spread, rather than percentage of reactors, we found to be the best criterion on which to determine the best time to retest, but the attitude of the owner, the season of the year and various other factors have helped to determine the program that actually could be carried out. As nearly as we can state in general terms, we have advised retesting each two months until two consecutive clean tests of a group have been obtained. We have advised the testing of clean herds twice a year, once as the cattle go to pasture, and again as they are placed in winter quarters. In some herds this program has been faithfully carried out, in others there has been a tendency to neglect testing as long as no breeding trouble of consequence has appeared.

It should be noted that this entire project has been a growth governed by accumulating experience, hence a general statement that will apply in every particular to every herd cannot be made. For instance, the original survey chart, which we regard as highly essential for systematic work, was not used in its present form in earlier years, nor were methods of keeping breeding records as well organized in the beginning as they are now. We also have found it possible, as the work progressed, to lay down more definite policies regarding retests, the handling of doubtful reactors and recovered animals, the replacement problem and various other phases of the program.

Tables I to VI, inclusive, describe the status of the work as of the approximate date, May 1, 1933.

Tables I and II show that most herds we have taken under supervision contained originally a high percentage of reactors, and that it usually has been possible to maintain or increase the original numbers and at the same time gradually to eliminate the reactors, or to work in this direction with reasonable speed and assurance. Tables III and IV show that herds almost clean can be cleaned, and that clean herds can be so maintained without undue loss or difficulty. Table V (herd 42) shows what happened when tests were allowed to lag and when recommenda-
TABLE I—*Herds once badly infected. Now clean.*

<table>
<thead>
<tr>
<th>Herd</th>
<th>Breed</th>
<th>First Test</th>
<th>Present Numbers</th>
<th>Plan</th>
<th>Approximate Time Under Supervision</th>
<th>New Reactors</th>
<th>Individual Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reactors</td>
<td>Clean</td>
<td>Reactors</td>
<td>Clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>H</td>
<td>47</td>
<td>100</td>
<td>1*</td>
<td>118</td>
<td>3†</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>GG</td>
<td>42</td>
<td>9</td>
<td>0</td>
<td>42</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>GG, H</td>
<td>69</td>
<td>80</td>
<td>0</td>
<td>81</td>
<td>3</td>
<td>31</td>
</tr>
<tr>
<td>4</td>
<td>G</td>
<td>24</td>
<td>19</td>
<td>0</td>
<td>55</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>H</td>
<td>24</td>
<td>13</td>
<td>0</td>
<td>37</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>35</td>
<td>40</td>
<td>0</td>
<td>51</td>
<td>3, 1</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>H</td>
<td>18</td>
<td>33</td>
<td>0</td>
<td>39</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>H</td>
<td>12</td>
<td>10</td>
<td>0</td>
<td>20</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>H, G, J, A</td>
<td>35</td>
<td>58</td>
<td>0</td>
<td>98</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>H</td>
<td>11</td>
<td>6</td>
<td>0</td>
<td>19</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>GG</td>
<td>46</td>
<td>78</td>
<td>0</td>
<td>140</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>12</td>
<td>H</td>
<td>19</td>
<td>23</td>
<td>0</td>
<td>40</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Totals</td>
<td>382</td>
<td>479</td>
<td>1</td>
<td>749</td>
<td>171</td>
</tr>
</tbody>
</table>

* Bull recently purchased. † See text.
### Table II—Herd once badly infected. Satisfactory progress.

<table>
<thead>
<tr>
<th>Herd</th>
<th>Breed</th>
<th>First Test</th>
<th>Present Numbers</th>
<th>Plan</th>
<th>Approximate Time Under Supervision</th>
<th>New Reactors</th>
<th>Individual Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reactors</td>
<td>Clean</td>
<td>Reactors</td>
<td>Clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>H</td>
<td>17</td>
<td>22</td>
<td>3</td>
<td>40</td>
<td>3</td>
<td>3½ yrs.</td>
</tr>
<tr>
<td>14</td>
<td>H</td>
<td>17</td>
<td>13</td>
<td>11</td>
<td>24</td>
<td>3</td>
<td>3½ yrs.</td>
</tr>
<tr>
<td>15</td>
<td>H</td>
<td>23</td>
<td>19</td>
<td>21</td>
<td>56</td>
<td>3</td>
<td>3 yrs.</td>
</tr>
<tr>
<td>16</td>
<td>H</td>
<td>21</td>
<td>17</td>
<td>14</td>
<td>34</td>
<td>3</td>
<td>5 yrs.</td>
</tr>
<tr>
<td>17</td>
<td>A</td>
<td>62</td>
<td>50</td>
<td>31</td>
<td>133</td>
<td>2</td>
<td>2½ yrs.</td>
</tr>
<tr>
<td>18</td>
<td>GG</td>
<td>33</td>
<td>22</td>
<td>19</td>
<td>55</td>
<td>3</td>
<td>2 yrs.</td>
</tr>
<tr>
<td>19</td>
<td>J</td>
<td>275</td>
<td>150</td>
<td>185</td>
<td>253</td>
<td>2</td>
<td>2 yrs.</td>
</tr>
<tr>
<td>20</td>
<td>H</td>
<td>35</td>
<td>41</td>
<td>32</td>
<td>48</td>
<td>2</td>
<td>2 yrs.</td>
</tr>
<tr>
<td>21</td>
<td>G</td>
<td>31</td>
<td>19</td>
<td>14</td>
<td>19</td>
<td>3</td>
<td>4 yrs.</td>
</tr>
<tr>
<td>22</td>
<td>H</td>
<td>24</td>
<td>19</td>
<td>5</td>
<td>60</td>
<td>3</td>
<td>4½ yrs.</td>
</tr>
<tr>
<td>23</td>
<td>G</td>
<td>36</td>
<td>26</td>
<td>33</td>
<td>33</td>
<td>3</td>
<td>3½ yrs.</td>
</tr>
<tr>
<td>24</td>
<td>H</td>
<td>12</td>
<td>19</td>
<td>5</td>
<td>37</td>
<td>3</td>
<td>1 yr.</td>
</tr>
<tr>
<td>25</td>
<td>BS</td>
<td>11</td>
<td>28</td>
<td>6</td>
<td>41</td>
<td>3</td>
<td>2 yrs.</td>
</tr>
<tr>
<td>26</td>
<td>A</td>
<td>32</td>
<td>38</td>
<td>29</td>
<td>110</td>
<td>2</td>
<td>7½ yrs.</td>
</tr>
<tr>
<td>27</td>
<td>J</td>
<td>53</td>
<td>63</td>
<td>26</td>
<td>85</td>
<td>3, 1, 2</td>
<td>6 yrs.</td>
</tr>
<tr>
<td>28</td>
<td>G</td>
<td>55</td>
<td>28</td>
<td>8</td>
<td>111</td>
<td>2</td>
<td>5 yrs.</td>
</tr>
<tr>
<td>29</td>
<td>H</td>
<td>0</td>
<td>23</td>
<td>3</td>
<td>52</td>
<td>2</td>
<td>3 yrs.</td>
</tr>
<tr>
<td>30</td>
<td>H</td>
<td>9</td>
<td>10</td>
<td>5</td>
<td>15</td>
<td>3</td>
<td>2 yrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Totals</strong></td>
<td><strong>755</strong></td>
<td><strong>616</strong></td>
<td><strong>450</strong></td>
<td><strong>1,206</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Table III—Herds with a few reactors on first test. Now clean.**

<table>
<thead>
<tr>
<th>Herd</th>
<th>Breed</th>
<th>First Test</th>
<th>Present Numbers</th>
<th>Plan</th>
<th>Approximate Time Under Supervision</th>
<th>New Reactors</th>
<th>Individual Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reactors</td>
<td>Clean</td>
<td>Reactors</td>
<td>Clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>H</td>
<td>5</td>
<td>86</td>
<td>0</td>
<td>112</td>
<td>1</td>
<td>2 yrs.</td>
</tr>
<tr>
<td>32</td>
<td>H</td>
<td>4</td>
<td>35</td>
<td>0</td>
<td>49</td>
<td>1</td>
<td>3½ yrs.</td>
</tr>
<tr>
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<td>A</td>
<td>3</td>
<td>38</td>
<td>0</td>
<td>37</td>
<td>1</td>
<td>3½ yrs.</td>
</tr>
<tr>
<td>34</td>
<td>H</td>
<td>3</td>
<td>15</td>
<td>0</td>
<td>11</td>
<td>1</td>
<td>2½ yrs.</td>
</tr>
<tr>
<td>35</td>
<td>GH</td>
<td>3</td>
<td>34</td>
<td>0</td>
<td>52</td>
<td>1</td>
<td>3½ yrs.</td>
</tr>
<tr>
<td>36</td>
<td>G</td>
<td>4</td>
<td>24</td>
<td>0</td>
<td>28</td>
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<td>4½ yrs.</td>
</tr>
<tr>
<td>37</td>
<td>GH</td>
<td>4</td>
<td>23</td>
<td>0</td>
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**Table IV—Herds clean on first test. Maintained clean.**

<table>
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<th>Herd</th>
<th>Breed</th>
<th>First Test</th>
<th>Present Numbers</th>
<th>Plan</th>
<th>Approximate Time Under Supervision</th>
<th>New Reactors</th>
<th>Individual Tests</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>Clean</td>
<td>Reactors</td>
<td>Clean</td>
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<td></td>
</tr>
<tr>
<td>38</td>
<td>H</td>
<td>...</td>
<td>*</td>
<td>0</td>
<td>78</td>
<td>1</td>
<td>4½ yrs.</td>
</tr>
<tr>
<td>39</td>
<td>J</td>
<td>0</td>
<td>41</td>
<td>0</td>
<td>58</td>
<td>1</td>
<td>3½ yrs.</td>
</tr>
<tr>
<td>40</td>
<td>H</td>
<td>0</td>
<td>34</td>
<td>0</td>
<td>44</td>
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<td>4½ yrs.</td>
</tr>
<tr>
<td>41</td>
<td>H</td>
<td>0</td>
<td>39</td>
<td>0</td>
<td>78</td>
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<td>7 yrs.</td>
</tr>
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<td></td>
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<td>114</td>
<td>0</td>
<td>256</td>
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</tr>
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</table>

*Assembled gradually as clean herd.
H=Holstein. J=Jersey.
Table V—Tests have lagged. Unsatisfactory progress.

<table>
<thead>
<tr>
<th>Herd</th>
<th>Breed</th>
<th>First Test</th>
<th>At Last Test*</th>
<th>Plan</th>
<th>Approximate Time Under Supervision</th>
<th>New Reactors Since Last Test</th>
<th>Individual Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reactors</td>
<td>Clean</td>
<td>Reactors</td>
<td>Clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>H</td>
<td>5</td>
<td>59</td>
<td>42</td>
<td>44</td>
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<td>5 yrs.</td>
</tr>
<tr>
<td>43</td>
<td>J</td>
<td>10</td>
<td>9</td>
<td>6</td>
<td>15</td>
<td>3</td>
<td>2 1/2 yrs.</td>
</tr>
<tr>
<td>44</td>
<td>H</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>17</td>
<td>..</td>
<td>2 yrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Totals</td>
<td>15</td>
<td>59</td>
<td>42</td>
<td>44</td>
<td></td>
</tr>
</tbody>
</table>

*Herd 42, April 16, 1933; herd 43, May 18, 1932; herd 44, March 5, 1931.
H=Holstein. J=Jersey.

Table VI—Work recently begun.

<table>
<thead>
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<td>Reactors</td>
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<tr>
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<td>35</td>
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<tr>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Totals</td>
</tr>
</tbody>
</table>
tions regarding herd management were not carried out. The other two herds described in table V have not been tested recently and their present status is therefore not known. Table VI includes herds recently taken under supervision and is inserted merely to complete the picture of the present status of the work. Two herds (51 and 52) which have been taken under supervision and dropped are not included in the tables. Individual histories of all herds are included in the complete paper of which this is a summary. Also, there is a statement regarding testing done in earlier years, and discontinued.

In many of the herds spread of the infection was checked with surprising ease, in some the number of new reactors is excessive. In the latter, failure to observe the stipulations of the plan, rather than defects in the plan itself, was responsible. Temporary use of the same parturition barn for reactors and clean cows accounted for many new reactors in herd 1; purchase of animals on the test of the individual produced the same effect in herds 2 and 28; repeated failures to remove reactors and retest promptly have kept herd 6 in continuous difficulty; months of delay, following the first test, in putting into effect a segregation plan in herd 9 provided an interval during which most of the new reactors appeared; and the burning of a barn, which made necessary a temporary reversion to the original custom of stabling infected and clean cows together, produced a disastrous flareup in herd 26.

We already have stated that tables I to VI are presented to give a summary of the status of all the data that we have compiled in 27 of the herds, selected on the basis of the time under supervision and availability and accuracy of records. Our plan was to use the cow-year as the unit, and to compile sufficient data to establish a basis for comparisons between groups composed of (a) clean cows, (b) recent reactors, and (c) chronic reactors. These data do not include all the herds under supervision nor do they bring the records of all the herds included entirely to date because in each case the records were compiled as of the date on which the herd was visited for that purpose. In each herd data were collected on all the females of breeding age regarding which there were accurate records covering a year or more. There is every reason to believe that the data would be essentially unchanged in purport if they were extended to include the remainder of the herds under supervision of an indefinite number of herds, or cow-years.

Tables VII, VIII and IX are largely self-explanatory, but a few
points require amplification. The actual normal-calf-equivalent was obtained by adding to the number of normal calves born in a group during the period of observation the calculated calf-equivalent obtained by dividing by nine the total months of unterminated pregnancy shown by the records at the end of the period. The percentage reproductive efficiency was calculated by dividing the actual normal-calf-equivalent by the ideal equivalent or standard, represented by one calf (nine months of productive pregnancy) each year. Thus, in table VII (herd 1), 277 normal calves were born, and there were in the group at the time the data were compiled, cows in various stages of pregnancy totaling 360 months, the equivalent of 40 calves. Two hundred seventy-seven plus 40 equals 317, the actual normal-calf-equivalent. The ideal calf equivalent is 369, the number of cow-years covered in the observation, as shown in the third column of the table. Three hundred seventeen divided by 369 equals 85+ per cent, the reproductive efficiency recorded in the last column. This centers the calculation around the number of months of productive pregnancy, determined by crediting the individual cow with nine months for each healthy calf, and any additional months of unterminated pregnancy shown by her record at the end of the period of observation.

The method of approach to the record of the individual cow needs some explanation. In each case the record began with the first accurately recorded service and terminated on the date on which the data were collected. Assume that a cow was bred January 1, 1926, rebred April 1, 1926, calved January 1, 1927, bred June 1, 1927, aborted January 1, 1928, bred June 1, 1929, rebred August 1, 1929, and was five months pregnant when the records were assembled, January 1, 1930. The record covers exactly four years, representing an ideal of 36 months of productive pregnancy or a normal-calf-equivalent of four. Actually the cow would be credited with 14 months, the nine that preceded the birth of the normal calf on January 1, 1927, and the five representing the unterminated pregnancy as of January 1, 1930. She would be credited with a breeding efficiency of 14 over 36, or 39- per cent and two extra services would be charged against her.

The record of a recent reactor began on the date of the test showing her first reaction and continued two years, or until she was disposed of. If she still remained in the herd at the end of the two-year period, she was carried as a chronic reactor through-
Table VII—Summary of breeding records of animals negative through the entire period of observation.

<table>
<thead>
<tr>
<th>Herd</th>
<th>Cows</th>
<th>Cow-Years</th>
<th>Normal Calves</th>
<th>Extra Months Normal Preg.</th>
<th>Normal Calf Equivalent</th>
<th>Abortions</th>
<th>Dead at Term</th>
<th>Births Before 270 Days</th>
<th>Extra Services</th>
<th>Reproductive Efficiency (%)</th>
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<td>1</td>
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<td>369</td>
<td>277</td>
<td>360</td>
<td>317</td>
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<td>205</td>
<td>85 +</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
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<td>86</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>89</td>
<td>80 -</td>
</tr>
<tr>
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<td>16</td>
<td>30 1/4</td>
<td>23</td>
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<td>2</td>
<td>0</td>
<td>7</td>
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<td>77 -</td>
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<td>NORMAL Calf EQUIVALENT</td>
<td>ABORTIONS</td>
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<td>BIRTHS BEFORE 270 DAYS</td>
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<td>REPRODUCTIVE EFFICIENCY (%)</td>
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<td>0</td>
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<td>74</td>
<td>34 +</td>
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### Table IX—Summary, chronic reactors (animals that have reacted more than two years).

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<th>Cow-Years</th>
<th>Normal Calves</th>
<th>Extra Months Normal Preg.</th>
<th>Normal Calf Equivalent</th>
<th>Abortions</th>
<th>Dead at Term</th>
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<td>43</td>
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<td>Recent Reactors (Two Years or Less)</td>
<td>Chronic Reactors (More Than Two Years)</td>
<td>Total</td>
<td></td>
<td></td>
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<td>Animals</td>
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<td>Years of observation</td>
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<td>Extra services</td>
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<td>Actual normal-calf-equivalent</td>
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Table X—Summary of breeding records compiled in 27 herds comparing cattle free from Bang's disease with recent reactors and chronic reactors.
out the remainder of the period of observation. In a few instances heifers present at the time of the first test were carried as recent reactors, as they obviously were not chronic cases.

Table X presents a summary of data. The percentages are based on cow-years, 5,074 of which form the basis of the calculations. The cows that have remained free from Bang's disease throughout the entire period of observation show a normal-calf-equivalent of 86.8 per cent of the ideal in spite of the policy in a few of the high-producing herds of breeding so as to allow an interval of 14 months or more between calves. The drop to a normal-calf-equivalent of 54.5 per cent in recently infected animals and the gradual swing upward to 76.38 per cent in the chronic reactors probably is a quite accurate measure of a well-known characteristic of Bang's disease. It is exceedingly important to note that the wide difference between the clean group and the reacting groups does not completely portray the damage done by the disease. These tables include only the more promising cows that naturally have been kept because of actual or anticipated breeding value. Those that have been slaughtered or sold at a sacrifice soon after they became infected have been an additional source of heavy loss which we are not yet able to measure.

An accurate conception of the value of a blood-testing program can be gained by considering, at the same time, the degree of success attained in weeding out reactors and growing sound cattle as shown in tables I to VI, and the difference between the reproductive efficiency of clean and infected cows as shown in tables VII, VIII and IX, and summarized in table X. The first series of tables shows that reacting cows can be weeded out effectively; the last, that they do not approach clean cows in breeding value.

SUMMARY

1. Fifty herds, containing 3,510 animals more than ten months old, were under supervision at the end of the period covered by these records. The period of supervision in different herds has varied from seven years to a few months.

2. Ten herds formerly under supervision have been turned over to practicing veterinarians. Five were clean at the time supervision terminated and there has been no retrogression in any of the ten reported to us. Fifteen herd-owners tested once or twice with some thought of a consistent program for Bang's disease control, but failed to follow up the testing. These herds did not differ in any essential from others that have remained
under supervision and have been freed from the infection. One large beef herd withdrew from supervision. Its manager had reversed the usual policy of selling reactors and retaining clean raised stock and there were other extraordinary aspects of the plan of management. One badly infected herd was freed from the disease and the owner discontinued testing thinking it a needless expense. The owner of one herd died and the herd was dispersed.

3. Of the herds under supervision, twelve were badly infected when first tested and have been freed entirely from Bang's disease. Originally they contained 382 reactors and 479 clean animals. They now contain 749 clean animals. Eighteen herds are steadily being freed from Bang's disease, and their breeding efficiency has shown great improvement. These originally included 755 reactors and 616 clean animals. Now there are 450 reactors and 1,206 clean animals. Seven herds each originally contained a few reactors and are now clean. In this group there were originally 26 reactors and 255 clean animals. Now there are 342 clean animals. Four herds were clean on the original test and have been maintained clean, increasing their total number from 114 to 256 animals. Three herds have not been tested recently, or their owners have not carried out the provisions of any plan. These originally contained 15 reactors and 85 clean animals. They now contain 48 reactors and 76 clean animals. Six herds, containing 110 reactors and 272 clean animals, have recently been taken under supervision.

4. Of the twelve herds once badly infected that are now clean, six have been cleaned with the partial segregation plan, two with the complete segregation plan, in three the reactors were sold, and in one partial segregation was followed by sale of reactors. Of the 18 herds formerly badly infected and in which satisfactory progress is being made, twelve are under partial segregation, five under complete segregation, and one has shifted from partial to complete segregation. The reactors were sold out of all six of the herds that formerly contained a few reactors and are now clean. The sale of sporadic reactors out of the four herds found clean on the original test has been practiced. Partial segregation is the nominal plan followed in the three herds whose owners have neglected to test or follow suggestions.

5. The cow-year has been the basic unit used in compiling breeding data, and statistics have been collected covering 5,074 cow-years in 27 herds. In all, 3,884 individual cows have entered into the compilations. These consist of three groups: (a) clean
cattle, (b) recent reactors, (c) chronic reactors. In the clean group, 1,519 cows, furnishing 3,664 cow-years, showed a breeding efficiency of 86.8 per cent, an abortion rate of 2.26; in the recent reactors 232 cows, furnishing 361 cow-years, showed a breeding efficiency of 54.5 per cent, an abortion rate of 24.35 per cent; in the chronic reactors 333 cows, furnishing 1,049 cow-years, showed a breeding efficiency of 76.38 per cent, an abortion rate of 9.24 per cent. The losses from forced sales of reacting cattle were heavy, but reasonably exact calculations of their extent have not yet been made.

6. Complete segregation or sale of reactors and rapid retests of all clean groups are the measures recommended as the most certain and in the long run the least expensive in freeing herds from Bang's disease. Partial segregation as we have used it has proved surprisingly effective. It undoubtedly has a wide but not universal application in one-unit herds kept under conditions that preclude use of the more certain methods.

7. Herds badly infected with Bang's disease can usually be placed on a satisfactory breeding basis in a year or less. When spread of the infection is cut off, the accumulation of clean cattle, the transposition of recent into more productive chronic reactors, and the entire elimination of the troublesome group consisting of recent reactors, cause the herd to right itself and rapidly regain its equilibrium as a breeding unit. Its efficiency is determined less by the proportionate number of reactors it contains than by the amount of recent spread that has taken place.

8. No special difficulty has been encountered in protecting herds originally clean, or those that have been cleaned by a blood-testing program. The tests have revealed a few sporadic reactors which have been removed promptly. One herd met disaster because reactors were present but not promptly removed, and because retests were long delayed.

9. The limitations of the effectiveness of plans for the control of Bang's disease through blood-testing no longer exist chiefly in the fund of knowledge regarding the disease itself, or in the equipment at hand for carrying out necessary measures. For the most part they are purely human limitations that manifest themselves in the indifferent, the careless, the superficial or the half-informed, and in those who lack thoroughness in method and steadfastness of purpose. Some way usually is open for the breeder who actually wants a clean herd and who is thorough and consistent in his efforts to obtain it.
REFERENCES


DISCUSSION

Dr. W. J. BUTLER: Dr. Birch, did I understand you to say that you found infection in the feces of calves?

Dr. BIRCH: We have not, Dr. Butler. Dr. Hayes and others have. We have found that it does pass through a mature cow very readily. Hence, we have taken precautions in handling calves. We are working on that particular point now, and can tell you more in a couple of years.

Dr. BUTLER: I understood from your paper that you had found some infection.

Dr. BIRCH: We have had infection which apparently traced to that source, and, as a means of protecting ourselves while we are finding out definitely the role of the calf as a spreader, we are forbidding the placing of calves that have been taking milk from reacting cows, into clean herds until a month has elapsed since the calves have taken the last milk.

Dr. BUTLER: Do you call a 1:25 reaction suspicious?

Dr. BIRCH: No, sir. We do not call a 1:50 agglutination suspicious.

Dr. BUTLER: In retesting herds where you have had a 1:25 or 1:50 reaction, do you ever find that their titre has jumped up?

Dr. BIRCH: Yes, we find as well that the titre of an animal that has shown no agglutination will jump up when the animal contracts Bang's disease.

Dr. BUTLER: I grant you they will become infected.

Dr. BIRCH: Let me answer that question in another way. In testing any large herd we almost always find reactions as high as 1:50. If there are no reactions higher than that, we pay absolutely no attention to them.

Dr. BUTLER: I will grant you that, but where you have an infected herd, do you disregard a reaction of 1:50 and 1:25?

Dr. BIRCH: We disregard 1:50, but where there is infection in the herd, that animal in conjunction with all others that previously have been clean will be retested.

Dr. BUTLER: But do you not segregate the animal.

Dr. BIRCH: No.

Dr. R. L. CONKLIN: I should like to congratulate Dr. Birch for presenting a truly sanitary problem to this Association. I think he has dealt with the question of Bang's disease from the standpoint of sanitation. I also should like to say that I believe, and have for several years believed, through the agglutination test we have a very valuable psychological weapon by means of which we may enforce sanitary regulation. That appears to have been done with the work that Dr. Birch has carried out.

The mystic side of the serological test has had its effect on carrying out the sanitary regulation. Dr. Birch was very careful to state to the owner of these herds, with sufficient amount of pressure on the back door, and explain any error or any break that might occur in those herds. That probably is quite necessary. But I think it is probably one of the stocks in trade of the medical profession, that to be successful you must be the back-door opener.

The cows in the herd for less than one year were not shown in table VII, were they, Dr. Birch?
Dr. Birch: No cow appeared in any of the tables that has not been in the herd more than a year. Every cow that has remained in the herd more than a year does appear. Further, our records show that we have not used the back door. The work has gone forward and the herds have been cleaned.

Dr. Conklin: There is no record shown of the elimination of cows because they were not breeders?

Dr. Birch: No, because we have not the data with respect to the causes for the elimination. Several causes often contribute to the elimination of a single animal.

Dr. Conklin: Do you consider there were a sufficient number of animals in that recent reacting group to draw a comparison between the breeding efficiency of the two groups?

Dr. Birch: I don't think that would be materially changed if you were to multiply it by ten, Dr. Conklin, but everyone is entitled to his own opinion.

Dr. Conklin: I would take exception, first, on account of the number of cow-years; second, to the statement you made in your summary that if one got rid of the troublesome animals, the efficiency of any herd must be remarkably stepped up. I think that is commonly acknowledged. I should like to know whether in those groups any attempt was made to ascertain the clinical conditions of the animals in this group of recent reacting animals.

Dr. Birch: I don't know that I just have your point except that we had the breeding records of all of them.

Dr. Conklin: What did the clinical examination show?

Dr. Birch: We have not the clinical examination except in those cases in which the owner requested an examination. We have the record of what the cows did as reactors as opposed to what they did as chronic reactors or clean cows. Every cow that failed to breed for any reason is penalized for time lost.

Dr. Conklin: The chronic reactors consisted of the cows carried on and shown in the reacting groups?

Dr. Birch: The recent reactors became chronic reactors after reacting two years, and appear in our records as such.

Dr. Conklin: Are they shown in both groups?

Dr. Birch: Yes, some of them are, of course. Any cow that remained in the herd a full year or more either as a clean animal, a recent reactor or a chronic reactor is included in the records.

Dr. Conklin: Are those tables comparable?

Dr. Birch: Yes, in all essentials.

Dr. Conklin: I disagree. I don't see how you can compare them with an equal group.

Dr. Birch: In some of the cases we are comparing the same cow as a clean cow, then as a recent reactor, and again as a chronic reactor. She is going through the whole line, provided she remains in the herd long enough.

Dr. Conklin: You consider that a fair comparison?

Dr. Birch: It would seem so to me. It would seem that all cows that stay in the herd under either status should appear in the records. You cannot find any perfect system of presenting so much data of this character, but this is essentially correct.

Dr. Conklin: Perhaps you did not get the point. If you have a recent reacting cow, and the same cow is carried into your chronic reacting group, you are not comparing the same data with your negative animal.

Dr. Birch: I am comparing the recent reactor with the chronic. If the cow previously was in the herd a full year as a negative animal she enters into the comparison as such.
DR. CONKLIN: You are merely taking numbers. You are not basing it on the time of infection. According to my interpretation, one year you may have in that herd, due to the introduction of new infection, a more virulent source of infection than some other year. Therefore, if you are not comparing on the same particular year, the figures would not seem to me to be comparable.

DR. BIRCH: This covers a great many years in many groups, and it simply represents what happens over a period of time among cows that are clean as compared with cows that are recent reactors and those that are chronic reactors. Breeding failures from any cause whatsoever enter into the computations on which the comparisons are based.

DR. CONKLIN: I think that contributes still further to the results of the sanitary program and to this meeting.

DR. R. GWATKIN: At the Ontario Research Foundation we have had cattle under observation for the last four years varying in number from 1,500 to 3,000, and our figures are extremely like those that Dr. Birch has given. We have shown from our work that infected positive cattle are not as efficient as negative ones. It seemed hardly necessary, perhaps, to have to show that, and yet that was one of the first things that we had to do there. I am unable to give you the figures today, but an article was published in the November number of the *North American Veterinarian*, in which we give a table that shows figures that are very similar to those of Dr. Birch, about 2 per cent in non-reacting animals, and a very much larger number in positive ones, and also a marked difference in premature births, that is where the calf was born alive. We have not found a marked difference in the number of dead calves that were born in either group, which is about the same thing that you found.

We have, in fact, two areas north of Toronto which are now merging into one, and which contain about 150 farms. We now have all the reactors out of the first area and about 60 per cent out of the second area. They were all tagged. I will admit they were not branded but tagged, and certainly the great majority were sold for beef.

We have progressed very favorably in those areas. The only difficulties which have occurred were due to breaking of the regulation by the introduction of animals which were said to have been tested or which had perhaps been tested at some previous time, and we had two breaks due to that, fortunately in quite small herds, and they are now being disposed of.

We are also progressing favorably in the government herds, which we are cleaning up, though we ran into severe trouble there. again through failure to observe the regulations, in that three animals were left for a period of six months without test. They became positive, and one aborted, since when I believe we have taken out 16 of the young animals, and a fair number of those aborted before we found they were positive. So that in that herd we have run into considerable trouble. That is the only herd in which we have met with serious difficulties from this fact.

As an example, a heifer was tested on the first of the month and was negative to both the agglutination and complement-fixation tests, and aborted on the twelfth of the month, and the organism was found to be present. These things are disconcerting. It is hard to soothe the owner or the manager when it happens, but, fortunately, we have not run up against that in the majority of our herds, and we have quite a large number that are clean.

We were fortunate in our areas that we had a large number of clean herds to begin with, and, with but two exceptions, these have remained
THE HANDLING OF BANG'S DISEASE

These two exceptions were people who lived on each side of a badly infected herd.

I do not want to take any more of your time, except to say that I think our figures do agree quite closely with those of Dr. Birch. We have not arranged them quite in the same way. We are unable to tell you the types of sterility that were present in all cases. In a great many there was nymphomania, and in other cases the animals did not come into season. Apart from that I am unable to tell you, because we did not make clinical examinations of them.

Dr. A. T. KINSLEY: I have certainly enjoyed the essayists this afternoon and their clear-cut manner of presenting these subjects. There is one thing that appeals to me from the viewpoint of the American citizen, and that is herds are cleaned, as Dr. Birch has shown, and perhaps remain clean for two or three or ten years. Those herds, of course, are highly susceptible to this infection. I should like to ask Dr. Birch if he has any suggestion as to the future of these clean herds.

You may clean 100 herds in the next year or five years, and then start out on another lot of herds. What becomes of the first group of clean herds? The cattle-owners in our section of the country would become just a little dubious about paying the expense of retesting every so often in that clean herd where there is no abortion. That seems to me to be a very vital point in this line of work.

Dr. BIRCH: I am glad you asked that question, Dr. Kinsley. I don't think we are going to have trouble with any of these men who have been in serious difficulty with Bang's disease, in keeping their testing going. We may have trouble with their sons, and they may have to go through the same thing again, but these men themselves have had enough of it, and they are not going back.

Dr. KINSLEY: I should like to ask these men that are interested in tuberculosis eradication if they are having any difficulty with reaccreditation of herds that have had tuberculosis, even in the same generation.

Dr. BIRCH: We always will have some difficulty. I look at it in this manner: I would not ask for a garden that would not have weeds grow up in it if it were neglected.

Dr. HARRIE W. PEIRCE: In connection with New York's regulation relative to the shipment of cattle into New York, they require that the cattle must be from accredited herds. I should like to ask Dr. Faulder how he classes an accredited herd. If the titres of positives are 1:25 or 1:50, do you consider that herd accredited, that is if they are negative to all titres over 1:100?

Dr. BIRCH: If they don't go any higher in subsequent tests, we pay no attention to 1:50. In the process of accreditation they must be retested. If these animals go higher, they are treated in exactly the same manner as a negative animal that goes higher.

Dr. PEIRCE: Do I understand that New York State will accept cattle on titres of 1:25 or 1:50?

Dr. BIRCH: Yes, if the herd contains no reactors above 1:50. The significance of the titre has been very greatly misunderstood. We look at a titre swinging from minus at 1:20, to plus at 1:50 as being normal, just as we look at the swing of a temperature of a cow up and down within the normal range. When the titre exceeds 1:50, we consider the cow a reactor.

Dr. PEIRCE: In the establishment of accredited herds in the eradication of tuberculosis, that means one thing in all states. It would seem to me as though the states ought to agree as to what is an accredited Bang disease-free herd. Shouldn't we have an established basis to classify a herd as abortion-free?
Dr. C. P. Fitch: I think the report of the Committee on Bang's Disease will answer this question.

President Faulder: We will pass on to the report of the Committee on Bang's Disease, by Dr. C. P. Fitch, chairman.

Dr. Fitch: Mr. Chairman and Members of the Association: It is particularly unfortunate that we are not able to place this report in your hands in mimeographed form so that you can follow it and know exactly what is being presented, but such has not been possible, due to the fact that it was not adopted by the Committee until 12:30 today. I shall have to seek your indulgence in its presentation in trying to read it and present it as clearly as I may, and being very willing to answer any questions which may come up about it. I desire to state that this report was passed by the entire personnel of the Committee in attendance at this meeting.

Dr. Fitch then read the report.

REPORT OF COMMITTEE ON BANG'S DISEASE

Dr. C. P. Fitch, Chairman, Saint Paul, Minn.

Dr. George H. Hart, Davis, Calif. Dr. W. Wisnicky, Madison, Wis.
Dr. F. M. Hayes, Davis, Calif. Dr. W. E. Cotton, Bethesda, Md.
Dr. R. R. Birch, Ithaca, N. Y. Dr. J. M. Buck, Bethesda, Md.
Dr. C. M. Haring, Berkeley, Calif. Dr. M. F. Barnes, Harrisburg, Pa.

Your Committee this year has confined its efforts largely to six fields of endeavor. We desire now to present our findings to the Association.

I

The Bureau of Animal Industry, United States Department of Agriculture, at Washington, has been approached to learn its attitude on federal interstate regulations in regard to Bang's disease control. The Bureau at this time does not believe that these are desirable, nor is it in a position (financial) to carry out such interstate regulations. The Bureau has signified, however, its willingness to consider workable regulations that promise to aid in controlling the disease. We desire in particular to call this to the attention of next year's Committee.

II

Your Committee believes that a standard technic for making the agglutination test, uniformly applied, is essential to the workability of interstate regulations regarding Bang's disease that are based on this test, and the use of such will greatly clarify the present unsatisfactory condition relative to such regulations. It is therefore suggested that state authorities be requested to adopt and use such a standard technic and that it be applied uniformly. It is recommended that, until a better technic is developed, the one adopted by this Association be regarded as the standard. We are including blanks outlining several important factors and giving our conception of what should be included in a uniform health certificate for animals in interstate traffic. This information may be included on a single form if desired.

III

Your Committee recommends the following rules as a guide for a Bang's disease-free herd and the official designation for such a herd.

Officially Recognized Bang's Disease-Free Herd

1. A herd may be designated as an Officially Recognized Bang's Disease-Free Herd when it has passed three semi-annual or two annual agglutination blood tests without evidence of infection and the other necessary requirements have been carried out.
2. A certificate to this effect, valid for one year unless canceled, may be issued to the owner by the sanitary authority.

3. Owners may be listed as having Officially Recognized Bang's Disease-Free Herds when they have:
   (a) Immediately disposed of positive animals.
   (b) Segregated the positive animals under conditions absolutely precluding contact with the negative herd. (Under usual conditions this should be on a separate farm.)
   (c) Carried out the other requirements hereafter listed.

4. The requirements to be observed by an owner of an Officially Recognized Bang's Disease-Free Herd are as follows:
   (a) Provide adequate veterinary supervision.
   (b) Every animal to be properly identified.
   (c) Proper disposition of the infected cattle.
   (d) Negative herd not to be kept in contact with other bovines, or untested or positive swine.

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**RESULTS OF AGGLUTINATION TEST FOR BANG'S DISEASE**
(Contagious Abortion)

<table>
<thead>
<tr>
<th>Owner</th>
<th>Date Blood Tested</th>
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<tbody>
<tr>
<td>P. O. Address</td>
<td>Test Used: Test Tube Rapid</td>
</tr>
<tr>
<td>Township</td>
<td>Test Tube Dilutions Amounts of</td>
</tr>
<tr>
<td>County</td>
<td>Test Tube Concentration of</td>
</tr>
<tr>
<td>Veterinarian</td>
<td>Test Tube Antigen Producer</td>
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<tr>
<td>P. O. Address</td>
<td>Test Tube</td>
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<table>
<thead>
<tr>
<th>No. on Tube</th>
<th>Tag or Reg. No.</th>
<th>Registry Name or Description</th>
<th>Age</th>
<th>Sex</th>
<th>Breeding History</th>
<th>Results of Tests in Different Dilutions</th>
<th>Diagnosis</th>
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*+ = Complete agglutination.*

*I = Incomplete agglutination.*

*-= No or very slight agglutination.*

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Signature of person responsible for test.
(e) Immediately report to the proper state authorities evidence of abortion in the herd.
(f) No infected or untested cattle shall be added to the herd.
(g) Undertake tuberculosis control.
(h) Maintain premises in the proper sanitary condition.

5. After a herd has been officially recognized as Bang’s disease-free, should a subsequent test reveal one animal as positive, the herd may be reinstated as Bang’s disease-free after two negative tests within 90 days. These negative tests must be conducted at least 30 days apart.

6. Owners shall not allow the use of any biological product for the prevention or treatment of Bang’s disease in an Officially Recognized Bang’s Disease-Free Herd.

---

**RECORD AND CERTIFICATE BY VETERINARIAN TO ACCOMPANY AGGLUTINATION TEST REPORT**

Owner of the cattle.................................................................
Owner’s address ........................................................................
Herd location ...........................................................................
Total number of cattle including calves in the herd....................
Total number from which blood samples were taken...................
Number considered to be positive to the agglutination test...........
Number considered to have indecisive (suspicuous) tests..........
Number considered to be negative ..............................................
Remarks ..................................................................................
.........................................................................................
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.........................................................................................

This is to certify that on the ........ day of ........, 19....
I collected blood samples from ........ cattle in the above described
herd and that attached herewith is the report on these samples.
...........................................................................................
...........................................................................................
...........................................................................................
...........................................................................................
...........................................................................................

I further certify that the attached report contains a correct corre-
alation of the sample numbers with the identifications of the respec-
tive cattle.

Dated at ....................... , State ......................
this ........ day of ........, 19....
(Signed) ...........................................................
Address ..............................................................
7. All cattle in the herd shall be tested for Bang's disease whenever it is deemed necessary by the state live stock sanitary authorities.

8. The herd bull must not be used for service on cattle which have not been tested and found free of Bang's disease.

9. All milk and milk products used in Officially Recognized Bang's Disease-Free Herds, or herds in the process of becoming so recognized, should be either produced by an Officially Recognized Bang's Disease-Free Herd or shall be properly pasteurized.

10. Cattle from Officially Recognized Bang's Disease-Free Herds may be added to such herds, or to the herds in the process of recognition, without test. If shipped, the car used must be cleaned and disinfected and stockyards should be avoided.

11. All cattle, with the exception of pregnant cows as provided in paragraph 12, and calves under six months of age, to be added, other than those from Officially Recognized Bang's Disease-Free Herds, must pass a blood test approved by the state live stock sanitary authorities and must be isolated until they have passed a second blood test approved by the state live stock sanitary authorities not earlier than 30 or later than 120 days. Calves under six months of age may be added to the herd after having passed one negative test.

12. Pregnant animals, other than those from Officially Recognized Bang's Disease-Free Herds, to be added must be isolated until after having calved and must pass a negative blood test not earlier than three weeks after having calved.

13. Cattle moved from the farm for exhibition or any other purpose shall not be allowed to again associate with the herd or other cattle until they have been held in isolation for a period of 60 days and have then passed a negative blood test. In the case of pregnant cattle isolation as provided by paragraph 12 is recommended.

14. Any animal which aborts in any Officially Recognized Bang's Disease-Free Herd, or herd in the process of becoming so recognized, must be immediately isolated and reported to the state live stock sanitary authorities. The place where the abortion occurred must be immediately cleaned and disinfected. The fetus and membranes must be properly disposed of by burning or burial.

15. The agglutination blood test shall be carried out only by agencies approved by the live stock sanitary authorities of the state in which the herd is located.

It should be clearly understood that these requirements for an Officially Recognized Bang’s Disease-Free Herd are the minimum. We believe, however, that they represent the essential points in safeguarding the freedom from Bang's disease of such a herd. We further believe that they are practical and represent a sufficiently uniform system that can be developed throughout the United States which ultimately will justify federal recognition of such Officially Recognized Bang's Disease-Free Herds.

IV

Your Committee has carefully studied the situation that confronts the live stock industry with respect to the illegal transportation of cattle by truck. This refers not only to interstate but intrastate transport. The business of carrying cattle by trucks is growing by leaps and bounds. It has become a real problem confronting the live stock sanitary authorities of all states. Your Committee does not at present have specific recommendations to curb this menace properly. We believe, that the licensing of trucks for the transporting of live stock should be carefully studied by future committees. Only in this way can we bring about a proper control of those individuals who consistently attempt to evade the law. We recognize the difficulties and hazards of any system, but we are also fully cognizant of the dangers that are besetting the live stock industry because of
the illegal transportation of animals by truck. In some manner, we believe, as stated above, they must be recognized as common carriers by the state or federal government.

V

We recommend that all animals giving positive reactions to Bang's disease be identified in some manner, preferably by a special ear-tag. The sale and transportation of such animals should be freely permitted but under special permit. We believe that it is not properly controlling Bang's disease to allow positively reacting animals to remain unidentified. Traffic in such animals should be carefully controlled by the proper state authorities and such animals should not be allowed to enter herds without the full knowledge of the purchaser.

VI

Your Committee desires to call your attention to the fact that the federal Bureau of Animal Industry has discontinued licensing bacterins or dead cultures of Bacterium abortus Bang for prophylactic or therapeutic purposes. We further desire to state that the federal Bureau of Animal Industry is now regulating the pathogenicity of the live cultures used in the preparation of living vaccine for the control of this disease. These cultures are either avirulent or low virulence and directly supervised by the federal Bureau. We believe, also, that the new regulation in respect to the preparation of live abortion vaccine from solid media only, is a step in advance. We desire to commend the Bureau for these actions.

Dr. Wisnicky has an additional recommendation to make.

Dr. Fitch: I move the adoption of the report.

Dr. N. S. Mayo: I second the motion.

Dr. Walter Wisnicky: The Committee on Bang's Disease had a very strenuous session this morning. The discussion was on the subject pertaining to legislation that has been sponsored by this Association to the effect that the various states would have the power to formulate regulations, and that those regulations would become effective after they had been approved by the United States Secretary of Agriculture.

That legislation is very intimately associated with the Bang's disease problem. We have a chaotic condition in connection with the regulations of the various states.

I might remark that after we had discussed this point and had taken a consensus of the Committee, four of the members were for the recommendation and two were against it. Everything was so amicable during the consideration of this report that we thought it best to present this thing for the consideration of this Association.

I, therefore, want to offer an amendment to make the following addition to this report:

"Federal legislation is favored which will provide the various states authority to promulgate necessary live stock sanitary regulations, but no such regulations will become effective until officially approved by the United States Secretary of Agriculture."

Mr. President, I move the adoption of this amendment.

Dr. W. J. Butler: I second the amendment.

President Faulder: Are you ready for the question? Those in favor of amending the original report will signify by saying "Aye."

Dr. Fitch: I think there should be discussion on the amendment and on the report before it is adopted. There are a good many things here that are of vital importance. I believe that a good many individuals here, or at least some of them, have something to say in regard to it.
DISCUSSION ON BANG'S DISEASE

Dr. T. E. MUNCE: Do I understand that that resolution is similar to the so-called Walsh resolution introduced in Congress?

Dr. WISNICKY: This legislation has been before Congress for some time. This Association has spent considerable funds in promoting this legislation. The legislation as it was left when Congress adjourned, with the amendments attached thereto, was supported by the federal Bureau of Animal Industry, and this Association had a Special Committee that was interested in furthering the passage of that legislation. Since it has such a vital effect on Bang's disease and interstate regulation, it came up for discussion in the Committee, and properly so. Therefore, we are putting it to a vote of this Association, so that it may go on record as to whether it wants to continue sponsoring legislation of the type that existed at the time that Congress adjourned, and actually use it, if it does finally pass, as the means for bringing about a satisfactory and amicable solution to this chaotic condition that now exists in connection with interstate regulations.

Dr. MUNCE: Mr. Chairman, that isn't the answer to my question. Is this similar to the Walsh resolution that applied to all diseases, or does this apply only to Bang's disease?

Dr. WISNICKY: This would apply to all diseases.

Dr. MUNCE: Is it similar to the Walsh resolution?

Dr. WISNICKY: I am not familiar with the various identifications.

Dr. MUNCE: It is a resolution that was endorsed by this Association two years ago and last year.

Dr. WISNICKY: Yes, it is the same thing.

Dr. C. H. HAYS: According to a recent ruling of the Supreme Court, it clarified the situation about the power of the state to provide rules and regulations in this regard, and the law as desired at that time or previously would not be required. As I gather, what Dr. Wisnicky is getting at is the control over this situation by the Department of Agriculture.

Dr. WISNICKY: Mr. Chairman, this is heading right into the direction of where this thing is going to be thoroughly discussed. You livestock sanitary officials know that when the Must-Hatch Incubator case versus the states of Washington and Oregon was decided, the livestock sanitary officials felt they did not have any legal ground to stand on, that they did not have any authority to make any regulations.

It was conceded by those who were well informed on interstate regulations and the legal aspect thereof that when this New York case came up before the Circuit Court, the New York case would be defeated, that is that New York would lose out on the proposition.

When the decision was given, it was given by a three-judge court. Two judges sustained New York, and one judge sustained Wisconsin, which shows the very fine division of opinion there. Naturally, when this went to the Supreme Court, since no further evidence could be produced, it was only to be expected that it would be confirmed, but here is what the attorney said when he returned from Washington, or words similar to those I am about to speak, that the Supreme Court indicated that if this situation is an injustice to the livestock industry, they will have to seek their remedy through legislation.

You all know what the situation is in connection with the interstate regulations, particularly pertaining to Bang's disease. I need not elaborate on that, only to mention that if you talk to any livestock owner who has anything to do with the movement of animals, he will throw up his hands and show you his utter disgust with the condition as it is today. They are losing confidence in all sanitary
regulations, and we will have a most difficult time in the future to control disease unless we can establish the confidence of the live stock owner in reasonable, sound and practical regulations.

This legislation that we are proposing, or this proposition that is before you now for your approval is of far greater importance today than it ever has been in the past. I think, unless we go at it through the legislative channel (and this Association has gone on record in favor of that very thing and the federal Bureau of Animal Industry has given its unqualified support to it), we will continue going on until someone else with better judgment will come and straighten this thing out for us. I think the problem is right before us, and we cannot dodge it. We just have to take action on it.

DR. KINSLER: Mr. President, if you please, may I call your attention to the Constitution which says, under Article V, in reference to officers: "The Executive Committee shall be composed of the executive officers representing the live stock sanitary departments of the various states and territories, the Chief of the U. S. Bureau of Animal Industry, the Veterinary Director General of Canada, the executive regulatory officers of Cuba and Mexico, and the elective officers of this Association. The Executive Committee shall constitute the administrative body of this Association and shall determine its activities and policies. All recommendations and reports of officers and committees shall be referred for consideration to the Executive Committee."

I, being an ordinary member in this Association, of which there are dozens of others, appreciate the privilege of sitting in with you, but according to this Constitution the Executive Committee is the one to make the decision on this particular point.

DR. U. G. HOUCK: Will you re-read the proposed amendment to the Committee's report?

DR. WISNICKY: "Federal legislation is favored which will provide the various states authority to promulgate necessary live stock sanitary regulations, but no such regulations will become effective until officially approved by the United States Secretary of Agriculture."

DR. KINSLER: Mr. President, may I ask for a ruling on the reading I just gave? Should that be decided here or before the Executive Committee?

PRESIDENT FAELDER: It would appear to me at the present time that this is a matter to be decided by our Executive Committee.

DR. A. W. MILLER: Mr. Chairman, the report used the term "public" stockyards, in connection with the interstate shipment of cattle from officially tested herds. I think that term should be defined if it is going to be used.

PRESIDENT FAELDER: We have to dispose of this amendment.

DR. N. S. MAYO: I think that, according to the Constitution and By-laws of this Association, this whole report should be considered by the Executive Committee and not by this Association.

DR. J. F. DEVINE: The Executive Committee may be the final master, but what do we congregate here for if not to discuss these matters so as to guide the Executive Committee.

DR. C. E. COTTON: This has brought up a subject that this Association has been facing and on which it has spent its hard-earned money in the last two years.

I happen to be a member of the Special Legislative Committee, consisting of Dr. Moore, as Chairman, Dr. Butler, Dr. Williams, Dr. Chrisman and myself. We are not ready to make that report. We have not yet been able to have a session. I have all of the material that was sent to me by Dr. Moore, asking me to present it to the Committee. It is perfectly proper, as I understand it, to refer this
to the Executive Committee, but the final recommendation of the Executive Committee will be subject to the approval of this body.

As long as this question has been brought up, I think it is perfectly proper to discuss it at this time. I am heartily in favor of this recommendation. When we introduced legislation two years ago, we did so because of the result of the appellate court decision on the celebrated Must-Hatch case against the states of Washington and Oregon, in which the appellate court stated that no state law or regulation was constitutional because of the fact that Congress had delegated that power to the Secretary of Agriculture and to him only. It was brought up in the argument, particularly in the last case, the New York case, that in instances where the states had not undertaken to do anything, why couldn't they be protected? The decision stated the fact that as no action had been taken by the Secretary of Agriculture it was conclusive to their mind that it was not necessary.

Federal regulations or federal rulings, outside of the movement of tuberculous cattle, have never been specific with the exception that no animal affected with a communicable disease could go interstate. That is all they have undertaken to do to date.

When this bill was introduced, Senator Walsh introduced it in the Senate. It passed very nicely two successive times as a result of the action of our friend, Dr. Butler. When it was brought up the second time it was referred to the Agricultural Committee of the House, at which time we were opposed by a bunch of poultry people who called attention to our old "fool" regulation, as they stated it, at the time of the European fowl pest.

They succeeded in having this Walsh resolution amended, on which our Committee split, as you recall. That amendment in the Agricultural Committee provided that before any law or rule could be adopted by a state, it should be submitted to the Secretary of Agriculture for his approval.

As one of the members of this Committee, Dr. Moore, last year made, I think, two contacts in Washington before we succeeded in having the Supreme Court decision on the New York case. After that was decided, reversing the decision of the appellate court in the Must-Hatch case, the Committee did not feel, with the conditions and troubles that were going on in Washington in legislative affairs and this big program they were undertaking, that we were going to get anywhere if we undertook to go further with it, and we did not do anything.

I am of the opinion personally, and I know Dr. Moore is, that we expect to ask this Association to continue this Committee or another Committee, with the idea that when the time is right, when it is possible to undertake to get legislation such as was amended by the House Agricultural Committee, the original Walsh resolution, we will proceed to do so.

I can recall that some years ago two legislators from the state of Iowa went into Barron County, Wisconsin, and bought a bunch of cattle and brought them down to Iowa and introduced them into the herds, and Bang's disease and abortion resulted. They immediately went into the legislature (they happened to be on the Appropriations Committee and were controlling all the appropriations for the work) and introduced a bill that no cattle could be imported unless they passed a satisfactory test for Bang's disease. The authorities of the state of Iowa could not buck it because they had larger problems at issue. It became a law. Iowa had not done a thing in their own state to undertake to control it. To my mind that was premature and unjustified at that time. The Must-Hatch case was the result of the same thing.
DISCUSSION ON BANG'S DISEASE

The states of Oregon and Washington established a rule that no baby chicks could be imported unless they had been derived from hens that passed a satisfactory pullorum test, when at that time we did not have a satisfactory test. That is the condition, as I look at it, at the present time. I don't believe any state is justified in passing a regulation or law to prevent the introduction of a disease unless that disease does not exist in their own state, or unless they have adopted plans for the efficient control and elimination to justify their adopting such a regulation.

In other words, in our enthusiasm let us not go ahead and do things that we are going to be condemned for by the live stock interests of this country.

I am heartily in favor of this recommendation, and I hope it will be included in the report of the Special Legislative Committee to this body on Friday afternoon.

DR. MAYO: In order to get this in proper form, I move that the report by the Committee and the minority report be referred to the Executive Committee.

... The motion was regularly seconded...

DR. WISNICKY: I want to clarify a situation. This is not a minority report. In fact four members of the six voted for it. It could not be a minority report. I should like to amend the amendment to read this way: that we have an expression, by a vote of this Association, for the guidance of the Executive Committee on the amendment which I read here.

DR. MAYO: I accept that.

DR. BIRCH: I can't see how this amendment belongs to the report of the Committee. It has a much broader significance. I believe that Dr. Mayo's way of taking care of it is the best way. I therefore second Dr. Mayo's motion if he has not withdrawn it. It belongs to the report of the Legislative Committee and not to that of the Bang's Disease Committee.

DR. WISNICKY: In connection with that, I wish to call the attention of this Association to Part I of our report which is directly connected with this proposition. There is no line of division by which you can separate a problem that is of immense value to the people who are concerned with Bang's disease, from what we have given in that report. They are very closely connected. The people who are concerned with Bang's disease are the ones who are suffering from this chaotic situation that exists in relation to these interstate regulations. Therefore I contend that this is an appropriate procedure, to have the expression of this Association on this amendment for the guidance of the Executive Committee.

I agree with Dr. DeVine that these people who come here as members certainly have a right to at least an expression of opinion. They spend their time and money to come down here, and they like to enter into some of these deliberations.

DR. C. A. CARY: It seems to me that we should follow the procedure we have always followed. These reports go to the Executive Committee and are then reported back to the house. They can be reported back to this house tomorrow, and then you can discuss them and act upon them. The Constitution provides that a report shall go to the Executive Committee before you act on it.

DR. BUTLER: Would you mind reading that section of the Constitution again? I don't believe this report belongs to the Executive Committee. It is not a regulation.

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

DR. BUTLER: That may be referred with a recommendation of the body to the Executive Committee, but this body certainly may pass on whether or not Congress is to be asked to pass a law. This is not providing for a regulation. If we were to adopt some particular regulation, then it probably would not come before the body as a whole. But I do believe it is perfectly proper for this body to pass upon this question now and to refer it to the Executive Committee with their recommendation.

DR. KINSLEY: I think you had better change your Constitution if you want to do it otherwise.

DR. COTTON: I am satisfied that Dr. Kinsley is absolutely correct. In all past meetings the reports of committees have been accepted by this full body.

DR. KINSLEY: I want to ask, if we have been wrong in the past, should we continue to be wrong or get right?

DR. COTTON: I agree with Dr. Wisnicky that we want to get an expression of opinion.

DR. HUBERT SCHMIDT: Do I understand that Dr. Wisnicky's recommendation deals with all diseases?

DR. WISNICKY: The legislation is drafted for all diseases. It is wide in its scope.

DR. SCHMIDT: Then how are you going to twist it around and connect it onto the report of the Bang's Disease Committee and not the Legislative Committee? I think I am in favor of this recommendation but I am not in favor of hooking it up with the report on Bang's disease.

DR. B. J. KILLHAM: We are voting on the amendment to the report of the Bang's Disease Committee. Personally I am in favor of the amendment, but I see it as belonging to the Legislative Committee. I think we should vote the amendment down, with the understanding that it will come up for consideration in the report of the Legislative Committee.

DR. CONKLIN: From the point of view of the execution of business, I believe this amendment of Dr. Wisnicky's could be voted on as he suggested, to be referred to the Executive Committee. Then the Executive committee may determine whether it shall go to the Executive Committee for final settlement and be referred back to this body or referred to our Committee on Legislation. I would suggest that the amendment be put.

DR. CAMPBELL: I think a motion to refer is in order. It takes precedence over the question now before the house. It seems to me this is a question for consideration by the Committee on Uniform Regulations, and if brought up by them it would be perfectly proper to consider it. I move that it be referred to the Committee on Uniform Regulations.

DR. MAYO: Mr. President, the gentleman is out of order. According to the Constitution you cannot refer it to that Committee. It must go to the Executive Committee. If they want to refer it back to the house for their approval, well and good.

. . . The question was called for. . . .

PRESIDENT FAULDER: You have heard the report by Dr. Fitch. You have heard the amendment by Dr. Wisnicky, with the suggestion that the amendment be amended. You have heard the motion to refer this report, including the amendment, to the Executive Committee, and the motion to refer it to the Legislative Committee. You have heard the report of Dr. Kinsley on the activities and the power of our Executive Committee. What is your pleasure? (Laughter.)
DISCUSSION ON BANG'S DISEASE

Dr. Mayo: Mr. President, I rise to a point of order. There is only one thing to be done. The motion to refer to the Executive Committee takes precedence over all others, and it must be voted upon.

The motion was regularly seconded. The question was called for.

President Faulder: The question is to refer this amended report to the Executive Committee. All in favor signify by saying "Aye"; opposed, "No." The motion is carried.

Dr. Fitch: Mr. Chairman, with the consent of the other members of the Committee (and I feel sure they will give their consent) I have deleted the word "public" before "stockyards" in the report. In other words, that paragraph will read, "Cattle from officially recognized Bang's disease-free herds may be added to such herds or to the herds in the process of recognition without test. If shipped, the cars used must be cleaned and disinfected and stockyards should be avoided." That does not say, "must be."

Dr. Butler: Are you going to define "stockyards?"

Dr. Fitch: No, sir.

President Faulder: You have all heard the change suggested by Dr. Fitch. What do you wish to do?

Dr. Butler: I should like to know what they mean by "stockyards."

President Faulder: I will ask Dr. Fitch to answer that.

Dr. Fitch: I can answer that by saying that stockyards are points of concentration where animals are shipped from.

Dr. Butler: Does that mean loading yards, like railroad yards? You say where they are concentrated and shipped from. That means loading yards, too.

Dr. Fitch: It means that loading yards too should be avoided. It does not say, "must be avoided." Understand, this is only for cattle from officially recognized Bang's disease-free herds. We believe it is unwise for those animals to come in contact with places where infected animals have been.

Dr. Butler: Granted, but why don't you say "should be tested"?

Dr. Fitch: There are cases where it is impossible to do that. For instance, in cases of feeding in long shipments from Montana, we will say, to New York State, they have to be unloaded, in point of law, at feeding stations.

Dr. Butler: You can provide for feeding in cars, to a great extent.

Dr. Fitch: Then that should be done.

Dr. Butler: This is an accredited herd, isn't it?

Dr. Fitch: Yes.

Dr. Butler: That is all right for other animals, but for accredited herds I think it should be more explicit.

Dr. Miller: I should like to have just a word on that. The reason I objected to the word "public" is that under our B. A. I. Order 309 we define public stockyards. There are about 50 public stockyards in the United States. There are a great many feed, water and rest stations that handle far more animals than some of the public stockyards. So it looked rather absurd to me to use the word "public" in there.

Dr. Butler: I did not quite understand the first part of your report where you provide for the certificates to be made out by the veterinarian, that he shall give a list of all of the cattle tested. Is it the intention of the Committee that before animals may be moved interstate as free from Bang's disease, all of the herd from which these cattle originated must be tested?

President Faulder: Are you satisfied with the report, with the change of the word "public" as it stands now?
DR. MILLER: That is the change I had in mind.

PRESIDENT FAULDER: Is there any further discussion?

DR. MAYO: May I make a brief statement? I noticed, by the program that this is the thirty-seventh annual meeting of this Association. I want to tell you that previous to that time was one that kind of died a-borning. In 1888 I was a student in the veterinary college here. A meeting of the live stock sanitary officials was called. They met in the Sherman Hotel. Two members that I recall were there. One was Dr. Paul Paquin, then state veterinarian of Missouri, whom I happened to know because he practiced in my home town, and the other was Dr. Detmers of Ohio State University. Dr. Paquin very kindly invited me up to the meeting. Soon after these two men and I got there, the Association adjourned to a beer hall down in the cellar somewhere, and we spent the evening, until the wee small hours, discussing hog cholera mostly. I say "we" but I did not take any part in the discussion. I remember that Dr. Detmers drank stein after stein of beer and Dr. Paquin drank red wine. That was the first meeting that I attended. (Laughter.)

PRESIDENT FAULDER: Is there any other business? If not, the meeting is adjourned.

... The session adjourned at 4:45 p. m. ...

RECESS

THURSDAY MORNING, DECEMBER 7, 1933

The third session convened at 9 a. m., President Faulder presiding.

PRESIDENT FAULDER: Please come to order. Yesterday I announced that this morning's session would start promptly at nine. I am somewhat disappointed in seeing so few in attendance at the stroke of nine. However, we will proceed.

The session this morning deals with an important subject, Milk and Meat Hygiene. The first paper is by Dr. W. G. Hollingworth, of Utica, N. Y., entitled, "Municipal Food Hygiene—A Problem for the Veterinary Profession to Enhance." I know of no man more interested in this subject than Dr. Hollingworth, and I take pleasure in presenting him to you. (Applause.)

... Dr. Hollingworth read his paper. ...

MUNICIPAL FOOD HYGIENE—A PROBLEM FOR THE VETERINARY PROFESSION TO ENHANCE

By W. G. HOLLINGWORTH, Utica, N. Y.

Bureau of Food Hygiene and Sanitation

First and foremost I want to read a poem entitled, "The Bridge Builder," (author unknown) which to me is expressive of something beyond the external mark:

An old man, traveling a lone highway,
   Came at the evening, cold and gray,
To a chasm vast and deep and wide.
The old man crossed in the twilight dim,
The sullen stream had no fear for him;
But he turned when safe on the other side,
And built a bridge to span the tide.
"Old man," said a fellow pilgrim near.
"You are wasting your strength with building here,
Your journey will end with the ending day,
You never again will pass this way.
You have crossed the chasm dark and wide;
Why build you this bridge at eventide?"

The builder lifted his old gray head:
"Good friend, in this way I have come," he said,
"There followeth after me today
A youth whose feet must pass this way;
This chasm that has been as naught to me
To that fair haired youth may a pitfall be,
He, too, must cross in the twilight dim,
Good friend, I am building this bridge for him."

Municipal food hygiene has great potentialities. It stands for the conservation of human life, the preservation of public health, enhances live stock interests, and establishes public sanitation on a firm and certain basis. It is an economic proposition when efficiently enforced.

Enhancing public health is a most laudable undertaking. It must be encouraged. It is brought about by education, which is the foundation of research, naturally by those most interested. Vice and lack of knowledge could arise only from ignorance or mistaken ideas as to the means or with reference to a future act. Hence the proper corrective is an enlarged teaching, a more practical knowledge of "How to do it."

The efficiency of public health activities is due to progressive health authorities, whether that be federal, state, or municipal. The same is governed to a very great extent by the money set aside in the budget for such purposes, furnished by the taxpayers who are going to have something to say as to how it is to be expended. Do not forget that.

Pasteur once said there are two laws contesting with one another—one the law of Health and the other the law of Death. God only knows which of these will gain the upper hand. What is needed is that we as guardians of health, whether that be of human or animal type, use every method at our disposal to help enforce the law of health. There is no other word used more than the word "health."

No persons can get nearer the gods than the ones who are benefiting their fellow men. No business is bigger than the business of keeping well. Public health is a community problem, the same is nine-tenths up to the individual. A policy that safeguards and guarantees an adequate food supply is the primary consideration of a people. The prevention of the illnesses caused by the consumption of unwholesome food tomorrow is due to the
information we receive today. The first requisite in a food supply for a nation, state, or municipality is that it should be sufficient in amount, wholesome in quality, and well-balanced.

Only as we educate the coming as well as the present generation to the science of human duty can we hope to eliminate or lessen the diseases of humans as well as of live stock, and especially those that are transmissible to man. What is greatly needed is better educational facilities for veterinary students in public health work, which is more or less lacking in veterinary medicine today.

My object has been and is now to try and indicate what can be done to prevent or to a greater extent lessen the diseases of animals which may be transmitted to the human family; to eliminate as much as possible the waste and consumption of unwholesome foods; and to see that an investigation is made as soon as a communicable disease appears and is known by our department.

I am asking a few questions: Are we using all the facilities at hand that might prevent sickness, suffering and possibly death? Why should we be satisfied with the present health regulations, when we know that great improvements are possible by having municipalities create ordinances that would have the same standing as a state law as far as public health is concerned in food hygiene? Why should public health officials in so many communities pay so little attention to certain health regulations, when statistics will show positively what is being done in municipalities that are efficiently caring for those under their charge in food hygiene? Why should the veterinary profession stand by and allow others to usurp its rights in filling positions that are being created in connection with food hygiene?

I believe the time is ripe for the veterinary profession to get busy, if it cares to be associated with food hygiene. Why? The American Public Health Association, at its meeting at Indianapolis this year, resolved to proclaim war on diseases attributed to unwholesome food.

The function of a health department is to regulate the preparing, handling, serving and dispensing of and caring for foods; emphasizing clean, cool, and covers—fingers, filth, flies—precaution, prevention, protection—pumps, privies, pestilence.

Somewhere I have read that there is a certain amount of similarity between some phases of public health activities and road-building—an ancient and honorable profession. A number of operations are necessary in the technic of road-building, as follows: Selecting the proper route; planning the highway; draw-
ing the specifications; building the highway; placing signs which direct the traveler and warn against dangerous detours and curves; maintaining the road; building bridges; placing the responsibility of success upon one official.

Now, as to food hygiene, there are those who go ahead and blaze the trail; those who maintain the road; those who study better methods to be adopted in preparing students in the knowledge of food hygiene; those engaged in educating the public, especially the officials, to be health-respecting citizens and thereby obtain their assurance to aid in placing funds in budgets pertaining to public health activities; those engaged in repair work; those who point out the dangerous detours which are tended by unqualified persons; those who are engaged in checking unnecessary waste—the official head of the bureau of food hygiene and the bridge-builder.

Food hygiene, under efficient management, is one of the most important bureaus of a government, whether it be federal, state, or municipal. It means no more nor less than adding to the longevity of our lives and cheapening the cost of living by following out the rules and regulations of same. It is a positive fact that under natural conditions we can have health if we follow the suggestions of the Department of Health.

Consequently, the general attitude toward health has changed perceptibly in the last decade or so. The citizens of average intelligence know more today than their parents or grandparents did about the means of securing personal health and they are eager to know more. Such being the case, they are more careful of the food consumed. The public is going to demand that the same is wholesome. As animal products enter into at least two-thirds of the food consumed, the veterinarian's services are going to be required to have charge of the most necessary item that our body requires in order to live a healthy life—food.

This being true, we (that is, our profession) are going to be more closely linked with human medicine. Indeed, now-a-days the one profession can not exist without the assistance of the other. Why? Comparative medicine is assisting greatly in solving problems of human illnesses which may be traced to food products. We are able to come to a just conclusion when we amalgamate the diversified opinions of others.

There are times when the people complain that too many free services are created by the heads of the different governments—whether they be federal, state, or municipal. But no one will
argue against any service that is in a position to pay back dividends of great amounts, such as health.

According to the New York State Health Department, public health is purchasable and any community can, under natural conditions, control its own death-rate. Consequently, adequate appropriations are required for public health activities to function. The efficiency of such a bureau depends upon its personnel. A veterinarian should be connected with every such bureau.

The most desired thing that can be asked for by the populace is health and to maintain it is a large item in our budget. The old adage, "Prevention is better than cure," is well worth thoughtful consideration. This proverb is a well-known truth, ascertained by experience and observation.

I ask this question: What better safeguard can be proposed than the wholesomeness of food used for human consumption? It is the world’s greatest problem. Fifty per cent of our income is spent for it. Our health, wealth, happiness and prosperity, as well as our vigor and success, are wholly dependent upon it. The amount of food consumed annually runs into hundreds of millions of tons in the United States alone. Now just concentrate and see what the care of that enormous amount means, as a large amount of it is of a perishable nature, and a great quantity is wasted for more than one reason.

It is the duty of science to enter the picture and render the valuable service of what food hygiene is capable of doing, and the same is too complex for the untrained to meddle with in perfect safety. Often, due to lack of far-sightedness in carrying out the ideals of hygiene and sanitation, many municipalities have been ordered by the courts to pay persons heavy damages due to illnesses and the results of same caused by the partaking of unwholesome food or water. This may be applicable to other corporations as well.

It is stated that 10 per cent of our food is wasted, and a large amount of that waste is by persons who can least afford it. Hunger, the desire for food, is always with us. The request must come forth; if not, serious consequences will be the result. Food must be wholesome and that is brought about only by competent inspection.

It is estimated that 275,000,000 days are lost annually in this country by the 43,000,000 people who are engaged in a gainful way, due to sickness and its results, at an annual cost of 15 billion dollars. It is estimated also that 6 billion dollars of that amount could be saved if the populace only were educated to be
health-respecting citizens. Would it not be interesting to know what percentage of such illnesses is due to food poisoning, which today is a public health problem. It is a fact that food is the focal point in our meals. It is the direct factor in causing both types of food poisoning—food infection and food intoxication. Both are preventable, within limits. Why? Food must be partaken of or there is no such illness. It is not a new malady—it has occurred since time began. When Socrates saw how foods were handled, prepared and served, he said, "How much there is in this world I do not want." In the past the great trouble has been that the etiology and epidemiology of food poisoning has not been understood. Education and science have instructed the public of today in the seriousness of the same. Who asks the reason why municipal food hygiene has been so neglected in the past, and why not enhance it today?

In Dr. Stange's paper,* which was read in Chicago this year, at the A. V. M. A. meeting, he has very courageously answered this question. He said the lack of interest in food hygiene in many sections is undoubtedly due very largely to the fact that veterinarians, as students, received little or no instruction in this subject.

Dr. A. F. Schalk, in a paper entitled, "The Veterinarian in Public Health Service," said: "What stock and part we have in public health programs today, with the 'stepmotherly' attitude and support that has been accorded the movement by veterinary science, might be favorably compared with that of the case of 'Topsy'—it just grew up. And this is in spite of lack of proper nurturing and fostering by the profession."

I quote from an address of Dr. Wm. J. Mayo, of the Mayo Clinic, "Memorizing vs. Ability to Do."

Knowledge is static. Wisdom is active. Wisdom is the power to use knowledge. In the colleges of today the student standing at the head of the class is the one who is able to retain the greatest amount of knowledge poured into him during the year and regurgitate it, so to speak, at examination time. We have been teaching our youth too much memorizing of things of the past. We have not been showing the way to think of the conditions and problems of the present. It does not matter one whit how much knowledge of the principles of medicine, law, engineering, or any other profession, a youth may have had poured into his memory if he does not know how to use it.

Since the time of Louis Pasteur, it has been demonstrated that the greatest proportion of sickness is due to bacteria and,

as stated, spoilage of food is due to germs. Municipal food hygiene, when its principles are carried out, will check to a great extent the unnecessary waste. How? By educating the consumers of food in the ideals of refrigeration, emphasizing that it costs less for proper cooling of food than the value of the food wasted by lack of refrigeration. Anything which increases the earning and saving power of the worker is bound to be an important factor in the welfare of our nation.

I say without fear of contradiction that the Bureau of Food Hygiene of Utica, New York, has accomplished many achievements. It is a success, and even though our work is constantly increasing I welcome it. Our city is proud of its activities, and any municipality can do just what we are doing, if veterinarians just take the initiative. Directness is the word that we ought to emphasize. Our profession cannot let this opportunity go on as it has in the past. It must be developed. We are starting on the right track; we must keep on the main line and see to it that we do not get side-tracked.

Sciences are grand things to enhance when you are efficient but when you only think you have the capability of directing the same and are not equal to the occasion, they are not so good. Preventive medicine is advancing by leaps and bounds. Why does not the veterinary profession use all the means at its command to do its part in enhancing preventive medicine?

Food inspection became effective in Utica in 1917, with one person in charge. He was a veterinarian. Today there is a personnel of thirty. Politics does not enter the picture. Our success has been due to organization, cooperation and education. The citizens of our city are as much interested in our work as we are. The chief’s duty in this busy department is to direct operations. Our accomplishments are too numerous to mention in an address of this kind. However, I might mention just one—solving a peculiar form of food poisoning which had occurred for years, frequently after banquets. As a result, it received world-wide recognition and the New York State Department of Health added Regulation 18 to the State Sanitary Code. Other states also followed a like course:

Any polish, or article, or substance containing any cyanide preparation or other poison shall not be used in any hotel, club, restaurant or public eating place for the cleaning of nickel, copper, silverware or silver-plated ware or other articles or utensils used for the service or preparation of food or food stuffs.—Adopted Nov. 6, 1929.
In conclusion, I feel that veterinarians, due to their knowledge of bacteriology and comparative medicine and the practical training they ought to receive, should be the advance agents in movements to create municipal bureaus of food hygiene throughout our nation. The veterinary profession must realize that its members hold within their grasp the future of our profession. We cannot stand still—we must either go ahead or retrograde. Mistakes always have and always will be made. Such being the case, the veterinary profession has made its mistakes. We must be governed by the same; that is, we must learn by the errors that have been made and govern ourselves accordingly. To me, they have been costly to our profession and to public health.

PRESIDENT FAULKNER: The next paper, "Municipal Meat, Milk and Food Inspection," is by Dr. J. S. Koen, Chief of Food Control, Division of Health, Saint Louis, Mo. I believe that most of you know Dr. Koen. He spent many years in the U. S. Bureau of Animal Industry, and I know that experience has fitted him for the position he now holds. I now present to you Dr. J. S. Koen. (Applause.) ... Dr. Koen read his paper. ...

MUNICIPAL MEAT, MILK AND FOOD INSPECTION

By J. S. KOEN, Saint Louis, Mo.
Department of Public Welfare

Meat inspection service is largely a federal service. Approximately 75 per cent of all meat offered for sale as human food comes under some form of inspection. Probably 65 per cent is under federal supervision and 10 per cent under municipal or some local inspection. Most of the 25 per cent not inspected is ineligible for federal inspection. If the uninspected meats are brought under supervision, that service will probably be municipal inspection. There can be no question but that this 25 per cent should be inspected. It is quite likely that it needs inspection more than the 75 per cent that now gets it. Therefore, if we are to undertake to extend meat inspection service, we must interest municipal officials under whose direction such work would come. Municipal health commissioners would need to be interested and their support secured, for meat inspection is a health project.

Only one standard of meat inspection should be recognized and proposed. That should be the U. S. B. A. I. standard. Meat inspection as conducted by the B. A. I. is the best in the world. Insofar as its rules will apply to municipal conditions, they should be adopted and enforced. An inferior inspection cannot be
MUNICIPAL MEAT, MILK AND FOOD INSPECTION

MILK AND FOOD INSPECTION

B. A. I. inspection is conducted by veterinarians and lay inspectors, but always under veterinary supervision. The veterinary inspectors are required to be graduates of recognized veterinary colleges. The lay inspectors should be required to have practical experience in the slaughtering of live stock and in the various departments of meat packing plants.

MILK INSPECTION

Milk inspection is largely a municipal service. I have been unable to learn what percentage of the total milk consumption comes under some form of inspection, but I hazard the guess that it is less than 75 per cent. There are a number of cities supposedly operating under the Standard Milk Ordinance of the U. S. Public Health Service. But the U. S. Public Health Service does not and cannot maintain strict supervision over the milk inspection work of these cities, hence there is a wide variation of performance in the application of the Standard Ordinance. That the U. S. Public Health Service is doing all it can to unify the action of the various cities is not doubted. Yet without adequate inspection, authority and personnel, it is impossible for it to secure the degree of uniformity the B. A. I. secures in meat plants under its supervision.

The Standard Ordinance has accomplished a tremendous amount of good in those cities that have adopted it and are attempting to carry out its provisions. But, the very large majority of cities that maintain a milk inspection service have ordinances of their own. Most of these ordinances are good; some are better than others. The disappointing thing about so many of them is that the good provisions of their ordinances are not enforced. The Standard Ordinance, or any other good ordinance, is worth while only when its requirements are enforced. When we were placed in charge of food control in Saint Louis last June, there were 42 milk pasteurizing plants in the city and a dozen or more in the country operating under 1933 city permits. Within 60 days and with no change in ordinance we had closed twelve of the smaller pasteurizing plants whose methods, equipment and plant construction were so faulty that safe milk could not be produced. All other plants are being altered and new equipment installed to meet the requirements of our ordinance and methods are being so corrected that on next January 1 we can make public the announcement that all milk offered for sale in Saint Louis is thoroughly pasteurized, free of contaminating...
influences after pasteurization, sealed in bottles that have been sterilized with steam and delivered to the homes a safe product.

I believe this Association should adopt a policy for milk inspection for all cities and other governmental agencies thus: In essentials, unity; in non-essentials, liberty. We should then proceed to determine just what are the essentials for any agency concerned in milk inspection. This should not be difficult. To meet some local situation any city would be privileged to add whatever was desired or needed. I believe that milk and dairy products that enter into interstate trade should come under federal supervision the same as meat. I think that all milk-caps and dairy containers should carry an inspection legend and a plant number the same as meat is required to be marked or branded. Whatever requirements are made, the contents of the bottle or other container should conform to the statements on the cap or package. I believe daily reports of operations should be required in milk inspection the same as in meat inspection. And I think competent milk inspectors should be on the job during the processing of milk the same as during the processing of meats.

No milk inspection is worthy the name that cannot certify to the healthfulness of the source of milk, the cow. Only veterinarians have the training and experience to make physical examinations and determine the healthfulness of cows. They have been trained in sanitary matters, in the proper methods of feeding live stock, and the very important problem of improving the herd by better breeding practices. Efficient milk inspection demands such qualifications and thereby becomes essentially a veterinary service. Yet most milk inspection is performed by laymen whose appointment is made too often because they were good ward workers, rather than experienced milk workers. Fortunately, Saint Louis has a Health Commissioner, Dr. J. F. Bredeck, who demands that all appointments be made for qualifications and fitness for the job and who recognizes the necessity of having veterinarians direct the work of milk inspection.

The control of the butter supply of the nation is a very pressing need. I believe we should insist that all butter be made from milk or cream that is obtained from tuberculosis-free cows. Several cities have adopted such provision in their milk ordinances. Oregon is the first state, to my knowledge, to adopt such requirements. This Association should not delay the adoption of a policy providing such requirements. A campaign should be started immediately to bring about its accomplishment. Health commissioners of the various cities can render valuable assistance in this phase of milk inspection.
It may happen that we shall sooner or later be calling on municipal health commissioners to assist us in promoting a campaign of abortion control. This may be necessary in cities where large quantities of raw milk are consumed.

This Association has a remarkable record for achievement in bringing about more uniform laws, rules and regulations for the control of animal diseases. It deserves great credit for the persistent manner in which it has attacked difficult control problems and for its unparalleled success in solving most of them. The eradication of bovine tuberculosis, now practically assured, is the outstanding accomplishment. In this great campaign the regulatory and research officials of our national and state governments are cooperating in a magnificent manner. These groups of regulatory officials have made up the active working force of this Association. Yet, the remarkable progress made against bovine tuberculosis would have been seriously delayed had it not been for the very aggressive support of another group of public officials whose work is partly regulatory and most intimately associated with ours. I refer to the health commissioners of our cities.

By securing the enactment of and by rigidly enforcing ordinances prohibiting the sale of milk in their cities, except that obtained from cows that had been tested and found free of tuberculosis, these health commissioners became militant sanitary and regulatory officers. It was an easy matter for this Association to adopt a policy providing that milk from tuberculosis-free cows only should be offered for sale for human consumption. To secure the enforcement of that policy was quite another matter. It called for executive ability and courage of the highest order to secure such ordinances from local boards of aldermen and to enforce them against the determined opposition of a large percentage of the dairy industry. It became the duty of the municipal health officials to make possible the practical application of the scientific conclusions of this Association. They have accepted the recommendations of this association and have set about diligently to assist you with the eradication program. A very definite part of the credit for the success thus far obtained belongs to them.

Municipal health commissioners are not a part of this Association, yet they have faithfully supported its policies. It seems to me we have been rather lacking in showing our appreciation in not urging them to become affiliated with us, appear on our programs, and give us the advantage of their experience and counsel.
Meat and milk inspection service is supposed to be complete when these products leave the plants where they have been prepared. General food inspection service begins for them where meat and milk inspection leaves off. Along with all other food products, they are reinspected in the many stores, markets, hotels, restaurants, etc., where they are sold or used. Because food inspection is so closely related to and so interwoven with meat and milk inspection, Health Commissioner Bredeck has combined the three services into a Section of Food Control and placed all under the direction of a veterinarian.

PRESIDENT FAULDER: The next paper is "Some Essentials in Quality Milk Production," by Dr. J. G. Hardenbergh, Plainsboro, N. J.

Dr. Hardenbergh read his paper.

SOME ESSENTIALS IN QUALITY MILK PRODUCTION

By JOHN G. HARDENBERGH, Plainsboro, N. J.

Director of Laboratories, Walker-Gordon Laboratory Company, Inc.

During the past year, we have been made conscious of a "Century of Progress" in many fields of scientific and industrial activity. Some twenty million people have had an opportunity to visualize, by means of exhibits and demonstrations, the extraordinary developments that have taken place in chemistry, physics and engineering; in biology and medicine; in transportation methods, means of communication, ways of living and of working and in many other lines that contribute to human welfare and the advancement of civilization.

The progress made by the dairy industry during the past century is no less striking than that in other fields and constitutes a record second to none in its importance to public health. One hundred years ago, we did not have the tremendous concentrations of population that characterize our metropolitan areas today. Methods of milk production for commercial distribution were primitive and, in the light of modern dairy science and practice, most insanitary. From an industry practically without organization or regulation, the production, processing and distribution of fluid milk and other dairy products has become the most regulated, most supervised business associated with our daily lives.
One hundred years ago, the production and marketing of milk was, in some cities at least, a part of the activities of the distilling business. Operators of breweries and distilleries found it profitable to feed their grain wastes to cows and so, for a time, much of the fluid milk in these communities came from the "brewery dairies." The cows were housed, fed and milked under conditions that beggar description: the stables were in basements or sheds so located that the utilization of the distillery wastes was facilitated; many cows entered these poorly lighted and ventilated quarters and never left them except on the trip to the slaughter-house. (It is even reported that some of the pitiable creatures had to be propped up at milking time.)

In spite of the fact that in many cities there was ample pasture within the city limits, the contracting for these pasture areas was such that the control of fluid milk production still resided with the distillery operators. Under such conditions, with primitive methods of handling milk, lack of sanitary requirements, inadequate cooling, and poor transportation facilities, there was in those times little, if any, "fresh country milk" obtainable in urban centers. At best, milk could stay sweet for only a few hours and in many other respects its quality was questionable. Whether or not there were complaints about the alcoholic content or other qualities of brewery products in those days, it is certain that the water content of milk was seldom limited to the now well-known 88½ per cent.

Today, with modern dairy methods, the observance of sanitary requirements, prompt and efficient cooling of milk, refrigerator cars, tank cars and tank trucks constructed on the vacuum-bottle principle, rapid transportation, pasteurization, and a host of other hygienic precautions, we see the practical elimination of so-called "city dairies" and the extension of milk-sheds in some cases to 500 miles or more beyond the limits of the cities they serve. These marked improvements were made slowly at first and then more and more rapidly; they have been made possible by health organizations and commercial interests which recognized the importance of pure milk supplies and which were willing to devote their energies to their development. Again, these developments are rather typical of the American attitude, characteristic of the determination and ability to meet new challenges, to serve changing needs and to adapt to those needs the benefits resulting from pure and applied research.

During the past four decades, particularly, it is safe to say that the dairy industry of this country has made greater advances than in most countries in the past four centuries. In
that time, to name only three principal factors, we have seen the tuberculin test of cattle introduced and generally adopted; we have seen Pasteur's work adapted to the protection of market milks; and we have seen the pure milk movement as best exemplified by the certified milk industry.

From the successful application of the tuberculin test, especially as carried on for the past 16 years by federal and state agencies under the cooperative plan, we can envision the eradication of a serious bovine disease in the not-too-distant future and the consequent disappearance, already apparent, of a certain amount of tubercle infection in humans, especially children.

By the process of pasteurization, we have been able, more and more every year, to make safe for the consuming public general market milk supplies that could not otherwise have been adequately safeguarded. This has resulted in a reduction in infant mortality alone that stands out as a shining mark in public health achievements.

To the efforts of those who created and developed certified milk, we owe much of the present generally satisfactory quality of our market milks, because the former certainly pioneered in refined methods of production, in supervision of the health of the cattle and of the dairy employees and in control methods which today are requirements in some degree for all grades of milk.

The effect which these three developments alone have had upon the dairy industry, especially as related to the public health and welfare, is well known to members of this Association and need not be further exemplified. However, it may soon be time to consider this thought: The three factors just mentioned, i.e., the tuberculin test of dairy cattle, the pasteurization of market milks, and the certified or pure milk movement, have reached or are rapidly reaching the peaks of their development with respect to the milk situation in general. So-called "tuberculin-tested" milk is no longer a mark of great distinction, or at least should not be such, in any progressive community; all milk for fluid consumption should be from tuberculin-tested cattle whether or not it is to be pasteurized. Pasteurization of market-milk supplies is becoming more widespread every year and, while much remains to be done, the principle and the method are bound to be increasingly applied to supplies not otherwise protected. The place of certified milk as the leader in quality remains unaltered, but it too possibly feels the effects of its own example in the ever-increasing quality of other milks. The wide gap which previously existed between certified milks and the lower grades has been narrowed appreciably.
If these things be true, we now face the consideration as to what direction quality milks must take for future progress. During the past one hundred years, we have reached or passed certain definite objectives in milk quality. In general terms, these objectives may be identified as, first, that of unadulterated milk; second, clean or wholesome milk; third, safe milk. One hundred per cent proficiency in all these cannot be claimed, but certainly a relatively high standing has been achieved. At present we are facing a new objective in which the chief consideration is that of the improved nutritional quality of our milk supplies. So, in addition to all the other requirements that are accepted as essentials in milk production, a new standard of biologic values is set up. A few years ago, the evaluation of food products as to available nutrients was largely a matter of chemical analysis and calorimetry. It has been appreciated, only within recent years, that two bottles of milk—identical in composition according to the usual chemical tests—can be widely different in nutritive values. The idea of “building” a milk of optimum biologic value in relatively new, but it offers possibilities that are extremely interesting. It is along this line, perhaps, that the greatest advancements in quality milk production are to come in the future.

**Essentials for Production of Highest Quality Milk**

It has been said that the production of good milk is the most complicated branch of the farming industry. It requires a knowledge of animal husbandry; of feeds and their utilization by the cow; of animal physiology and perhaps even of animal psychology. Above all, it requires a proper appreciation and an ability to apply, at least under supervision, the principles of hygiene and sanitation to the control of animal diseases and to the handling of a perishable food product. It is obvious, then, that the production of quality milk should be a major activity of the producer and not simply a “side-line.” This means that certain essentials must be considered to insure the quality demanded by official requirements and commercial standards. For the purpose of this discussion, these essentials may be itemized as follows: (1) economic dairy herd units; (2) a system of technical control, part of which must be at the source of production; (3) application of research to the improvements in milk quality.

*Economic dairy herd units:* By this it is meant that dairy herds, to be economic producing units, should be of sufficient size to support the improvements in methods and equipment that are
demanded by milk control officials and by competitive quality requirements. It is becoming more and more difficult for the owner of a few cows to keep up with modern standards. Often-times, the burden of expenditures involved in providing approved barn and milk-house equipment or in eliminating dairy animals that are diseased is out of proportion to the return which he can obtain on his investment. In other words, the farmer with a very small herd who is producing milk as a "side-line" or minor activity often cannot afford to meet the demands made upon him; whereas, the dairyman who makes milk production a major activity cannot afford not to meet them.

**Technical control:** This comprises four activities: (1) Medical supervision, responsible to the city and state health authorities, to insure the health status of all milk handlers; (2) veterinary supervision of the herd which, in addition to being responsible for the control of infectious bovine diseases, such as tuberculosis and Bang's disease, also exercises control over mastitis and other ailments, so that no cow with any condition that can affect the quality of the milk is permitted to stay in the milking line; (3) nutritional control to oversee the selection of feeds for the dairy cattle so that the rations will contribute not only to the best maintenance of the cow but to the biologic values of the milk she produces; (4) research phases, which are largely of an applied nature and relate to such problems as the dehydration of forage crops to conserve and increase their nutritive qualities. For instance, the vitamin A content of dehydrated alfalfa is from four to seven times that of field-cured alfalfa. Genetics studies also are of importance in order that dairy animals may be bred with greater constitutional vigor and resistance to disease. We have come to believe that in breeding dairy animals for quality milk production, the health pedigree is of far greater importance than the blood lines.

We believe that progress in quality milk production is going to be just as great as progress in other lines of industry and that the concept as to what quality milk of the future may be is only beginning to be realized.

**President Faulder:** I am sure you have all enjoyed this excellent paper by Dr. Hardenbergh. The next is the report of the Committee on Meat and Milk Hygiene by the Chairman, Dr. C. H. Stange. (Applause.)

**Dr. Stange:** As the report is presented, I think you will appreciate that the Committee was a little bit confused as to the definite policy
of this Association in regard to the question of meat and milk inspection, more particularly that of milk.

. . . Dr. Stange then read the report. . . .

REPORT OF COMMITTEE ON MEAT AND MILK HYGIENE

DR. C. H. STANGE, Chairman, Ames, Iowa
Dr. L. A. Klein, Philadelphia, Pa. Dr. J. G. Hardenbergh, Plainsboro, N. J.
Dr. J. S. Koen, Saint Louis, Mo. Dr. W. G. Hollingworth, Utica, N. Y.
Dr. O. V. Brumley, Columbus, Ohio

Previous reports to this Association indicate that there is considerable variation in the policies and practices in the various states relative to meat and milk hygiene. Your Committee believes that the policies should be unified as far as practicable. We believe also that food hygiene presents two quite distinct problems in most states, viz., meat inspection and milk inspection.

Meat inspection, whether properly so or not, begins at the killing-centers and approximately two-thirds of the animals slaughtered in the United States are killed under federal inspection. Meats are subjected to long-distance transportation to a much greater extent than milk, and consequently enter more largely into interstate commerce and thereby come under federal supervision. We have a most efficient system of federal meat inspection; and in many of the small cities and towns in the northern part of the United States, meat coming from federally inspected plants is sold almost exclusively. The objective, of course, should be to bring the additional one-third under competent inspection.

The question of meat inspection undoubtedly lies within the field of veterinary medicine, but, in the actual application of food inspection, it is frequently carried along with the more controversial work of milk inspection, and the work often, therefore, is done by the same inspectors.

Milk, on the other hand, presents quite a different problem. Milk is, undoubtedly, a much greater potential factor in the spread of disease than is meat. Your Committee does not want to be understood, however, as discounting the importance of meat inspection but simply desires to point out that inherently they are quite different but very commonly considered together.

Milk is produced on the farms chiefly outside cities and towns, and any adequate milk inspection must begin at the source. Aside from the supply to the larger cities, milk is consumed not far from the place of its production. It is, therefore, not a large item in interstate commerce, and supervision, therefore, must be of a state and local character. Milk-producers are well organized, and milk and its processing have been the subject of more extensive bacteriological and chemical studies than any other food product.

Your Committee considers meat and milk inspection properly as a part of the sanitary police work of our government and its various subdivisions. It also considers that this Association as an organization should sponsor the development and supervision of food inspection. We are not unmindful of the efforts of associations such as the International Association of Dairy and Milk Inspectors, and your Committee believes that a plan of cooperation may be possible between these organizations.

Your Committee believes that the development of a complete program should not be attempted within a single year, but that annual
contributions and additions should be made in a manner somewhat similar to the tuberculosis eradication program. One question, concerning which several members of the Committee are uncertain, is whether or not the live stock sanitary officials of the various states consider themselves the logical officials to administer laws and regulations governing the production and distribution of milk and whether they would welcome this increased responsibility. If this question is decided in the affirmative, then the logical procedure for this Association is to direct its energies toward the adoption of a more or less uniform set of principles for the proper supervision of milk production and distribution in the various states.

Little can be accomplished by having a committee consume its time each year in working out an elaborate report which is adopted and then forgotten. This Association can accomplish much, as it has amply demonstrated in connection with a number of branches of our sanitary control work. The question your Committee feels should be decided in the beginning is whether or not this Association sincerely desires to bring the control of food hygiene under the live stock sanitary officials of the various states. If only partially, then to what extent?

Dairy farm inspection, i.e., the examination of the cows, sanitary conditions, and the equipment and methods used in producing and handling milk, is distinctly a problem for the man trained in veterinary medicine. The processing of milk and other manipulations to which it is subjected after it leaves the dairy farm cannot be said to be outside the field of dairy bacteriology and dairy industry. The transmission of human diseases through milk, it must be admitted, comes properly within the scope of the physician. If the veterinarian is qualified in these fields and in veterinary medicine as well, he would be the “ideal milk inspector” and should be in charge of the entire field from production to consumption. As a rule, the veterinarians are not so well qualified in the processing as in the production of milk and milk products. It is our opinion that we should coordinate our efforts with those of the members of the International Association of Dairy and Milk Inspectors.

The greatest good will come to the public health, the dairy industry and the veterinary profession by cooperation with others already engaged in the supervision of milk processing and handling, who have shown that they are competent. In any case, it is the opinion of your Committee that meat and milk inspection, like other sanitary police work, will be most efficient if removed as far as possible from political influence. A non-partisan sanitary board who would appoint the state director of health, state veterinarian and other sanitary police officials of the state has been suggested as an improvement over most of our present systems.

Your Committee wishes to submit the following recommendations for your consideration and approval:

1. That the administration of laws, rules and regulations, relating to meat and milk inspection, be considered the function of the live stock sanitary officials of the various states.

2. That milk inspection be considered of first importance and that future committees make an effort to unify and harmonize our efforts with those of other organizations having a common interest in a clean milk supply.

3. That a systematic study of dairy and milk inspection be made by this Association, through its Committee on Meat and Milk Hygiene, according to the following program:

   a. Milk control laws and regulations.
   b. Dairy farm inspection.
   c. Dairy and milk-plant inspection.
   d. Laboratory examination of milk.
   e. Adjustment of the system of inspection to small towns.
ANAPLASMOSIS-LIKE DISEASE IN SWINE

By A. T. KINSLEY and J. D. RAY

Kansas City, Mo.

In the April, 1932, issue of Veterinary Medicine, we reported a condition that had been identified in a herd of hogs in Illinois under the name of "protozoon-like body in blood of swine." In this article it was stated that a spherical body similar to Anaplasma was identified in many red blood-cells. During the spring and summer of 1932, the same condition was found in other herds of swine.

Dr. L. P. Doyle,* of Purdue University, has described a malady that is apparently identical with that previously described by us.

This malady has occurred in swine in Illinois, Iowa, South Dakota and Missouri. It is apparently quite prevalent in the territory adjacent to Sioux City, Iowa. The disease appears to be most common in pigs weighing from 60 to 150 pounds, although other swine may become affected. The usual symptoms are depression, rise of temperature in the early stages, dyspnea, thumps, rapid shrinkage, and pallor of the visible mucosa, followed by icterus. The course of the disease is variable. Some affected animals die promptly, others live for several days, and a few may survive. In some of the lingering cases there is a tendency to a scurvy-like condition. In an occasional case, the extremities of the ears may become dry and slough.

The outstanding lesions are icterus, anemia, excessive quantities of fluid in the serous cavities, especially the pericardial sac, an excessive tumefaction of the spleen and a yellow discoloration

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of the liver. These lesions are practically the same as the lesions of bovine anaplasmosis.

We have not had an opportunity to observe treatment of these cases. However, we have been informed by veterinarians that the administration of sodium cacodylate in 10- to 15-grain doses, or the use of therapeutic doses of Fowler's solution, administered directly to the affected animals and in the feed of the exposed animals, has given very good results.

The natural method of transmission has not been determined. Although this disease has a relatively low mortality, we believe that its recognition is of considerable importance, for there is a possibility that infection can be carried from one pig to another by the needle during vaccination and the disease become widespread in a very short time. We have made one unsuccessful attempt to transmit the disease to healthy swine by the injection of two- or three-day-old blood. It is probable that the disease can be transmitted by using freshly drawn blood.

PRESIDENT FAULDIE: We will return to the Section on Milk and Meat Hygiene and take up the paper of Dr. A. F. Schalk, Ohio State University, Columbus, the subject being “Veterinary Service in Public Health Control Work—The Largest Undeveloped Field in Veterinary Science.” It is with pleasure that I present Dr. Schalk. (Applause.)

. . . Dr. Schalk read his paper. . .

VETERINARY SERVICE IN PUBLIC HEALTH CONTROL WORK—THE LARGEST UNDEVELOPED FIELD IN VETERINARY SCIENCE

By A. F. SCHALK, Columbus, Ohio
Ohio State University

In wording the title of this paper, “Veterinary Service in Public Health Control Work—The Largest Undeveloped Field in Veterinary Science,” it was done deliberately with the express hope that it be considered in its most literal interpretation and not in a restricted or figurative sense.

Dismissing inconsequential details in classification, we can conveniently place the functions of veterinary medicine in a few major fields, viz., practice, both general and special; federal and state sanitary control work; teaching and research activities; biologic production and distribution; army service and veterinary service in public health work. With the exception of the latter, I think we can consider the remaining fields in a fairly well-developed state, comparatively speaking. I do not wish to be misconstrued as inferring that we have reached the saturation
point in improving all the possibilities in these fields, for we have not. The evolution of the science and the onward march of civilization with its attendant demands for greater and more varied services will undoubtedly create new sources of work and ways and means for our profession to meet them.

However, as regards our participation in public health work, an entirely different situation prevails. As a matter of fact, our profession is only in the beginning stages of developing the many possibilities in this field.

THE IMPORTANCE OF PUBLIC HEALTH WORK

Man's struggle through the ages, from primitive times down to our present-day civilization, has been attended by periodic progress in public health. Declining morbidity and the extension of the average span of life is largely and chiefly the result of achievements in this work. At the time of the discovery of America, the average time of earthly existence of all members of the human family was about nineteen years. Today it is somewhat over fifty-seven years. Thus, the life span has been multiplied approximately threefold—a truly remarkable accomplishment and an exceedingly encouraging situation.

It is needless for me to tell this body or any group of medical men that a high grade of public health, maintained on a lofty plane, constitutes the most highly valued earthly institution that any unit of peoples could hope to possess. It is true that our citizenry in general does not at all times realize this fact. Obviously, such lack of appreciation on the part of the public only emphasizes the weaknesses and failures of the medical and veterinary professions. We have failed in our educational program to those peoples. Notwithstanding this element, it is exceedingly encouraging to know that an overwhelming majority of those who have had the benefits of a real, progressive, efficient health program are usually deeply appreciative of the results. I think this last stated condition should serve as our "guiding star" for the future.

VETERINARY MEDICINE A DEFINITE AND VITAL PART OF PUBLIC HEALTH

Public health control is primarily a medical institution as it essentially involves human beings. However, if we carefully analyze the actual work the modern up-to-date health department is doing, it will be readily disclosed that many of their functions lie outside the domain of human medicine. Evidently this work involves the legitimate fields of both medicine and veterinary
medicine as well as that of certain skilled and lay workers. There is no one professional or learned group that receives adequate basic training to carry out efficiently the multifarious duties incumbent upon a modern health department.

Of the various phases of public health work, that which involves a wholesome and pure food supply is of quite vital importance in the general scheme of things. It is truly fundamental as its importance actually permeates the entire fabric of public health. The average layman and, I may also add, many veterinarians who have not given the problem serious thought, usually think of food hygiene in its most narrow scope, viz., simply the inspection of milk and meat. As a matter of fact, this subject occupies a much larger sphere. The true magnitude of this field becomes evident only when we consider that it includes all of the hygienic and sanitary aspects of everything that pertains to the production, transportation, processing, storing and distribution of milk, meats, poultry, eggs, game and fish and possibly some foods other than those of animal origin.

A WIDELY CIRCULARIZED QUESTIONNAIRE REVEALS SIGNIFICANT DATA

A couple of years ago, when the College of Veterinary Medicine of Ohio State University was readjusting its curriculum better to meet present-day needs and requirements, it circularized a large number of public health departments of municipalities of varying populations throughout the country. The questionnaire was designed foremost, to learn, first-hand, just what they were doing and what different agencies were doing the various kinds of work.

The survey revealed, among other things, that in organizations that had veterinarians they served in a variety of capacities, viz., director or supervisor of veterinary divisions of departments of public health, director of food inspection, dairy, milk, meat and food inspectors and various combinations of the foregoing positions. In some instances they were members of health boards and in some cases had served as president of the board.

With the possible exception of general food inspection, there is no challenging the fact that the remainder of the foregoing activities come in the category of legitimate veterinary services. It was astounding, at least to me, though quite enlightening to learn that more than 75 per cent of the veterinarians involved were engaged in general food inspection. By this I mean that it was the duty of the veterinarians to make inspections of foods not only of animal origin, but practically of all foods of a perish-
able nature that require hygienic and sanitary control to insure their wholesomeness and safety to the consumer. This included inspection of the culinary departments of hotels and restaurants, markets, storages, confectioneries and other food-preparing and dispensing establishments.

We may ask just why are veterinarians called upon for this type of service? Is it not because the health authorities consider the veterinarians best qualified among their personnel to carry out this work? And so it is with practically all the health officers whom we have contacted or with whom we have discussed the problem. It was not usually an instance in which the veterinarian was soliciting or requesting this inspection, but on the contrary, in most cases it was inflicted upon him as a part of his duties in the department. Should he ignore it and cast it aside because it is not a 100 per cent veterinary function? I think not. I think it is our duty to accept it and develop this phase of inspection to the highest plane possible when brought upon us.

SOME MEDICAL MEN RECOGNIZE THE IMPORTANCE OF VETERINARY SERVICE IN PUBLIC HEALTH WORK

It has not been very many years since the medical profession was somewhat apprehensive about veterinarians in public health work and many medical men were quite reluctant to have them affiliated with the service. This assumption was predicated partially on the belief that veterinarians were not scientifically trained and did not have the proper background to carry out the work. They found further disillusionment in the false conception that, if veterinarians were brought into the picture, they might possibly attempt to wrest the balance of power from them and endeavor to dominate the service. Of course both of the premises were ill-founded and erroneous.

The present day, however, finds a very materially changed viewpoint on the part of most medical men as regards the veterinarian and his service in public health control work. This is especially applicable to those who have had well-trained, efficient veterinarians on their staffs or have been associated with first-class veterinarians in some phase of the control work. They have come to realize that veterinarians with the proper background, training, experience, initiative and diligence are quite essential and practically indispensable in meeting all the obligations implied in a modern up-to-date health program. I make these statements only because they are in accordance with the sentiments of a number of competent health officials who have had
the privilege of operating under such favorable conditions and with whom we have discussed the situation. Practically all are enthusiastic “boosters” for the veterinarians’ services. This is certainly an encouraging state of affairs and should go far in dispelling any fear or timidity presently entertained by many members of our profession that broad-minded medical men belittle veterinary service in this field of work.

THE NEED OF MORE VETERINARIANS IN HEALTH WORK

In the foregoing discussions I have endeavored to establish two major points. First, that competent veterinary service is essentially indispensable in all public health work that is worthy of the name. Second, that comprehensive-minded medical men in official capacities in health control work are usually quite appreciative of capable, well-qualified veterinarians as assistants in the execution of their responsible offices.

The establishment and recognition of these two salient features are self-evident and sufficing. They indicate, in no uncertain terms, that the veterinary profession has been and is at the present time overlooking an excellent opportunity of greatly extending its service in this field. One of our greatest limitations in this work is attributable to the fact that far too many health departments throughout the land do not have any veterinary representation, whatsoever, in their organizations. Then in an overwhelming majority of health departments that do have representation, it is limited to a single man. There are many cities in the United States of large populations that have but one veterinarian on their staff. This is a very sad situation to say the least. It simply means that a large number of inspections involving delicate decisions on important food-hygiene problems lie at the mercy of lay inspectors wholly lacking in special training and knowledge pertaining to the subject.

If we subscribe to the thesis advanced in previous paragraphs of this paper, we will readily conclude that food hygiene, in practically all of its ramifications, is a truly legitimate veterinary function. It is almost continuously confronted with problems of a highly technical nature requiring skill and scientific knowledge for their intelligent solution. This being true, it would require the services of several veterinarians on the health staffs of our large cities if all food inspections were conducted by adequately trained and properly qualified inspectors. In this way hundreds of veterinarians would be oriented into proper channels where their services would react favorably to the public welfare.

The paramount question is how can these objectives be best
and most rapidly attained and to the best interests of the public
and the medical and veterinary professions?

As the matter stands, there is an utter lack of uniformity in
both the organization and operation in the different health de-
partments. In a very few cities the health department has a
distinct and separate division of veterinary medicine, of which
a veterinarian is director or supervisor. Here the veterinary
duties are set out quite definitely.

In a majority of cities where health control is maintained,
the department has one or more veterinarians whose duties are
not so specifically outlined, but nevertheless whose contributions
constitute a major portion of the departmental activities.

Lastly, there are the health departments that do not have any
veterinary service whatsoever. Instead, the food inspections are
entrusted largely to laymen whose chief qualifications are mainly
cheap politics.

The very nature of many of the problems of food hygiene and
the necessity for expert sanitary advice for their intelligent in-
terpretation and solution indicate that veterinary services con-
stitute a most vital part of the public health structure. This
being true, we firmly believe that, for the best interests of all
concerned, the personnel of every health board, state, municipal
and county, should include a competent, qualified veterinarian.
Likewise, every Department of Health should have a Division
of Veterinary Medicine or its equivalent, and a sufficient number
of properly trained veterinarians on their operating staffs to carry
out in a thorough manner all veterinary inspections incident to
health organizations. Their presence on health boards is neces-
sary for the formulation of sound, workable, sanitary policies,
and for the promulgation of suitable and proper regulations.

A coalition of this sort between medical men and veterinarians,
properly coördinated, should go far towards rendering the public
an unusually high grade of health, embodying the richer fruits of
coöperation and unification. A set-up of these proportions will be
of tremendous significance in the realm of public health control.
There is nothing of a revolutionary nature about it. It does not
even represent anything entirely new. In reality a number of
cities are operating under such policies and from what can be
gathered, it is quite satisfactory to all interests.

As it appears to me, our profession's premise in this movement
is exceedingly well defined. Our chief and foremost concern is
to endeavor to place more veterinarians in public health control
work in order that purely veterinary activities will be performed
by properly trained sanitarians who in these instances, should be
veterinarians. This accomplishment is by no means beyond any
probability. However, it will require a consistent and concerted
program of education and convincing salesmanship to put it over
to the public, public officials and some medical men. The first
two agencies should be educated to the value and need of good
public health and the very important rôle played by good, whole-
some, pure foods in maintaining same.

The medical profession should be diplomatically informed that
veterinarians are the only group or class of people that are trained
fundamentally in animal diseases transmissible to man and in
sanitation incidental to food hygiene. Each succeeding year finds
the sanction of an increasingly greater number of medical men,
of high-grade veterinary assistance in public health control work.
They are beginning to realize that it is a most valuable asset in
the successful performance of their offices.

**ADDITIONAL OBLIGATIONS OF THE VETERINARY COLLEGES**

I think we are justified in presuming that each succeeding year
will find an ever-increasing demand for veterinary service in
public health. This condition confronting the profession brings
additional obligations upon the veterinary colleges, i.e., to train
the students adequately for this service.

In the course of this discussion I have spoken repeatedly to the
effect that veterinarians were the only class of people who are
adequately trained for certain public health services. These
statements should have been made with some reservations, as
they are only relatively true. It is a fact, however, that veteri-
nary students are the only group that receive academic instruc-
tion in the courses that pertains to food hygiene. However, in
many instances this academic training is far from complete or
sufficiently adequate to enable the student just emerging from
graduation to assume the responsibilities of such a position.

Therefore, it may be well for college officials, who have not
already done so, to readjust their curricula to meet the new and
increased demands. This can be done with less difficulty than
one would at first anticipate. From time to time changing con-
ditions in veterinary medicine leave some "dead timber" in the
regular courses. If this obsolete material in the branches of
bacteriology, pathology, physiological chemistry and dairy tech-
nology can be removed and replaced with new subject matter
pertaining to the problems of food hygiene, a good start will
have been made. Then, if we supplement this with a separate
course in food hygiene, we think the school will have gone a long
way toward giving the students an adequate working knowledge upon which to build and grow in this service. In this way, we think the student with average ingenuity and initiative will be able to measure up to the responsibilities of a modern health department position.

**PROBLEMS CONFRONTING A PRACTITIONER IN THE APPLICATION OF THE IMMUNIZING TREATMENT AGAINST HOG CHOLERA**

*By J. H. Spence, Clinton, Iowa*

The problems encountered by the veterinarian engaged in the immunization of swine against hog cholera are of various kinds, but for the purposes of this discussion, they may be classified as (1) clinical, (2) economic and (3) legislative.

**Clinical Problems**

Among the most serious of the *clinical* problems hampering the veterinarian in this work are the following:

These, of course, include not only all of those problems arising in connection with the actual vaccination of the animals, but also those in connection with the professional supervision of their care from the time the drove is prepared for immunization until, in many instances, they are moved from the farm to slaughter, as the veterinary practitioner is held responsible until they are safely marketed.

Of all his problems, these are perhaps of the most vital importance to the veterinarian, because his efficiency in handling them indicates the justification for his existence as a factor in our scheme of economic life. It has often been stated that any person of average intelligence can be quickly instructed in the mechanics of injecting serum and virus into pigs. This statement is only partially correct. The actual manual operation of injecting the serum and virus constitutes a minor phase of the entire procedure of immunizing swine against hog cholera in the manner most profitable and most satisfactory to the owner.
The logical method of procedure in different droves will vary, depending upon the conditions and circumstances encountered and upon the extent to which the veterinarian endeavors to meet them. The proper handling of these unusual conditions constitutes, in itself, a major problem for the veterinarian in preparing the drove for immunization. Many of these conditions are obscure in nature and, in many instances, completely defy the most painstaking efforts to determine their existence. We refer here especially to the existence of those obscure, latent infections in apparently healthy animals, which conditions are so prone to manifest their existence a few days following vaccination against hog cholera.

Early in our immunization experience, we were unable to account for the development of these infectious conditions shortly after vaccination. Many were inclined to question the quality and potency of the products with which the pigs were injected. Years of study and field observations have absolved the products from responsibility and have clearly demonstrated the real cause for these undesirable reactions. It is now generally accepted as a fact that the vaccinated pig experiences a reaction following the injection of the serum and virus. During the period of this reaction, the resistance of the animal is lowered and its susceptibility is thereby increased to organisms residing in its own body or to those organisms existing on the premises. These conclusions, based on field observations, have been materially supported by research work reported by Cole,* of the U. S. Bureau of Animal Industry. This work actually demonstrated that within a few days following the administration of the simultaneous treatment there occurred a material reduction in the number of white blood corpuscles. This occurred in the case of every pig under observation and none of the animals showed visible manifestations of this reaction. If medical scientists are correct in their conclusions that the white blood corpuscles are one of nature’s chief means of defense against infection, it would seem logical to believe that this leucopenia following the simultaneous treatment would account, in a measure, at least, for the increased susceptibility of the animals to harbored infection during the reaction period.

There are a great number of these infective conditions, which occasionally develop shortly after vaccination but those most frequently observed are perhaps the following:

Salmonella suifestifer (frequently causing enteritis).
Paratyphoid infections.
Bloody dysentery.
Swine flu.
Colon bacillus infections.
Pasteurella suisepticum infections.

The question of what is our most frequent causative factor can be answered partially by Doctor McBryde's experiments with a pure culture of S. suifestifer and hog cholera virus injected simultaneously. Death resulted in a much shorter time when virus alone was inoculated. S. suifestifer, when injected alone, will stunt but rarely kill a hog. So, from a clinical standpoint, a mixture of S. suifestifer and hog cholera virus is to be strictly avoided. If suipestifer infection is suspected in the drove, vaccination with serum and virus should not be undertaken except in case of dire necessity or without adding to the treatment a bacterin containing heavy suspensions of killed S. suifestifer.

From what we learn from laboratory and research workers, the bacteriological picture centers around that group commonly called the intermediate or Gaertner group of the paratyphoid type, of which S. suifestifer seems to stand out as the most troublesome. Some of the more virulent of the colon group found in filthy drinking fountains have caused intestinal and respiratory disturbances. As far as our present-day knowledge goes, the colon bacillus does not produce a hypersensibility to hog cholera virus and is of importance only when an unthrifty condition of the drove is charged to vaccination failure, which follows the use of insufficient virus or virus of low virulence and the practitioner stands charged with a "virus break."

Every premise where hogs die of hog cholera as a result of a virus break must be presumed to be cholera-infected and the case should be regarded as a hog cholera outbreak. This brings up another question: Just why do hogs vaccinated with an insufficient virus break in from six to eight weeks when there is no evidence of imported infection? Are we to share the thought of some of our European colleagues that virus persists in the hog for a considerable but as yet undetermined length of time?

In view of the serious losses sometimes caused by these post-vaccination infections, the veterinarian must constantly strive to handle each drove in a manner which will, as far as possible, prevent the development of these infections or control their activities. His responsibilities and his efforts frequently begin days or weeks before the drove is actually vaccinated and his
supervision of the care of the animals must be continued at least through the reaction period subsequent thereto. A careful study of the history of the drove and of the premises frequently indicates the advisability of a course of bacterin treatment a week or two prior to the administration of the simultaneous treatment.

The existence of anemia indicates the necessity for the administration of iron and copper in conjunction with other essential procedures to correct the diet and undesirable hygienic or sanitary conditions. Pigs heavily infested by internal or external parasites are poor subjects for vaccination and when these infestations are found, the simultaneous treatment should be postponed, if possible, until the condition of the animal has been improved. On some premises, it is even necessary to administer tetanus antitoxin to prevent the development of tetanus resulting from needle-wound infection from a badly contaminated soil.

The actual injection of the serum and virus should be carried out in a manner purely indicative of unusual skill and professional workmanship on the part of the operator. The exercise of good judgment in this operation is of paramount importance to the owner as well as to the veterinarian himself. The doses of serum and virus should be ample to suit the condition of each animal presented for vaccination. Even in apparently healthy droves, the temperatures of enough animals should be taken to offer assurance that an increased dosage of serum or a word of warning to the owner is not indicated. The keenness of present-day competition is not always conducive to the administration of liberal doses of serum and virus, yet it is a recognized fact that those practitioners who use large doses of both serum and virus experience the least embarrassment from post-vaccination difficulties of either the early or late variety. This is a logical result, because the larger dose of serum probably reduces the intensity of the post-vaccination reaction.

In offering suggestions for the proper postvaccinal feeding and care of a drove the owner should be made to realize that the simultaneous treatment is in a sense a major operation for the animal. A very definite reaction must occur, otherwise swine could not be converted from cholera-susceptible to cholera-immune animals. During the period of this reaction the resistance of the animals is lowered, not only to the disease organisms in their bodies and on the premises, but also perhaps to the virus of hog cholera used in their vaccination. It therefore behooves the owner to exercise every precaution in their care which may avoid
a further reduction in their resistance to these infectious agents
until the vaccination reaction is completed.

Many veterinarians prefer to make little change in the feed
after vaccination except to reduce the amount of feed for two
to three weeks. Feed in amounts too large following vaccination
is responsible for many serious losses.

There are too many owners who cannot be convinced of the
wisdom of this recommendation until they have had personal
experience with these losses. The feeding of much corn, and
especially of new corn, is quite generally discouraged by prac-
titioners. Some recommend that only oats or other easily digested
feeds be fed for three weeks after vaccination. Aware of the
fact that the farmer is giving special consideration to the feeding
of his hogs following their vaccination, mineral agents and
remedy peddlers frequently visit him at that time and convince
him of the pressing necessity for inaugurating the use of their
products. Many serious losses have resulted from the feeding
of such products in quantities perhaps too copious for the animals
during the reaction period. Home remedies such as kerosene,
lye, salt, brine and physics also have caused many serious post-
vaccination difficulties.

The hygienic and sanitary conditions surrounding the animals
should receive special attention following vaccination. During
the three-week reaction period, losses are frequently caused by
dusty, damp, or drafty sleeping quarters, improper, contaminated,
or insufficient water supply, etc.

The virus breaks or outbreaks of hog cholera in droves which,
for some length of time, have been vaccinated with serum and
virus are the most serious affairs indeed but such occurrences
are not common with the qualified veterinary practitioner in this
day and age, with choice of virulent virus and not being afraid
to use a sufficient quantity. The greatest advertisement for hog
cholera immunization is the hog which arises from sleeping with
cholera-sick and dead hogs and never misses a feed. Very rarely
indeed is the reverse true following veterinary vaccination and
no preventive treatment known to immunology or medicine is
any more perfect than the simultaneous treatment for hog cholera
devised by Drs. Dorset, McBryde and Niles.

Fortunately, the veterinary profession has learned through
bitter experience for some practitioners, of the brief protection
of the serum-alone treatment and we rarely hear of great losses
of hogs in the feed-lot given serum only to hold them during a
brief fattening period although most practitioners must refuse
owners such procedure during the season.

These virus breaks following lay vaccination are all too com-
mon. In such cases, delayed recognition of failure of the pro-
tective treatment often means great losses in the susceptible
droves of the community.

Because of the involvement of factors beyond his control, the
most efficient practitioner cannot hope to prevent these post-
vaccination diseases completely, but the value of his services to
the owner lies in his ability to reduce the frequency of their
occurrence and to control the losses caused by them. A definite
field diagnosis of these diseases is frequently very difficult and,
in many instances, they can be positively diagnosed only by
laboratory examinations. They frequently resemble hog cholera
in that they are septicemic in character. They produce symptoms
and lesions of a septicemia as does hog cholera; in fact, in earlier
years, it was the custom to diagnose them as hog cholera and
to re-treat the animals with anti-hog cholera serum. After
observing the results of re-treating these droves over a period
of years, that practice has been almost entirely discontinued.

These observations revealed that the losses in the revaccinated
droves were no less than those droves where other methods of
treatment were employed. In addition, the practice of re-treating
was rapidly destroying the confidence of the public in anti-hog
cholera serum, by its use for the treatment of conditions which it
could not be expected to benefit. Most veterinarians have there-
fore adopted more logical lines of treatment by reducing the
diet and correcting its nature, administering intestinal or respir-
atory antiseptics, prescribing the alkali or buttermilk treatment,
and by correcting undesirable features of the sanitary and
hygienic environment of the animals.

Respiratory infections make things miserable for the practi-
tioner especially if the condition arises a few days after vaccina-
tion. It is considered safer to vaccinate a drove of swine with
serum and virus while sick with a respiratory disease. The hogs
apparently make their recovery or convalesce from the respiratory
infection before the virus starts to work.

The middle western form of swine erysipelas seems to be one
infection which does not greatly hinder the practitioner in his
use of hog cholera virus according to the experiences of many
who have dealt with the disease.

It seems to me the weakest gesture a practitioner can make
is to seize the easiest way in postvaccinal troubles and promptly
administer additional serum. If revaccination were indicated at all it would call for both serum and virus. Revaccination could be indicated or countenanced only in case of hog cholera. In other septicemic infections, it would be useless, as anti-hog cholera serum is not polyvalent. If, on snap judgment, a drove is revaccinated and individuals continue to sicken and die faster than before, not only the practitioner but the owner, the neighborhood, and the reputation of the serum-virus treatment is worse off than ever before. It is far better to determine exactly the cause of the postvaccinal troubles and proceed by medical and sanitary aid to remedy them.

County agent, neighbors, hog-buyers, peddlers and other meddlers who nose into postvaccinal cases and throw a harpoon at the practitioner do not sense that the practitioner refuses to revaccinate because of his knowledge it will be ineffectual and not because of the cost. Such county agents usually show their ignorance before such affairs wind up.

In the event of trouble following vaccination, the practitioner is faced with the serious problem of determining the cause of the trouble in order to save the client's property as well as defending the reputation of himself and the serum-virus treatment. All careful and capable practitioners are compelled at times to endure these situations and, let me tell you, it is not always an easy matter to determine the exact cause of trouble of this nature. Our methods of diagnosing diseases are, at times, wholly inadequate even though we are most thorough and painstaking in our investigations. Very often the history is almost entirely unavailable or we are placed at a disadvantage from the start, as the farmer may be explosive in his expression of opinion that the trouble is due to the vaccination, faulty products, faulty technic, or something pertaining to the application of the treatment.

Postvaccinal troubles I have encountered are necrotic enteritis, necrotic stomatitis, acute enteritis, filth disease, respiratory diseases, such as flu, mange, pox, swine erysipelas, legume poisoning, lye, salt, copper sulfate, mineral supplement poisonings, calcium deficiency, rabies, parasites such as round worms, thornhead worms and lung worms, coccidiosis, too concentrated foods, too heavy feeding, new-corn feeding, new-oats feeding, clover, rape, alfalfa burning, sun scald, pyemia, empyema, tetanus and tuberculosis.

The importation into a veterinarian's territory of swine vaccinated in public stock yards under federal supervision naturally
engenders some resentment and bias and when such importations so recently vaccinated and suffering the exposure of public-stock yard infections and the rigors of the journey, go haywire, the local practitioner sometimes is disposed to knock the federal-supervised vaccination and make trouble for all concerned even spoiling for litigation and a chance to make a monkey of himself on the witness stand.

Pell-mell vaccination during enzoôtics of hog cholera, when the veterinarian is vaccinating exposed droves in a routine manner from early morning until late at night (by lantern, lamp, electric light or automobile headlights), not enough care is given to examination and increased dosage, after-care advice, etc. In vaccinating cholera-sick droves under such conditions, sometimes for an owner who knows nothing whatever of the limitations of the serum virus treatment and expects that every animal will live, trouble arises because the death losses exceed the expectations of the owner. It is easier and less embarrassing to predict heavy death losses before they occur than after.

**DIAGNOSIS**

The diagnosis of hog cholera in the field is most difficult, yet accurate diagnosis is very essential in conducting a successful vaccinating season in the Corn Belt. The veterinarian must battle his way through with his judgment and experience as his best aids. After all, his knowledge and judgment of conditions in his territory offset the crudity of his macroscopic pathological findings. Judgment and good horse sense are included in the diagnosis. If a very accurate diagnosis of suipestifer infection were made and the drove successfully treated for such an infection, then, three weeks later, the drove sickens with hog cholera and a great death loss occurs, the neighborhood will gossip for years that the practitioner made an error in diagnosis in the very beginning. To avoid such calamities, even though there is absolutely no question as to the diagnosis, the wise practitioner discusses the probabilities of hog cholera being connected with the trouble, or soon becoming connected with it, while the hogs are in such ripe condition to take on hog cholera infection, and recommends that as soon as it is safe to vaccinate for hog cholera, it had best be done.

To aid in differential diagnosis, it was hailed for a time with much acclaim that the study of the blood picture through the microscope would disclose a characteristic leucopenia, or a marked lessening of the white blood-cell count when hog cholera virus
was a factor in the disease being diagnosed. It would not be necessary to sacrifice a pig and the blood count could easily be determined on the farm in a few minutes by examination of a blood sample taken from the tail of an ailing pig. It is just too bad we do not have a certain diagnostic agent to aid in field diagnosis as leucopenia promised to be.

JUDGMENT

It is the duty of the veterinary practitioner to hold up the reputation of the serum-virus treatment at all times. Called in by a disgusted owner when postvaccinal difficulties arise in a drove vaccinated by another veterinarian, the second practitioner owes it to the community not to dissipate faith in preventive vaccination for hog cholera by snap judgment condemnation of the manner of administration, the dosage used, and the choice of brands of serum and virus. He should properly consult with the first veterinarian or politely withdraw. Trying to fix up postvaccinal troubles for another practitioner, no matter how simple, usually does not act as a practice-builder for the second veterinarian.

One of the disappointments most practitioners have experienced is to make an early and correct diagnosis of hog cholera and experience very excellent results by the serum-virus treatment, the death loss ceasing where the doctor quit vaccinating. Then he congratulates himself on the good results only to learn that the neighborhood is frankly skeptical that the infection was really hog cholera.

BABY-PIG VACCINATION

Bitter experience has taught veterinarians and hog-raisers of the Corn Belt that the vaccination of suckling pigs does not confer a lasting immunity. The publicity given by the Extension Division and the Bureau of Animal Industry of the U. S. Department of Agriculture in advocating this sensational saving (?) to the farmer resulted everywhere in a boomerang of condemnation for them and a great financial loss to the hog-growers of many states. Suckling pigs very commonly must be vaccinated in an exposed drove, but prudent practitioners recommend revaccination after weaning.

PREGNANT-SOW VACCINATION

It is seldom that a practitioner would consider administering serum and virus to a sow about to farrow unless in case of exposure to cholera infection or other emergency. However, we do have some swine-breeders of the belief that the administration
of the treatment during gestation makes for stronger, healthier litters. The dangers of such vaccination are the likelihood that the pigs will contract hog cholera either from their mothers' milk or through navel inoculation if the sows are vaccinated very close to farrowing time. Rough handling of pregnant sows during vaccination may, of course, result in abortion. There is a proper time for vaccinating. I choose two weeks after weaning and prefer that size of shoat for immunization.

VACCINATION SHOCK

When concentrated serum first became almost universally used, there was much complaint from practitioners due to excessive vaccination shock in pigs, due to chuffy, anemic individuals and litters and the use of superheated clear serum. The fault in the serum has been corrected by careful heating and these complaints have not been general for some time. The more prompt absorption following the intraperitoneal method of administration seemed to cause a greater percentage of shock but practitioners still favor this method as the best.

ABSCESSES

With the improved technic and vaccinating equipment used by practitioners, abscesses following vaccination are almost a thing of the past. As concentrated serum has proven a more nearly sterile product, there is less tissue destruction from pressure, debris and displacement. I consider that the Bureau of Animal Industry did the right and progressive thing in taking the old blood serum off the market. It ought to be as obsolete as the wasteful clear un-concentrated or "filled" serum. Practitioners have always warned against allowing recently vaccinated animals access to mudholes. In explanation, the owners were cited the fact that the needle wounds are gaping tunnels to the microscopically-small disease germs. I would much prefer turning pigs I have just vaccinated into a mudhole covered with a greenish slime than into the infected dust of some hog-houses or hog-lots.

DOSAGE

During these times of economic distress, we are faced with the above problems in aggravated form. In normal droves, it is difficult to obtain consent to use an adequate dosage, but in infected and exposed droves it borders on next to an impossibility to get permission to increase the dosage as the case indicates or requires.
The use of virulent virus is necessary in obtaining an immunity. In attempting to immunize all classes of droves with virulent virus, it is not surprising that practitioners do experience much trouble of the immediate variety.

Experimental evidence shows that dosage as low as 6 cc of serum for a 35-pound pig will protect against 2 cc of known virulent virus in some cases; while in others, it was no protection at all, proving that the resistance to virus varies greatly in litters and in individuals of the same litter. Therefore, in mapping out a dose for use in the field of general practice, it is necessary to adopt a dose table that is sufficient to protect the more highly susceptible. Those of lower susceptibility will take care of themselves. To underestimate the weight of the hog or to underdose the drove deliberately for mercenary reasons or otherwise, some authorities claim, "has caused more trouble in the hog-vaccination field than all other causes combined." Economic pressure brought to bear from publicly subsidized and other lay competitors has caused many practitioners to cut the dose to the minimum prescribed on the label, fighting for the right to exist when their own good judgment told them that a larger dosage was for the best interests of both owner and veterinarian.

**Using Care Not to Spread Hog Cholera**

Veterinary practitioners should be ever on their guard against spreading the virus of hog cholera from farm to farm by their own vehicles or footgear. My practice is to clean and disinfect my shoes or footgear upon leaving any farm where infectious disease is suspected. After all, there are plenty of peddlers, county agents, hog-buyers, neighbors and other visitors to infected hog-lots through whose carelessness and ignorance infectious live stock diseases are widely scattered. I have always made it a practice to destroy my empty virus bottles by burning them. To the credit of the veterinarian let it be said that I have never known or heard of virus containers having been left on a farm by a qualified practitioner.

Most Corn Belt veterinarians are equipped with syringes, needles, vaccinating outfits, instruments, portable troughs, tables, serum ice-boxes, insulated virus containers, antiseptics, etc., to do an efficient job of vaccinating at a real saving of time to the hog-owner and his labor-exchanging neighbors. The veterinarian will choose a serum and virus in which he has full confidence and both he and the owner can sleep without fear of hog cholera in that bunch of hogs. The owner feels that he has received his money's worth and the veterinarian reckons that the pigs have
received an immunity and not simply a "vaccination." Corn Belt hog-growers reckon the hogs vaccinated by their veterinarians *stay vaccinated*. Hog-owners jump over dollars to save pennies when they attempt to vaccinate their own hogs or go shopping for the cheapest price for vaccinating. *Vaccination* may be done at a very low cost, but *immunization* costs real money. Immunization can be accomplished only so cheaply.

**Economic Problems**

Among the more serious of the *economic* problems encountered by the veterinarian in this work are the following:

**Cash Basis**

The inability and failure of swine-owners to make prompt settlement of vaccination accounts. Serum and virus are expensive products, for which the veterinarian must make prompt payment. Their cost constitutes the bulk of the vaccinating bill. If the veterinarian is unable to collect promptly for his work and products, his activities are quickly curtailed because he is unable to finance his business operations.

The reluctance of some hog-owners to pay their vaccination bills immediately upon completion of the work may have originated from their desire for some sort of a guarantee that their animals would do well subsequent to vaccination. This is proven by the fact that during the last two or three years there has been a yearly increase in the proportion of the vaccination business conducted on a cash basis, in spite of the diminished finances of the hog-owners. This is a favorable omen, as unpaid vaccination bills make for lack of appreciation of the value of the treatment.

In other words, necessity arising from present economic conditions has compelled the veterinarian to require prompt settlement for his vaccination work. This, in turn, is educating the owner to the facts that he cannot reasonably expect vaccination against hog cholera to protect his hogs against the many other swine diseases, nor can he reasonably expect the veterinarian to function as a banker in financing the vaccination of the hogs in his territory. No veterinary practitioner could finance the immunization of the majority of the hogs in his territory.

**Subsidized Competition**

A disheartening and demoralizing factor in the hog cholera control work carried on by the practicing veterinarian is subsidized competition. Any situation is manifestly unfair to veterinarians in private practice, which compels them to compete
against vaccination subsidized by public funds. There are many locations in our country where the practitioners have been compelled to meet this unfair competition for years.

**Commercial Activities of Public Employes**

Activities on the part of county agents and others frequently constitute not only an encroachment upon the rights of the practitioners of veterinary medicine, but they also constitute a source of danger to the interests of the live stock industry as well. The serum and virus indiscriminately sold for profit or for political prestige is frequently misused or unskillfully employed with results which are detrimental to the interests of the hog-owners over a wide area by reason of the spread of disease, etc.

These invasions of the veterinary practitioner's rightful field of endeavor greatly reduce the financial income which he may rightly expect from a given territory and serve to discourage veterinarians from entering or remaining in practice. With a reduction in the number of practitioners, live stock losses will inevitably increase, because proper surgical and medical services are not available and because of the absence of the practitioner, who serves as a sentinel to detect the introduction and to effect the control of highly contagious and infectious animal diseases in his community.

**Sale of Biologicals by Farm Bureaus**

The merchandizing of biological products to any and all comers for profit would seem to constitute an activity in violation of the Act of Congress by which these organizations were created and are now supported by public funds.

Circumstances indicate that some of the county agents in Iowa are quietly extending their operations as agents for "farmer serums." The extension of these activities is, of course, welcomed and encouraged by the producers of serum who sell their product directly to the farmer. The justification for this line of activity, as offered by the farm bureau, is based upon the contention that the practicing veterinarians are overcharging the hog-owners for their vaccinating services and, in view of that fact, the farm bureau is forced to handle serum and virus. The Extension Service has long been proud to claim that their efforts have been an important stabilizing factor in the cost of veterinary immunization.

It is admitted that the veterinarian's vaccination charges were comparatively high years ago, when the use of anti-hog cholera serum was inaugurated, but the fact must be considered that the
cost of serum was then several times its present cost. It is also admitted that the service charges of a few veterinarians at that time were too high, but this phase of the situation soon was remedied through the competition which developed among the veterinarians themselves. It is a well-known fact, at present, that competition for vaccinating business is so keen that it would quickly eliminate from this line of activity any practitioner who might desire to overcharge for the work. In fact, the testimony of most practitioners at the present time proves that veterinary competition has reduced their vaccination charges to a point where there is little if any margin of profit in the work.

Certainly no one can seriously contend that the veterinarian is not better qualified than the farmer to carry out the immunization of swine against cholera. The veterinarian is schooled in those basic sciences which concern the control of infectious diseases and, from his knowledge of bacteriology, pathology and immunology, is capable of determining how and when the procedure of vaccination should be carried out as well as deciding when it should not be done. His experience in the annual immunization of thousands of hogs certainly qualifies him to do the work more skillfully, more economically and with better results than an operator who vaccinates a small number of pigs each year.

ATTITUDE OF THE OWNER TOWARDS DIAGNOSIS OF HOG CHOLERA IN HIS DROVE

Considerable difficulty is commonly encountered in convincing the owner of the accuracy of a diagnosis of hog cholera in his non-vaccinated drove. This difficulty at times leads to a delay in the administration of proper treatment, which, in turn, results in losses which might otherwise have been avoided.

When the U. S. Bureau of Animal Industry first introduced hog cholera immunization on a grand scale in several counties of the Hog Belt, over twenty years ago, the attitude of hog-owners was this: If the drove was not vaccinated and was ailing, the owner would believe the sickness to be anything but hog cholera. If vaccinated for hog cholera, the owner could not be convinced that a sickness was any other disease but hog cholera. This attitude remains somewhat to this very day and is both detrimental to the interests of the owner and damaging to the reputation of the veterinarian.

The fact that the serum-virus treatment protects only against hog cholera renders good judgment an essential asset in the practitioner’s efforts to control this disease and his success requires
the exercise of his best judgment regardless of any unreasonable attitude displayed by the owner, or any other distracting factors in the case.

**Minimum Dose Table**

It is a well-established fact among experienced practitioners that the dosage of serum for a given drove of hogs should be governed by conditions existing in that drove. The "minimum dose" recommended by the Bureau of Animal Industry for healthy pigs under favorable conditions is entirely inadequate for unhealthy animals or those in contact with unfavorable conditions. The appearance of this minimum dose table on the serum bottle label frequently leads to difficulties for the practicing veterinarian, because the owner, as a result of having consulted the government dosage table on the label, endeavors to effect an economy by insisting upon a dosage of serum for his animals which is manifestly inadequate in view of their condition.

**Code**

Just now our economists are prescribing industrial codes for the different lines of commercial endeavor. The manufacture and distribution of serum and virus have been brought under a code wherein certain trade discounts have been allowed to the different classes of users, distributors, and so on.

It appears to me that the yardstick of commonplace articles of commerce has been applied by the administration to a highly-specialized commodity with the dollar sign as the unit for computation and no thought given to the harm or good that might be done to the product when it reaches its field of application. I do not believe that any individual of ordinary intelligence and understanding will attempt to dispute the fact that the trained and experienced veterinarian is the safest man to administer hog cholera virus for the purpose of swine immunization on the average Corn Belt farm. Then let me ask you why did the makers of this code lose sight of the fact that the man best qualified to handle this dangerous biologic should be encouraged most in its use, and the least qualified discouraged through the trade discounts granted the different classes of serum handlers.

Is it not reasonable to suppose that in the compilation of the serum code, the highest permissible trade discount from the basic price should be accorded to the safe and competent, and the least discount to the dangerous and incompetent? I hope you will all agree with me that live hog cholera virus is a dangerous product in the hands of incompetent men, from the viewpoint of live stock sanitation.
SUBSIDIZED PRESS

Farm page, farm publications, direct mail and circular advertising to hog-owners of extremely low costs for serum-virus vaccination based on minimum doses of serum and virus not customary in the field with veterinary practitioners of experience makes it difficult to use adequate dosage of serum or virus.

FLUCTUATING PRICES OF SERUM AND VIRUS

The in-and-out-of-season changes in hog cholera serum and virus prices have proven very demoralizing to veterinary practitioners for several years. With each saving in cost of serum and virus, the weak sisters among the practitioners shave their fees further out of proportion to the savings in serum costs and work a hardship on all practitioners thereby.

DEPRESSED CONDITION OF AGRICULTURE

Despite the depressed condition of agriculture, bank closings, live stock handlers' strikes at central markets, direct shipments of live stock breaking live stock sellers' strike at central markets, no money, banks closed and slow release of frozen bank deposits, veterinarians of some sections have experienced a lively and profitable cash vaccinating business in 1933. After all, the fear of hog cholera makes vaccinating jobs. When hogs were selling on the market at $20 per cwt., plenty of unvaccinated droves died from hog cholera, many of them the proportionately valuable blooded droves. Vaccinating costs at that time did not rise in keeping with sky-rocketing hog values. In 1933, with the lowest possible hog market and a proportionately higher vaccination cost, it seems remarkable that many hog-growers would have the courage and hope to raise the money for vaccinating. It really denotes the tenor, faith and calibre of the average man on the farm today and there is much of encouragement to be had in this reflection. If they can have confidence that equitable swine values can return out of all this chaos, why can't we?

Legislative Problems

WEAK VETERINARY PRACTICE ACTS

Most states have veterinary practice acts which forbid the untrained and the unqualified from engaging in the practice of activities which may be detrimental or dangerous to the health or property of their citizens. In the widespread disrespect for law in our country today, our veterinary practice laws are extensively violated by traveling vaccinators, nostrum peddlers,
hog-wormers, etc. These imposters make diagnoses and administer treatments which sometimes result disastrously not only for the immediate victim but for his neighbors as well. Strengthening our veterinary practice laws with adequate penalties and permanent injunctions should have a very salutary effect in curbing the activities of these charlatans and the rigid enforcement of such laws would save thousands of dollars of property annually to the citizens of every state. A powerful lobby of the nostrum manufacturers watches closely and blocks effectively every legislative move of the profession designed to strengthen practice acts.

**USE OF BIOLOGICAL PRODUCTS BY UNTRAINED PERSONS**

Viruses and other disease-producing biological products in the hands of the untrained, the unscrupulous, the negligent, or the ignorant are like dynamite in the hands of a child. The improper or careless handling of these products has been, or could at any time become, a factor in the spread of anthrax, hog cholera, and several other highly infectious animal diseases. All legislative bodies should be petitioned for laws restricting the use of these products to those who are trained and qualified to handle them without jeopardizing the safety of our livestock industry.

**VACCINATION BY LAYMEN**

A discussion of this subject would be too lengthy for this paper and we shall merely state that legislatures should be urged to restrict the activities of lay vaccinators because of the consideration which the solons owe to the swine resources of their respective states. Sensible swine-growers condemn politicians for their short-sighted hog vaccination laws and lack of control over the distribution of virus. Iowa stands almost surrounded by states whose laws permit promiscuous vaccination by laymen and without regulation whatsoever. Our Iowa legislature early passed a law establishing a safeguard and some measure of control by requiring hog-owners to obtain a life-time permit to use virus in vaccinating their own droves of swine. To secure such a permit, it is necessary to pay a nominal fee, attend a two-day school of instruction, and pass an examination. Some 30,000 such permits have been issued by our State Department of Agriculture. Our legislature, at last winter’s regular assembly, were besieged by powerful interests to nullify the permit and vaccination-school provisions of the law and allow the sale of virus to all comers. These foes of the practitioners and animal disease control were soundly beaten at that session. We are expectant of another fight
if the bill be introduced in the special session now on at the Iowa State House.

Much of the blame for lay vaccination in the Corn Belt can be laid to the infant serum industry's poor business methods in the early years. The serum-producers, with none too great business sagacity, extended too much credit to veterinary practitioners and urged that the practitioners put the serum out onto farms, a great part of which credit vaccination never has come to a settlement. The average professional man has ever been notorious for lack of business sagacity. Poor judgment and lax collection methods of veterinary practitioners made heavy accounts receivable for both practitioners and serum-producers. The worst of the tragedy was the impression left with the hog-owners that excessive profits were made by veterinarians in administering the serum-virus treatment. This impression and the bad feeling due to large numbers of hog-owners owing veterinarians for vaccinating bills probably can be blamed on legislatures that have done so little towards correcting the abominable conditions in the field. They must be made to realize that so long as hog cholera virus is used by untrained or partially trained vaccinators, hog cholera will continue to be a serious disease problem on our farms.

LIEN LAWS

Prior lien laws for the protection of the veterinarian against the loss of vaccination bills would be of value in the control of hog cholera. Unpaid vaccination bills create disrespect for the value of the serum-virus treatment. Such laws would eliminate the difficulties and delay frequently encountered in the immunization of mortgaged animals. Such laws also would protect the equity of the owner of the mortgaged hogs in that he could, if necessary, proceed to have the drove immunized against cholera without the consent of the mortgage-holder. In a number of instances the equity of the owner of mortgaged animals has been entirely lost because the mortgage-holder refused to agree to immunization.

Legislation for the control, manufacture, sale, distribution and use of anti-hog cholera serum and virus became a public necessity because of the multitude of abuses that were practiced during the year 1912. At that time, a well boarded-up and roofed-over pen in the public stockyards passed muster as a serum plant, and bovine blood from the killing-floors of nearby packing-houses sometimes did service as anti-hog cholera serum and the cholera-
infected hogs of any size in the yards were the source of supply for virus.

Following these wholesale abuses, the federal Bureau of Animal Industry took over the licensing of all serum plants doing an interstate business and has carried on the work in its usually efficient manner and, in my humble opinion, veterinarians in general and live stock sanitary officials in particular may well extend their appreciation of a work so quietly and efficiently done.

A number of states enacted legislation for the manufacture, sale, distribution and use of anti-hog cholera serum and virus. The state manufacture of serum and virus was dropped like a hot cake by the several states when the agricultural colleges began to feel the back wash from bad luck in the use of the state-produced products. However, throughout the whole legislative program from 1913 to date, one thing has never penetrated the mentality of the legislator—"that hog cholera virus is a living entity of high virulence" and should be entrusted only to the hands of the trained, responsible and experienced. Promiscuous and uncontrolled distribution of hog cholera virus of high virulence is today a very potential source of hog cholera outbreaks in the Corn Belt.

It becomes apparent that wide employment of the great gift of the Dorset-McBryde-Niles discovery to the hog-growers of the United States has done little towards eradicating the scourge of hog cholera from the Corn Belt. After twenty years of hog cholera immunization by this method, the mortality has not been reduced appreciably. It is therefore apparent that the use of the treatment needs modification. It appears to me that the first steps in this direction should be to modify the unrestricted distribution and use of hog cholera virus. In support of this, let me call your attention to the attitude taken by the Dominion of Canada and some European countries towards the use of simultaneous virus.

In contradiction of some of these extreme views held against the use of virus in the field of immunization, let me say, after twenty years of experience with serum and virus in the greatest hog-producing area in the world, that 90 per cent of the qualified veterinarians in the Corn Belt use hog cholera virus with safety. In support of this, let me say that one veterinarian, over a period of four years, involving something like 50,000 head of hogs, used unvaccinated and susceptible check hogs in all healthy simultaneously-treated droves without sickening any of the checks with cholera.
Could legislative action be taken to limit the sale and use of hog cholera virus to the strict supervision of the U. S. Bureau of Animal Industry, I believe much of the harm from misuse of virus could be avoided. There is a small percentage of qualified veterinarians who do not utilize their full knowledge of living virus, either through carelessness or indifference, or by need of meeting unfair competition, and will infect a premise by having vaccinated hogs sicken and die of hog cholera. Restriction in the sale and use of and supervision of the users of hog cholera virus seem to me the outstanding needs towards curbing the losses from hog cholera in the United States.

Before asking for new laws, veterinary practitioners should lead in compliance with the live stock sanitary laws now on the statute books. Veterinary practitioners in most Corn Belt states are required to report to live stock sanitary authorities regarding the presence of hog cholera outbreaks. Publicity given the incidence and location of hog cholera outbreaks through the press can do a great deal to save mortality from hog cholera by causing hog-owners to suspect hog cholera more quickly and call for competent assistance before it is too late. Veterinary practitioners should cooperate with the regulatory authorities by complying with the law and making punctual and accurate reports of hog cholera outbreaks. In turn, regulatory authorities should not be so politically-minded that they will smother the true disease status and publish instead misleading statements in the newspapers that hog cholera is on the wane, hog cholera is less prevalent than in years, and similar disarming misinformation designed to make it appear that these authorities have kept the hog cholera situation well in hand.

Veterinary practitioners should also comply with the law regarding quarantine of cholera-infected droves. They should not counsel nor countenance the practice of cutting out the apparently well from the cholera-sick for transport over country roads, common carriers, and through loading-pens, packing-house pens, and public stockyards for slaughter.

Veterinarians should properly post, on the farm road gate, hog cholera warning placards, authoritative notice to the community that hog cholera has been diagnosed thereon. They should sell the owner of the sick drove on the propriety and good neighborliness of advising all his neighbors of the hog cholera found in his drove. They should also sell the owner so well on the benefits to himself of the warning sign that he will replace same if it comes down off the roadside gate in the rain and wind ere the premises are freed of infection.
Veterinarians also have a duty to perform in advising hog-owners of cholera-sick droves as to the proper disposal of carcases; segregating and penning up the sick animals in quarters which may be cleaned easily; and on methods of cleaning and disinfecting when the trouble is past to prevent harboring the infection on the premises.

The problems herein referred to are only a few of those which are, at the present time, causing grave concern to the practitioners of veterinary medicine. The actual financial incomes of a large proportion of these men have decreased to a point far below the amount required for the living expenses of their families with barter and exchange in lieu of coin of the realm. It is realized, of course, that this serious phase of their situation is caused by the depressed condition of agriculture. Present activities indicate that extreme efforts are being inaugurated for the satisfactory readjustment of agricultural conditions. It is most sincerely hoped that in the formulation and operation of these measures sufficient consideration will be accorded to the importance of the veterinarian to result in restoring him to his rightful position as guardian of the live stock industry.

SUMMARY

In summing up, I hold that, from a clinical standpoint, the practitioners' worst problem in vaccinating is found in the lurking evils that devitalize hogs. Farms with a questionable disease history are always a source of worry. Cholera-susceptible hogs are a source of danger on these farms and attempted immunization all too often brings on trouble. I wonder if the time ever will come when there will be a clinical field laboratory technic whereby a practitioner may detect the border-line drove and if so will we ever have specific treatments for the ailments that complicate and endanger the reaction period incident to the acquiring of immunity as a result of the serum-virus administration.

From an economic standpoint, the spread of serum, virus, and biological sales by subsidized competition is one of the greatest problems, as a man whose time and expenses are paid by the public can give much effort to building up a profitable serum business for himself at the expense of the veterinary practitioner.

From a legislative standpoint, the most important problem is to induce the legislatures to restrict the sale and use of hog cholera virus.
1. Serum and virus treatment, injudiciously applied, is frequently a potential source of a hog cholera outbreak.

2. All virus furnished for simultaneous vaccination does not possess the necessary properties to impart a solid immunity.

3. Subsidized competition in the use of our most dangerous biologic is a severe menace to disease control.

4. Clinical ability overpowered by economic necessity is an unthinkable condition in the field of livestock disease control.

5. The use of hog cholera virus must be restricted to those who are willing and able to safeguard its dangers as a disease-spreading entity.

President Faulkner: We are exceedingly fortunate this morning in having with us Dr. C. N. McBryde, of Ames, Iowa, who will present a paper entitled, "The Persistence of Hog-Cholera Virus in the Bodies of Swine After Simultaneous Inoculation." (Applause.)

... Dr. McBryde read his paper. ... .

THE PERSISTENCE OF HOG CHOLERA VIRUS IN THE BODIES OF SWINE AFTER SIMULTANEOUS INOCULATION

By C. N. McBryde, Ames, Iowa

Biochemic Division, Bureau of Animal Industry

U. S. Department of Agriculture

INTRODUCTORY

It has long been known that the virus of hog cholera circulates in the blood of swine for a considerable time after simultaneous immunization.

Experiments, carried out at our Field Station at Ames, in 1916, showed that virus persisted in the blood of simultaneously treated pigs for about two weeks, but was no longer present at the end of 28 days. The presence of the virus in the blood was established by the subcutaneous injection of susceptible pigs with blood samples obtained by tail-bleeding animals which had previously been subjected to simultaneous immunization. In spite of this fact, however, the virus apparently was not thrown off from the bodies of the vaccinated pigs unless the latter showed a visible reaction or symptoms of illness following immunization. This conclusion was reached through our invariable custom of placing untreated, susceptible pigs (pen controls) in contact with all simultaneously treated pigs in our early experiments in hog cholera immunization. It seemed to be quite clearly established
from these early experiments that healthy pigs, properly immunized with adequate doses of serum, did not transmit hog cholera by association and could not therefore be regarded as a potential danger in the spread of this disease. In some foreign countries, however, the practice of the double method of immunization has been regarded as fraught with danger because of this eventuality.

It would appear that this matter received little further experimental study until the last year or two, when a number of articles bearing on the subject have appeared in the foreign journals. A few of the more important of these articles will be reviewed briefly.

LITERATURE CITED

Michalka, in Austria, in 1931, published his results obtained with the simultaneous method of immunization in breeding and feeding establishments. This article aroused considerable discussion in Europe and apparently stimulated other investigators to carry out work along similar lines. Michalka states that he was able to demonstrate experimentally the virus of hog cholera in the hemorrhagic lymph-glands of immune animals up to 10 months, in 76 per cent of the cases studied by him. From this high percentage of so-called "virus carriers," he considered it likely that the immunity in hog cholera is what he terms an "infection immunity." He also states that four weeks after simultaneous inoculation, virus could no longer be demonstrated in the secretions or excreta of vaccinated pigs, but refers to the occasional occurrence of so-called "late reactions" in such animals after three or four months. He regards the existence of large numbers of so-called virus carriers as being the cause of the bad conditions in chronically infected breeding herds and suggests, for the improvement of these conditions, that the simultaneous immunization of all suckling pigs should be considered, but goes on to say that in Austria this procedure would be impossible because of regulatory and economic reasons.

Manninger and Csontos, at the veterinary college in Budapest, in April, 1932, published the results of an investigation, in which they criticized the work of Michalka. These investigators found that the lymph-glands in swine which had been subjected to simultaneous inoculation, or those which had survived a serious illness following a subcutaneous injection of highly virulent hog cholera virus, contained the virus for 26 days, at the latest, after injection and therefore claim there are no grounds for Michalka's assumption that the immunity in hog cholera is an infection immunity.
Manninger and László, also working at the veterinary college in Budapest, published the results of further experimental work in June, 1932, in which they reached the following conclusions:

1. Hog cholera virus, when introduced under the skin of simultaneously treated animals, does not generally reach the lymphatic glands, but appears to be destroyed at the point of injection.
2. In the case of simultaneously treated pigs, the virus disappears from the urine between the 15th and 21st days after inoculation.
3. The feces and also the blood of animals infected with hog cholera do not contain the virus after the 20th to the 28th day.

Hegyeli, working at Budapest, in the laboratories of a commercial concern engaged in the production of serum, published an article, in October, 1932, on virus carriers in hog cholera. His more important conclusions were as follows: (1) It was possible to set up fatal disease in susceptible pigs with the urine of simultaneously treated pigs up to the 19th day after immunization. At 31 days, virus could no longer be demonstrated in the urine. (2) Virus could not be demonstrated in the spleen or lymphatic glands after the 21st day. (3) Large amounts of virus are rendered harmless within the bodies of immune shots within 24 hours and such animals do not become virus carriers as a result of subsequent infection. (4) The immunity against hog cholera is a "sterile immunity" and not an infection immunity.

Uhlenhuth, Miessner and Geiger, working in Germany, published the results of an extensive investigation in December, 1932. These investigators state they were able to demonstrate virus in the urine of simultaneously treated pigs until the 39th day, at the latest, while experiments carried further to the 61st day were negative. They state that an absolute regularity in the excretion of virus did not occur in the first 40 days, as the excretion of virus could not be demonstrated in samples collected on the 23rd, 24th and 31st days. They conclude that the reaction of the vaccinated animals has an influence on the duration of the virus excretion. They believe that when a highly virulent virus is used, a more rapid infection takes place and there is an earlier termination of virus excretion, while in the case of a weaker virus there is a longer infection period and a longer excretion period. Experiments were carried out to determine whether virus is harbored in the lymphatic glands and muscles of simultaneously treated pigs, tests being made at 22, 27, 40, 64, 77 and 84 days, with negative results in every case, and attention was called to the fact that these results failed to confirm those of
Michalka. Transmission experiments also were carried out and the conclusion was reached that the danger is slight, under practical conditions, of creating continuous virus secretors or carriers through simultaneous inoculation and that consequently there is little reason to fear that disease will be spread by fully recovered pigs.

Beller and Biermann,7 of the veterinary division of the federal public health administration at Berlin, published in May, 1933, the results of investigations relative to the occurrence of virus carriers and virus spreaders in hog cholera. These investigators reached the conclusion that the duration of the excretion of virus in the case of simultaneously immunized swine depends upon the extent or degree of reaction. If there is no clinical reaction or a very slight reaction, the excretion of virus in the urine is practically ended after four weeks. In the case of insufficient serum protection, however, with a resultant slow infection, virus excretion was observed up to the 38th day and in one case to the 67th day.

Sarnowiec8 published in a Polish journal, in August, 1933, an article on the contagiousness of the virus of hog cholera in animals vaccinated by the serum-virus method. It was impossible to obtain the Polish journal, but a summary of the article was found in a French review. This investigator states that animals vaccinated by the simultaneous method discharge virulent hog cholera virus in their secretions and excretions and regards the duration of infectivity as a function of the intensity of the reaction in the vaccinated animals. He concludes that the secretions and excretions are more virulent in the case of a strong reaction than in the case of a weak reaction and the greatest virulence is observed in the first period of absorption of the virus, after which it diminishes until it finally disappears. Sarnowiec states further that the urine and saliva of vaccinated hogs possess all the properties of hog cholera virus and are capable of infecting healthy animals in all ways, notably per os, under the skin and through simple cohabitation. He states that the urine and saliva of vaccinated animals lose their virulence by the 15th day after the end of the reaction caused by vaccination, if this reaction has been a normal one, and he believes that the degree of infectivity of the urine and saliva can be estimated by an examination of the temperature curves.

In view of the somewhat varying results and divergence of opinion expressed by some of the European investigators who have been cited, and because of the fact that the question of the
persistence or survival of virus in the bodies of swine after simultaneous immunization is a matter of considerable importance, it seemed advisable to carry out some further experimental work along this line.

EXPERIMENTAL WORK

Experiment to Determine Whether the Virus of Hog Cholera Persists in the Lymphatic Glands of Simultaneously Treated Pigs

This experiment was designed primarily with a view to checking the findings of Michalka, previously cited, who claimed that virus persists in the lymphatic glands of immune swine for ten months.

In carrying out the experiment, eight susceptible pigs, having an average weight of from 45 to 50 pounds, were given simultaneous treatment, each pig receiving 35 cc of serum and 2 cc of virus. The pigs were divided into two lots of four, each lot being placed in an experiment pen along with two untreated controls. In order to avoid the possibility of introducing any outside infection, no temperatures were taken, but the pigs were kept under careful, daily observation. All of the serum-treated pigs remained well, as did the pen controls.

Three of the simultaneously treated pigs were killed at the end of 21 days by bleeding from the throat through a sterile canula, the blood of each pig being collected separately and saved for the injection of susceptible pigs. The only lesions noted in the organs of these pigs were a few petechiae in the bladder, the other organs being entirely normal. The cervical, bronchial, inguinal, mesenteric and portal lymphatic glands of each pig were carefully removed under as nearly aseptic conditions as possible and examined separately. In examining the glands, they were freed from connective tissue and fat and were carefully examined. The cervical glands in all three of the pigs showed well-marked, peripheral reddening and small petechial hemorrhages in the gland tissue; these lesions were sometimes apparent only in certain lobes and not throughout the entire gland. In one of the pigs, all of the glands were apparently normal. In two, the mesenteric, portal and bronchial glands showed hemorrhagic lesions in addition to those noted in the cervical glands, and in one of these pigs the inguinal glands also showed slight peripheral reddening in one lobe.

The glands of each pig were chopped with sterile scissors, mixed and ground in a large sterile, porcelain mortar. During the grinding process, 25 cc of sterile salt solution was added to
the combined gland tissue. The resulting suspension was then passed through several thicknesses of sterile gauze and in this way about 20 cc of slightly milky gland suspension was obtained from the glands of each pig.

Two susceptible pigs were injected subcutaneously with 10 cc of each of gland suspension from each of the simultaneously treated pigs and at the same time two susceptible pigs also were injected with 5 cc each of defibrinated blood collected from the corresponding simultaneous pig. Thus, there were four susceptible pigs injected with material obtained from each of the simultaneously treated pigs, two receiving gland suspension and two defibrinated throat blood.

At the end of 42 days, three more simultaneously treated pigs, which had shown no reaction following vaccination, were killed and the throat blood and gland suspension used for the injection of susceptible pigs, as before. On postmortem examination, all three of these pigs showed slight reddening of the mucous membrane of the bladder and one showed a few petechiae in the mucosa; there were no other lesions in the internal organs. The cervical glands were normal in all three of the pigs, as were the inguinal in two and the bronchial and portal in one. In two pigs the bronchial, portal and mesenteric glands showed slight peripheral reddening and in one pig there was some reddening of the inguinal gland on one side.

Twelve susceptible pigs, weighing from 55 to 75 pounds, were injected, as before, with the defibrinated blood and gland suspensions obtained from the three simultaneously treated pigs killed at the end of 42 days.

The results of this experiment were briefly as follows:

Defibrinated blood obtained from three simultaneously treated pigs, killed at the end of 21 days, failed to set up disease in susceptible pigs. In two instances, gland suspensions from the same pigs produced sickness. In one instance, the resulting sickness was clinically like subacute hog cholera, but the postmortem lesions did not correspond with those ordinarily seen in that type of the disease. In the other instance, the sickness was more acute, causing the death of one pig within 14 days, with lesions like those seen in acute hog cholera, and in another pig a transient reaction or illness, which was sufficient to protect the pig against a subsequent injection of hog cholera virus. From these results, it would appear that the virus, in a somewhat attenuated form, persisted in the lymphatic glands of two out of three simultaneously treated pigs killed at the end of 21 days.
All of the susceptible pigs which received defibrinated blood and gland suspensions obtained from three simultaneously treated pigs killed at the end of 42 days remained perfectly well, indicating that the virus had disappeared entirely from the lymphatic glands as well as the circulating blood at this time.

The susceptibility of all surviving pigs in this experiment and those which follow was subsequently established.

It was the intention to kill the remaining serum-treated pigs at a later date, around three months, for further tests of blood and gland tissue, but after the injections of blood and gland tissue proved negative at 42 days this was not deemed necessary.

The results of the experiment may be summarized as follows:
(1) Hog cholera virus could not be demonstrated in the circulating blood of simultaneously treated pigs at the end of 21 days and (2) hog cholera virus appeared to persist in the lymphatic glands of simultaneously treated pigs in an attenuated form at 21 days, but had entirely disappeared from these glands at the end of 42 days.

It will be noted that these findings, in regard to the persistence of virus in the lymphatic glands of simultaneously treated pigs, are in practical agreement with those of Hegyeli, and Manninger and Csontos, who found that the virus may persist in the lymphatic glands for from 21 to 26 days after immunization.

Experiments to Determine the Infectiousness of the Urine of Simultaneously Treated Pigs

Experiment 1: In carrying out this experiment, two susceptible pigs, weighing approximately 60 pounds each, were given a full dose of serum with the usual 2-cc dose of virus and placed in a clean, disinfected pen with an untreated control pig. At the same time, two shotes of approximately the same weight were given 2 cc each of virus only and placed in another pen with an untreated control pig.

On the fifth day after inoculation, urine was collected from the two pigs which received serum and virus, mixed in equal quantities, and used for the injection of two susceptible pigs. Urine was collected on the same day also from one of the pigs injected with virus only and used for the injection of two susceptible pigs. It was the intention to collect urine from both of the virus pigs at this time, but this could not be accomplished in the case of one of these pigs. The urine samples were collected by means of small glass jars fastened at the end of rods, which were slipped beneath the animals at the time of urination by attendants, who some-
times had to sit beside the pens for the greater part of a day. Sow pigs were used in these experiments for obvious reasons.

Urine samples were collected again from the vaccinated pigs on the tenth, 15th and 26th days and from the virus pigs on the tenth and 15th days after injection and used for the injection of susceptible pigs. Each of the susceptible pigs which served as test pigs in these experiments received subcutaneous injections of 30 cc of urine.

Both of the pigs which were given serum and virus to furnish urine remained visibly well. One of these pigs, however, showed a definite, though not severe, temperature reaction from the third to the eighth day and the other pig exhibited a slight temperature reaction. The pigs which received virus only were both slow on the fourth day, with temperatures above 105; both pigs grew progressively worse and died at 17 and 19 days, exhibiting at autopsy the characteristic hemorrhagic lesions of hog cholera. The uninoculated control pig in the pen with the virus pigs became sick on the eleventh day, was killed in moribund condition on the 23rd day and showed characteristic lesions of hog cholera at autopsy. The untreated control pig in the pen with the two vaccinated pigs sickened on the tenth day and was killed in worthless condition on the 17th day; this pig also exhibited cholera lesions at autopsy. This last result was altogether contrary to our earlier experiments, in which simultaneously treated pigs did not transmit disease in the absence of visible symptoms, and it seems not unlikely that infection may have been carried to the pen control in this instance by attendants in taking temperatures.

The results of the urine tests were briefly as follows: All of the susceptible pigs, eight in number, injected with urine samples collected from the serum-treated pigs on the fifth, tenth, 15th and 26th days, remained well. In the case of pigs injected with urine samples from virus pigs, the pigs receiving virus collected at five days did not sicken, whereas those injected with urine collected on the tenth and 15th days sickened promptly and developed acute hog cholera, from which they died or else were killed when moribund.

In this experiment, the urine of cholera-infected pigs collected on the fifth day was not infectious, but proved to be so on the tenth and 15th days. The urine from simultaneously treated pigs, collected on the fifth, tenth and 15th days, was not infectious.
Experiment 2: This experiment was virtually a repetition of the first experiment and was carried out in much the same manner but under different conditions, as will be explained later.

The two pigs which were given simultaneous treatment to furnish urine in this experiment showed no visible symptoms of illness, but one of these pigs showed a slight but definite temperature reaction beginning on the third day and lasting for several days.

The two pigs which were injected with virus only to furnish urine were both slow on the third day and developed typical, acute hog cholera. One of these pigs died on the 14th day and the other was killed in moribund condition on the 19th day; both showed typical hemorrhagic lesions at autopsy. Urine was collected from these pigs on the fifth and ninth days and used for the injection of susceptible pigs, the urine from the two virus pigs being mixed in equal quantities before injection.

Urine was collected also from the two simultaneously treated pigs on the fifth, ninth, 15th, 20th and 26th days and used for the injection of susceptible pigs.

The results of the urine tests were briefly as follows: All of the test pigs injected with urine collected from the virus pigs on the fifth and ninth days developed acute hog cholera within three to four days after injection. In the case of the pigs injected with urine samples collected from simultaneously treated pigs on the fifth, ninth, 15th, 20th and 26th days, all of these developed hog cholera with the exception of those receiving urine collected on the 15th day; the latter were exposed to cholera subsequently and proven to be susceptible.

Much to our surprise, the results obtained in this experiment were entirely contrary to those obtained in the first experiment. In the first experiment, urine samples collected from simultaneously treated pigs at five, ten, 15 and 26 days after vaccination were all negative, while in the second experiment virus was present in the urine of such pigs at five days and persisted for 26 days.

In explanation of the conflicting results obtained in the two experiments which have just been described, it is felt that the second experiment is open to possible criticism and the results obtained are somewhat questionable for the following reason: The first experiment was carried out in August and the pigs furnishing the urine were kept in outside individual pens. The weather then was fair and warm and it was no great hardship for the attendants to sit beside the pens watching for the pigs
to urinate. The second experiment, however, was not carried out until October and it was then too cold to keep men watching beside pens out-of-doors, so the pigs furnishing urine were placed in disinfected stalls in a large barn. In this barn, sick pigs had been kept and although the stalls in which the urine pigs were placed had been thoroughly disinfected, there was a possibility that the urine samples may have become contaminated with virus through outside channels and we feel that the conditions under which the second experiment was carried out were by no means as favorable as those obtaining in the first experiment. On the other hand, it is possible that the opposite results obtained in these experiments would indicate that virus may be thrown off by simultaneously treated pigs for a limited time, but in drawing our conclusions we would place more emphasis on the results of the first experiment, in which no virus was excreted in the urine of such pigs.

While the experimental work reported in this paper is somewhat meager, it nevertheless furnishes some additional data on important questions relative to hog cholera immunization and the spread of this disease. The main points brought out in these investigations, coupled with observations made in earlier experiments, are as follows:

SUMMARY

1. Hog cholera virus could not be demonstrated in the circulating blood of simultaneously treated pigs three weeks after vaccination. In earlier experiments, it was found to be present at two weeks, but not at four weeks and it apparently disappears from the circulating blood somewhere around the third week after vaccination.

2. Hog cholera virus may persist in the lymphatic glands of simultaneously treated pigs at three weeks, but in no case could it be found in these glands at the end of six weeks. These results, taken in conjunction with those of other investigators who have been cited, would seem to disprove the contention of Michalka that the virus persists in the lymphatic glands of simultaneously treated pigs as late as ten months after vaccination and would seem to negative his theories regarding "late reactions" and "virus carriers" in connection with simultaneous immunization.

3. In two experiments to test the infectiousness of the urine of simultaneously treated pigs, no virus was found at any time in one experiment, while in another experiment it was apparently present in tests made at five, nine, 20 and 26 days, but was absent on the 15th day. These results may indicate that the excretion
of virus in the urine of simultaneously treated pigs is a variable function; that is to say, it may or may not occur and when it does occur the virus is not thrown off with absolute regularity. In view of the entirely negative results in the first experiment, however, which was carried out under more ideal conditions than the second one, it would seem doubtful whether virus is excreted in the urine to any extent by simultaneously treated pigs. Furthermore, even though virus may be thrown off in the urine, it does not follow that susceptible pigs would necessarily pick up cholera infection from this source; this was shown in earlier experiments in which large amounts of urine from cholera-sick pigs were scattered in pens containing susceptible pigs, with negative results.

4. The findings reported in the present paper and in earlier experiments which have been cited would seem to support the conclusions arrived at some years ago, which have recently been confirmed by Uhlenhuth and his coworkers, that there is little, if any, danger, under practical conditions, of creating virus carriers or spreaders through simultaneous immunization. This conclusion is further confirmed by the good results which have followed the widespread use of simultaneous immunization in this country.

5. It is desired to emphasize the fact that the experiments reported in the present paper are of a preliminary nature and the conclusions which have been reached should not be regarded as final, for it is quite evident that further study should be given this matter.

REFERENCES

REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

DR. U. G. HOUCK, Chairman, Washington, D. C.
Dr. A. T. Kinsley, Kansas City, Mo.
Dr. C. N. McBryde, Ames, Iowa
Dr. Ralph Graham, Jefferson City, Mo.
Dr. H. D. Port, Cheyenne, Wyo.
Dr. H. J. Shore, Fort Dodge, Iowa

Committees of this Association have been invading the swine-disease battlefield continuously since 1916. Although the invisible enemies of swine have not been eliminated, sufficient has been learned through research and experience concerning their identities, habits, and modes of propagation, so that now we are able to prevent, or defeat, the attacks of many of them through the use of armamentarium developed by science.

The front-line trenches maintained by this Association, through approval of the reports of committees early in the field, are:

- Judicious breeding, proper feeding and management of swine.
- Sanitation, disinfection and quarantine.
- Recognition of the fact that the sick hog is the primary source of infection.
- State control of the sale and distribution of hog cholera virus.
- Uniformity in measures adopted for regulating the inter- and intra-state movement of swine.

Various wings have been, or are being extended from the front-line trenches to strengthen our defense and protect more effectually our swine industry against preventable losses. Prominent among the movements covered in the reports of previous committees are:

- The condemnation of worthless remedies.
- Disapproval of the administration of dangerous biological products by laymen.
- Recognition of the possible danger of feeding garbage containing pork scraps to animals susceptible to hog cholera.
- The importance of immunizing susceptible stocker and feeder pigs, especially those purchased at public markets.
- The advantages of immunizing pigs while they are young.
- Careful differential diagnosis of diseases and conditions which, through lowering vitality, interfere with success in immunization against hog cholera; in other words, a better understanding of the cause of most breaks in immunity.
- Supervision of the production and the proper care of anti-hog cholera serum and hog cholera virus continuously from the date of production until they are finally used.
- Liberal dosage of anti-hog cholera serum in field practice.
- The need for supervision of live stock public sales and the movement of live stock by motor trucks.
- A proper professional procedure in diagnosing disease and in administering prophylactic and remedial treatments.

A review of the reports of previous committees seems to indicate that little remains to be said without repetition, on the subject of transmissible diseases of swine. It is recommended that those who are interested in the diseases of swine review the reports which have been
presented by your committees and approved by the Association, as they contain much information and good advice.

An important question is: What is being done by state live stock sanitary officials to carry into effect the recommendations of the Association intended to improve and extend protection against losses from swine diseases? Recently your Committee addressed an inquiry along this line to the proper authority of each of our 48 states. Replies were received from 41 states, showing that protective measures have been extended, or improved, in twelve states during the present year. The improvements consisted principally of perfecting organization and expanding state veterinary forces, strengthening regulations, and establishing veterinary supervision over private places where swine are sold at auction.

**Swine Erysipelas**

The report of the 1932 Committee included a comprehensive statement on the swine erysipelas situation in this country. While this disease has not been so prevalent during the past twelve months as the preceding year, it has appeared in some new territory, showing that it is spreading, or that it has not been recognized before in these areas.

Results of investigations conducted in the laboratory and in the field during the current year show that both the rapid-plate and the tube agglutination tests are very helpful means of diagnosing outbreaks of swine erysipelas. Recent studies have shown that positive agglutination reactions are obtained early in the acute stage of the disease, as well as in the chronic cases where arthritis is present. A positive reaction to the test for swine erysipelas in the acute or chronic form does not, however, eliminate the possible presence of hog cholera or some other type of infection, since it has been shown that both hog cholera and swine erysipelas may be present in an animal at the same time. "Carriers" is a subject of interest in connection with this disease.

**Disease of Swine Other Than Cholera**

Reports from 25 states indicate that on the whole there has been no perceptible increase this year in the common diseases of swine, exclusive of cholera. One of the 25 states reported an increase in the prevalence of some of these diseases, 15 reported no perceptible change, and nine reported decreases. If statistics were available, they would, no doubt, show surprisingly large losses from the so-called suipestifer infections. Field observations suggest the need for further study with the hope of developing more successful measures for the control of these diseases.

**Hog Cholera**

Eleven of 25 principal hog-growing states reported some increases in hog cholera compared with last year; seven states reported less, and seven states reported no perceptible change.

The purchase of 6,140,976 pigs and 214,387 pregnant sows by the Agricultural Adjustment Administration between August 23 and September 30 has had a perceptible effect on the prevalence of hog cholera through removing susceptible pigs from our hog population. Reports indicate that up to November 1 there was some increase in the prevalence of hog cholera compared with last year, and the losses were correspondingly greater in most states where hog-raising is a principal industry. Since the first of November, there has been a marked decrease in the prevalence of this disease.

Hog cholera is still the swine disease of chief importance in this country. Although hog cholera has been studied and investigated more than any other disease of swine, there remain features which deserve further study, as, for instance, differential diagnosis and the methods by which the virus is disseminated.
REPORT OF SECRETARY-TREASURER

It is desirable that improvements be made in immunization with particular reference to reduction of cost. There is need for creating a more profound respect generally for quarantine regulations relating to hog cholera, and there should be more effectual supervision of auction sales, hog clinics, rendering-plants, and the transportation of swine.

We regret that this report does not represent the entire committee as appointed, due to the untimely death on June 13, 1933, of Dr. E. M. Pickens, one of its most capable and highly esteemed members.

PRESIDENT FAULDER: You have heard the report. What is your pleasure?

DR. KINSLEY: I move that it be received and referred to the Executive Committee.

. . . The motion was duly seconded and carried. . . .

PRESIDENT FAULDER: I am informed by the Secretary that the Executive Committee passed a motion authorizing the President to appoint three members of the Executive Committee to be known as the Nominating Committee. At this time I am pleased to appoint:

Dr. Walter Wisnicky, Wisconsin
Dr. R. W. Smith, New Hampshire
Dr. H. D. Port, Wyoming

That Committee will bring in nominations for officers for the ensuing year, President and three Vice Presidents.

At this time I will request Dr. Mayo and Dr. Dyson to come to the platform. Dr. Mayo has a message for the members.

DR. MAYO: Dr. Dyson, on behalf of this Association, I have a tribute for you. Its intrinsic value is not great, but if human appreciation and hopes and sympathies are of value, then it is unmeasured. (Applause.)

SECRETARY DYSON: This is the first time I have had an opportunity to present the report of the Secretary-Treasurer. I shall give my attention to this later.

. . . Secretary Dyson then read his report. (See page 434.) . . .

SECRETARY DYSON: There has been a decided number of changes in state veterinarians in states that hold memberships, during the past year. It seems that the new state veterinarians were not familiar with the fact that by reason of their office they automatically become members of the Executive Committee. It seems there was a misunderstanding of that, and some of the new members did not attend the meeting. Hereafter we will endeavor to notify them. It is sometimes a month or two before I find there has been a change in the office of state veterinarian. I have a good deal of trouble in keeping up with the procession.

In regard to this, this is the second occasion that I have been the recipient of a token on the part of the Executive Committee. It is in the form of a $100 United States Government bond. It is in appreciation of the services that I have rendered in my official capacity as Secretary-Treasurer.

I assure you that I accept the gift in the spirit in which it has been given. I don't know that I can add anything more to that. There are a lot of things I should like to say. I thoroughly appreciate this, but I want to assure you that I have never served the Association in any capacity in the hope of any material reward or compensation.

I thank you. (Applause.)
# FINANCIAL STATEMENT

O. E. Dyson, Secretary-Treasurer

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Los Angeles County, Calif.
U. S. Bureau of Animal Industry
Canada Department of Agriculture

*December 1, 1933.*
President Faulder: You have heard this excellent financial report of Dr. Dyson, which clearly indicates that our treasury is in a healthy condition. What is your pleasure?

Dr. Spence: I move that the report be accepted and filed.

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

President Faulder: We will adjourn until 1:45 o'clock.

... The session adjourned at 12 noon.

Recess

Thursday afternoon, December 7, 1933

The fourth session convened at 1:50 p.m., President Faulder presiding.

President Faulder: The meeting will please come to order. You will see by your program that the entire afternoon is to be devoted to a discussion of tuberculosis.

The first paper is entitled, "Human Tuberculosis and Its Control." This will be presented by Dr. J. A. Myers, Professor of Preventive Medicine, University of Minnesota, and Chief, Medical Staff, Lymanhurst School for Crippled Children, Minneapolis, Minn. It is an extreme pleasure to present Dr. Myers. (Applause.)

Dr. Myers: I feel greatly honored in being asked to speak before your group for, to my mind, you have presented the greatest demonstration of tuberculosis control that the world has ever seen. It really makes us ashamed in human medicine when we see how little we have actually accomplished, compared with what has been done by your group.

I want to talk almost entirely from lantern slides and, as we go along, try to point out that we are now attempting to follow the lead that you have taken.

... Dr. Myers then continued his address, illustrating it with an outstanding collection of lantern-slides that clearly and forcibly pictured the insidious ways and means by which tuberculous infections are transmitted from infected individuals to healthy subjects through intimate association or cohabitation prior to the development of any clinical evidence of the disease in the individual serving as a carrier of the infection.

President Faulder: Without hesitation, I am going to term that presentation by Dr. Myers as wonderful. I can't think of a better adjective to use.

To show our appreciation to Dr. Myers, let us give him a rising vote of thanks and hope he will come to us again.

The audience rose and applauded.

President Faulder: The first to discuss this subject is Dr. William H. Feldman, of the Mayo Foundation for Medical Education and Research, Rochester, Minn. I present Dr. Feldman. (Applause.)

Dr. Feldman: Those of us in Minnesota who have followed Dr. Myers' splendid work in combating tuberculosis in human beings have been impressed with his one major premise. He has insisted upon and keeps continually emphasizing an old truth that tuberculosis is really a communicable disease and that the susceptible individual contracts the infection by coming in contact with a live tubercle bacillus. Prevention is therefore fundamentally a simple matter of separating the sick from the well. In his attack on the disease, Dr. Myers is uncompromising and his efforts have netted results that are noteworthy.

After Koch's epochal demonstration of the causative agent of tuberculosis, precise knowledge concerning the pathogenesis, pathology and therapeutics of the disease was rapidly obtained. Before long, how-
ever, it became evident that the solution of the tuberculosis problem was not so simple as was first supposed.

While it has been over fifty years since the tubercle bacillus was first recognized, many phases of the disease are not yet understood. To mention but one of the problems we might consider for a moment the so-called "no-lesion" type of reactor. Animals that react to a diagnostic dose of tuberculin, yet which fail to reveal significant morphologic changes at postmortem are observed frequently enough to require an explanation. It is my impression that many reactions of this type in certain areas are due to a group sensitivity of tuberculin for various pathogenic forms of the genus Mycobacterium and not necessarily to the bovine form of the organism. Experimentally it has been shown that mammals, including cattle, may become sensitized by the avian tubercle bacillus and reveal an allergic state following the introduction of mammalian tuberculin. Furthermore, we have succeeded in a few instances in obtaining the avian tubercle bacillus from the tissues of cattle which had reacted positively to a routine tuberculin test and which failed to disclose lesions at necropsy. These observations would seem to justify renewed interest in the avian tuberculosis problem and emphasize again that final success in the eradication program will be achieved only when it is no longer possible for animals to come in contact with a pathogenic form of the bacillus regardless of its natural host.

PRESIDENT FAULDER: The second gentleman to discuss the address by Dr. Myers, is Dr. E. A. Crossman, B. A. I. Inspector-in-Charge, Boston, Mass.

Dr. CROSSMAN: When the tuberculosis eradication program was started in 1917, it was a distinctly economic measure proposed by a group of cattle-breeders and a few others. The disease was making inroads into some of the best breeding herds in America and it was evident that something must be done to control this insidious disease. The project was hardly under way, however, when the public health side came into the picture. Research workers had determined that tuberculosis in cattle could be transmitted to humans through the consumption of raw milk from tuberculous cows. This theory was not accepted by all physicians and health workers, or by many of the cattle-owners. It became necessary, therefore, to put on a campaign of education. This was done through the publication of bulletins by the government and many of the individual states, and by motion-pictures which embodied interesting stories and brought out the reality of the danger of contracting tuberculosis from tuberculous cows.

A large group of veterinarians, both state and federal, associated with public health workers and a few others, simply went out and sold this proposition to the public, both the producer and the consumer. We were fortified with the reports of research workers both in America and Europe. We made progress, but slowly. Unfortunately a very eminent scientist in Europe had made a public statement that the danger of infection from bovine tuberculosis was negligible. I say unfortunate. Possibly it was very fortunate, for almost immediately a number of equally eminent men began studying the conditions in their own country with the result that all were agreed that the disease was transmissible, their reports varying only in the percentage of infection found due to the bovine type.

Still with this evidence of outstanding scientists, it was difficult to persuade some of our executives and legislators that from a public health viewpoint it was economically sound business to spend public money for the purpose of destroying and partially reimbursing the owner for diseased cattle. We had also to contend with the theory advanced by some of the physicians, that an infant was fortunate to
have an infection of the bovine type, causing an immunity against a reinfection later in life. Not until we were able to demonstrate in a small way that eradication of bovine tuberculosis from a given area would reduce the infant mortality and reduce tuberculous infection in children, were we able to make much headway.

You are familiar with the records presented to this organization a few years ago by Dr. Herman N. Bundesen. Briefly, they are as follows: The first year following the Chicago milk ordinance, 532 fewer babies died than during the previous year. Our opponents immediately came back with the statement that, admitting that Bundesen's records were correct, in all probability this reduction in infant mortality was due to improved sanitary conditions and the pasteurization of milk. If it were true that the improved condition in Chicago was due to pasteurization, let us check up on some smaller cities and communities where not so many children and babies were involved. Let us look at the record of Manchester, N. H., a city of 75,000 population. In 1917, the year our project started, 35 deaths occurred in children from non-pulmonary tuberculosis. In 1927, ten years later, only 14 deaths from all forms other than pulmonary tuberculosis, and in 1929, not one child under three years of age died of tuberculosis in that city. Manchester was the first city of any size in New England which, early in the program, provided that all milk sold within its borders should be drawn from officially tuberculin-tested cows or pasteurized.

Now let me present a picture from two towns in Massachusetts adjoining each other. One, the town of Milton, population about 12,000. In 1922, the Board of Health of this town adopted a regulation requiring the tuberculin-testing of all cows whose milk was sold in a raw state in that town. An uproar came from the farmers. (Massachusetts as a state had done nothing to speak of up to this time in eradicating tuberculosis, except in individual herds scattered about the State.) After this ordinance had been in effect a year or so, the physician for the Board of Health decided to satisfy himself whether or not the ordinance was protecting the community. Was the hardship on the farmers justified? The physician tuberculin-tested all the babies and pre-school children coming into the Milton clinic and, as a control group, those going to the clinic in the adjoining town of Canton, where no milk ordinance existed. Sixty-nine children were tested in Milton. One reacted, three were doubtful, and there was 1.4 per cent positives. In Canton, 43 children were tested. Six were positive, six were doubtful, and there were 16.2 per cent positives. I mention these cases because in small communities it is much easier to keep an accurate check on all details.

Many of the men in this audience are familiar with the statistics recently edited by Prof. H. R. Smith, Live Stock Commissioner, National Live Stock Exchange. Without presenting a lot of figures which might be confusing, I will give you a brief summary of the statistics compiled by him. As soon as a state was placed in the modified accredited group, Prof. Smith ascertained through the State Department of Health the tuberculosis death-date in that particular state for the past twenty or thirty years. Without any exception, the death-rate from tuberculosis dropped consistently with the progress of bovine tuberculosis eradication.

In Michigan, from 103.3 in 1918 to 48.0 in 1932. In Indiana, from 136.3 in 1918 to 59.9 in 1932. In Ohio from 145.0 in 1918 to 55.1 in 1932. In Wisconsin, from 95.0 in 1918 to 45.5 in 1932. All of these states have become modified accredited. In Illinois, which is about to become accredited, from 135.0 in 1918 to 55.2 in 1932. In Iowa, where nearly 11 million tuberculin tests have been applied, the death-rate in 1918 was 58.4 and in 1932, 27.9. In Minnesota, where approximately 12
million tests have been made, the rate was 109.3 in 1918 and 40.5 in 1932. In comparison let us take the conditions in some of the states where tuberculin-testing has not progressed to the extent of the states just mentioned. In South Dakota, where only slightly over 1,000,000 tests have been applied, the death-rate in 1918 was 49. In 1932 it was 52.6. In my home state, Massachusetts, which was one of the last states to adopt a plan of cooperative tuberculosis eradication, the death-rate for non-pulmonary tuberculosis, which is confined almost entirely to children, was at its peak in 1924. In that year 577 deaths occurred and only one less the following year. At the same time, in Michigan, the rate in non-pulmonary cases had dropped from 15.8 in 1918 to 9.9 in 1925, while in Massachusetts the death-rate was on the increase. However, intensive tuberculin-testing was started in 1925 in Massachusetts and, as a result, we had only 260 deaths from non-pulmonary tuberculosis in 1932, against the 577 in 1924, as mentioned above.

Of course the death-rate for all forms of tuberculosis has been dropping off during this century. In the United States, in 1900, it was 180.5. In 1918 it dropped to 128.6. During this same period, however, the death-rate in non-pulmonary tuberculosis rose from 21.4, in 1900, to 26.5 in 1911 and remained at 21.4 in 1918. From that time on it has dropped gradually until in 1932 it was 6.4. Undoubtedly, the decline in the death-rate from pulmonary tuberculosis from 1900 to 1918 was due to improved sanitation and medical care. It is also undoubtedly true that the decline in the death-rate from non-pulmonary tuberculosis from 1918 to 1932 was due in a very large degree to the removal of tuberculous cows from the dairy herds of the United States.

As we approach the time when the entire country will be practically free from tuberculosis, let us not forget the men who, almost single-handed, carried on this work against organized opposition. Now that bovine tuberculosis eradication is popular, we are apt to forget those dark and stormy days when we struggled on without the support of those, who by rights should have strengthened our cause. We are not looking for honor or glory but we do feel that the facts should be recorded. Dr. Myers and a few of his associates have spoken and given the veterinarian the credit for the part he has played in this program. We are grateful to them for this recognition. It is indeed pleasing to have them come forward and approve the work we have done and announce to the world that this program of tuberculosis eradication has been worth while.

**President Faulder:** We have now reached an important milestone in our program. The next paper is entitled, "A Comparison of Koch's Old Tuberculin with a New Synthetic Medium Tuberculin," which is indeed important. This is presented by an acknowledged scientist and investigator, recognized as such both nationally and internationally. I know that the labors, the accomplishments and the contributions of this great scientist have saved the people and the federal government unknown millions. I know also that it is seven or eight years since he has been before us. I am happy, and I know you are all happy, that we can present him to you today. I take great pleasure in presenting to you our good friend, Dr. Marion Dorset, Chief, Biochemic Division, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C. (Applause.)

**Dr. Dorset:** Mr. President and Members of the Association: At the very outset I want to make it clear that I am not going to attempt this afternoon to review the entire subject of tuberculin in its manifold phases. Instead of that, it is my intention to endeavor to explain to you the nature of the so-called special tuberculin, which the Bureau has been distributing for several years in increasing amounts.

... Dr. Dorset then read his paper. ...
A COMPARISON OF KOCH'S OLD TUBERCULIN WITH A NEW SYNTHETIC-MEDIUM TUBERCULIN

By M. DORSET, Washington, D. C.
Chief, Biochemic Division, Bureau of Animal Industry
U. S. Department of Agriculture

For some years, the Bureau of Animal Industry has used in increasing amounts, for intradermic testing of cattle, a so-called "special tuberculin," known to many of you as "Special F" tuberculin.

Prior to the production of this special tuberculin on a large scale, the testing of cattle and other animals, was carried out with tuberculin made essentially in the same manner as the original product produced by Robert Koch more than 40 years ago. It is true that during the years that have elapsed since Koch's original announcement, many different forms of tuberculin have been proposed for use, principally if not entirely, in the practice of human medicine. Many of such products have been intended for use in the treatment of cases of human tuberculosis. Koch himself proposed certain new preparations made by grinding up and extracting the tubercle bacilli themselves. Also, tuberculins prepared by growing tubercle bacilli on synthetic culture media have been used, particularly in Europe, in human medicine, for treatment. But none of these modifications of Koch's old tuberculin have ever before come into large scale use for testing cattle.

There can be no question of the remarkable efficiency of the old broth tuberculin of Koch. It has enabled us to reduce bovine tuberculosis in the United States to a mere fraction of its former prevalence. In 13 states the disease has almost ceased to exist as a menace to the dairy industry and to the public health. But we must admit that the test is not 100 per cent perfect. There have been some instances, relatively few in number, where it has not been possible to find lesions of tuberculosis in reacting cattle, and others, where, on a single test, tuberculous animals have failed to react. It was with the hope that facts might be developed which would lead to a reduction in this small percentage of error that the studies here reported were undertaken. They have resulted in the production of a tuberculin from cultures of tubercle bacilli on a synthetic medium. I wish now to present the results of a comparative study of the new with the old tuberculin.
Koch's Old Tuberculin

In order that the differences between the special tuberculin which we are now producing and the old broth tuberculin of Koch may be quite clear, it seems desirable first to describe very briefly the Koch method of producing tuberculin.

A clear broth is prepared by extracting lean beef or veal with water. To this is added 1 per cent of peptone. This peptone is the product obtained by subjecting either meat or the casein of milk, to a partial peptic digestion, so that the so-called peptone consists of a crude mixture of proteins, including true peptones, albumoses, proteoses, etc. To the broth containing peptone there are added $\frac{1}{2}$ per cent of salt and from 4 to 7 per cent of glycerin, depending upon the choice of the producing laboratory. The completed mixture, which is generally referred to as *glycerinated* broth, is filled into flasks and inoculated with pure cultures of tubercle bacilli. In some laboratories the bovine type is used; we use the human type. The bacteria grow on the surface of the broth, forming a film or pellicle which gradually extends until it covers the entire surface. The tubercle bacilli grow actively on such a broth for only a few weeks.

Generally at the end of two months, though some laboratories allow the cultures to stand longer, these broth cultures of the tubercle bacillus are sterilized, the dead bacteria are removed by filtration and the clear sterile filtrate, concentrated to the desired degree and containing a suitable preservative, constitutes the broth tuberculin which has been used so many years for testing cattle. All of the Koch's old tuberculin produced by the Bureau of Animal Industry has been diluted in such a manner that the final product represents 40 per cent of the original volume of culture fluid. In other words, 100 cc of culture fluid in the original culture flask produced 40 cc of intradermic tuberculin. This matter of concentration may be expressed in a different and perhaps a better manner by stating that the filtrate from the sterilized cultures, which I have just described, is evaporated to one-tenth of the volume of the original culture fluid, so that 100 cc of the culture fluid produces 10 cc of what is commonly designated O. T.

The broth tuberculin which the Bureau of Animal Industry has distributed for intradermic testing, and I believe the same is true of most other laboratories, has always contained 25 per cent of that old tuberculin. Thus, having begun with 100 cc of culture liquid, we obtain 10 cc of Old Tuberculin which, in turn, is diluted to make 40 cc of intradermic tuberculin. It is thus apparent that the intradermic tuberculin contains 10 cc of Old
A COMPARISON OF TUBERCULINS

Tuberculin in each 40 cc, or 25 per cent by volume. It is evident also that the final product, used for testing cattle, contains not only the soluble substances derived from the growth of the tuberculosis bacillus on broth but also any portions of the culture medium which have not been used up during the growth of the bacilli.

It is generally recognized that the constitution of the Old Tuberculin is extremely complex. It always contains considerable quantities of unused glycerin. In addition, there are present unused nitrogenous substances derived from the beef, as well as similar nitrogenous protein materials derived from the peptone which is added to the broth.

THE SYNTHETIC MEDIUM

Chemists in attempting to isolate and purify the active principle of tuberculin have for many years utilized various combinations of known pure chemicals to constitute a medium for the growth of the tuberculosis bacillus. For our purpose it is not necessary to consider these various culture media in detail. It will suffice to describe the medium used in the production of the cultures from which our own special tuberculin is made. This medium contains, at the beginning, no protein whatever. The nitrogen required by the bacteria for their growth is supplied by the pure, crystalline amino-acid, asparagin. In addition there are present 1 per cent of dextrose, 10 per cent of pure glycerin and very small quantities of mineral salts, namely, magnesium sulfate, potassium phosphate, sodium citrate and a very minute amount of the citrate of iron. Table I sets forth the composition of the broth medium, on the one hand, and of the synthetic medium on the other.

TABLE I—Composition of media.

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<tr>
<td>Glycerin</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>Totals*</td>
</tr>
</tbody>
</table>

*Totals* water to make 100 cc in each case.

*Water to make 100 cc in each case.
GROWTH OF TUBERCLE BACILLI ON BROTH AND SYNTHETIC MEDIUM

It is clear that the strength of any tuberculin, provided the bacteria used are the same, must primarily be dependent upon the amount of growth per 100 cc of culture fluid. This is true because the active substance in tuberculin is derived from the growth of the bacilli. It is reasonable to expect that one gram of bacilli grown on a given quantity of culture medium would not produce as much active material as two grams of the same bacilli grown on the same quantity of medium. Careful chemical investigations and weighings of tubercle bacilli have shown that, under favorable conditions, from 0.5 to 0.7 gm of bacilli, dry weight, may be obtained from 100 cc of the ordinary glycerinated broth.

The synthetic medium which I have just described affords a vastly greater amount of growth. From each 100 cc of culture fluid there is obtained, at the height of the development, on an average, 2 grams of tubercle bacilli per 100 cc of culture fluid, or approximately three to four times as much as is obtained from the same quantity of the glycerinated broth medium. As far as we know, no other synthetic culture medium for tubercle bacilli has afforded such abundant growth. The credit for the development of this synthetic medium, which has enabled us to produce the tuberculin which is the subject of this discussion, belongs to Mr. Robert R. Henley, of the Biochemic Division, B. A. I.

COMPOSITION OF THE CULTURE FILTRATES

Now that we know the composition of the two kinds of culture media and the amount of growth usually obtained on each, we

TABLE II—Composition of filtrates from cultures grown on broth and synthetic media.

<table>
<thead>
<tr>
<th></th>
<th>CULTURES ON BROTH MEDIUM</th>
<th>CULTURES ON SYNTHETIC MEDIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash</td>
<td>Per Cent</td>
<td>Per Cent</td>
</tr>
<tr>
<td></td>
<td>.85</td>
<td>15</td>
</tr>
<tr>
<td>Protein</td>
<td>1.40</td>
<td>32</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>None</td>
<td>.30</td>
</tr>
<tr>
<td>Glycerin</td>
<td>3.34</td>
<td>.04</td>
</tr>
<tr>
<td>Total solids</td>
<td>5.59</td>
<td>.81</td>
</tr>
<tr>
<td>Water</td>
<td>94.41</td>
<td>99.19</td>
</tr>
</tbody>
</table>
may consider the chemical composition of the culture filtrates which, when filtered free of bacteria, concentrated and preserved, constitute the material used in testing cattle. Table II presents results which are a fair average of the analyses of culture filtrates diluted back, for purposes of comparison, to the original volume of culture fluid. It will be remembered (table I) that the broth medium originally contained 10.3 per cent of matter other than water, while the synthetic medium contains 12.65 per cent, or approximately 2 per cent more than broth. Yet, as may be seen from table II, after complete growth of the tubercle bacilli, the broth culture filtrate contains 5.59 per cent non-volatile matter, while the synthetic medium filtrate now contains only 0.8 per cent. Furthermore, it should be pointed out that the protein and the carbohydrate in the synthetic medium filtrate are produced entirely by the tubercle bacillus, since no protein is added to the medium and since both the asparagin and the dextrose have been entirely used up by the bacteria in their growth. There is left, then, of the original constituents of the synthetic medium, only 0.19 gm per 100 cc of filtrate. Of this small residue, 75 per cent is mineral (ash); the remainder is a mere trace of glycerin.

In the case of the broth filtrate we can not make such exact calculations but it is evident from the data in table II that the protein present is approximately five times the amount in the synthetic filtrate and since only about one-third as many bacteria have grown on the broth as on the synthetic medium, it seems fair to infer that the tubercle protein in the broth filtrate is only one-third of that in the synthetic filtrate, or approximately 0.1 gm, leaving 1.3 gm (93 per cent) of the protein in the broth filtrate which is derived from the unused protein of the meat and peptone used in preparing that medium. Figures 1, 2 and 3 show, in a very striking manner, the differences in the results from the two media.

Out of all of the preceding discussion the important facts to be remembered are:

1. That the growth of tubercle bacilli is three or four times more abundant on the synthetic than on the old broth medium.

2. That the proteins in the synthetic culture filtrates are derived entirely from the tubercle bacilli, and

3. That the culture medium constituents in the synthetic medium are entirely used up except for a small amount of mineral salts and a trace of glycerin.
ANIMAL TESTS

Many investigators have claimed, and it has been conclusively shown by the splendid researches of Long and Seibert, that the active substance in tuberculin is a protein derived from the tubercle bacillus. Since the cultures on the synthetic medium contained no protein except that derived from the tubercle bacillus itself and since the growth of the bacilli was very luxuriant, it seemed probable that tuberculin prepared from such cultures might be not only more potent but also more selective and less likely to result in no-lesion reactors than the old broth tuberculin of Koch.

![Image](image.png)

**Fig. 1.** Ripe cultures of *Mycobacterium tuberculosis*. Broth on left; synthetic on right.

TESTS ON GUINEA PIGS

Unfortunately we have no very accurate laboratory method for determining the potency of tuberculin. The power of tuberculin to kill tuberculous guinea pigs has long been used as a measure of potency, but in recent years this has been more or less superseded by the intradermic testing of suitably sensitive guinea pigs. Time is not available for a discussion of these two methods of standardization, so that it must suffice to say that, in our experience, neither of these methods enables us to determine with
exactness the potency of different tuberculins. Nevertheless either of them will serve, in experienced hands, to bring out wide differences in potency of different tuberculins. We have found it to be somewhat easier to bring out such differences by the use of the old lethal test.

By either of these methods we have had no difficulty in demonstrating differences in potency between the regular broth tuberculin on the one hand and tuberculin prepared from cultures on the synthetic medium on the other. The latter, which will hereafter be referred to as "Special Tuberculin," regularly kills tuberculous guinea pigs in a dose amounting to only one-fourth or one-half of that required of the broth tuberculin to produce the same result. In intradermic testing of tuberculous guinea pigs the special tuberculin regularly produces more pronounced skin reactions and proves potent in much more dilute solutions. We have not attempted comparisons by injecting various dilutions into the shaved skin of the necks of cattle as proposed by Buxton, but have made many comparisons by the injection of the two products simultaneously into the same cattle. It is of this comparison of the old with the special tuberculin in intradermic testing of cattle that I now wish to speak.
Tests on Cattle

We are indebted to Dr. Wight and his assistants in the Tuberculosis Eradication Division for the comparative testing of these two tuberculins. I wish especially to acknowledge our indebtedness to Drs. O'Rear, Howlett, Aldrich, Gillen, Blake, Yoder and Gruenewald.

For purposes of comparison, the two tuberculins were injected intradermally into the caudal fold and the vulva. The broth tuberculin was injected on one side and the special tuberculin on the other, so that each animal received, at the same time, four intradermic injections. The amount injected was the same in all comparative tests.

![Residues from evaporation of 1,000 cc of culture filtrate. Broth on left; synthetic on right.](image)

Table III, which does not include many herds in which no reactors were found, is a composite of the reports of five field inspectors. As the table shows, in this series, 13,288 cattle were tested. Both tuberculins were used in the same concentration, i.e., 25 per cent O. T. Of these, 1,127 reacted to the broth tuberculin, whereas 1,268 reacted to the special tuberculin. As may be seen, the percentage of "no visible lesion" cases found at autopsy was practically the same, slightly more than 5 per cent of the reactors with the broth tuberculin and slightly less than 5 per cent with the special. The important difference lies in the number of reactors, for we find that 141 more cattle reacted to the special than to the broth tuberculin, and of these, 135 were found at autopsy to be tuberculous. The total number of tuberculous cattle was 1,280, of which the broth tuberculin failed to detect 135 (approximately 11 per cent). No tuberculous animal in this
series reacted to the broth tuberculin without at the same time reacting to the special tuberculin. In the case of those cattle which reacted to both tuberculins, the great majority showed more pronounced and more clear-cut reactions to the special tuberculin.

**Comparison of Broth Tuberculin with Special Tuberculin at Different Concentrations**

Still using the broth tuberculin as a standard of comparison, a series of tests was carried out with different concentrations of the special tuberculin. The broth tuberculin was used always at a concentration of 25 per cent for comparison with the special tuberculin at concentrations varying from 2 1/2 per cent to 25 per cent of O. T. The object of these experiments was to determine more precisely the potency of the broth tuberculin in terms of the special. We also wished to ascertain the effect of reducing the concentration of the special tuberculin upon its efficiency in detecting tuberculous cattle and upon the percentage of N. V. L. cases. The results are given in table IV, in which are included the results already shown in table III.

**Table III—Comparative efficiency of special and broth tuberculins in intradermic testing of cattle.**

<table>
<thead>
<tr>
<th>Tuberculin</th>
<th>Strength (% O. T.)</th>
<th>Cattle Tested</th>
<th>Reactors</th>
<th>N. V. L. Cases</th>
<th>Tuberculous Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broth</td>
<td>25</td>
<td>13,288</td>
<td>1,127</td>
<td>57</td>
<td>135</td>
</tr>
<tr>
<td>Special</td>
<td>25</td>
<td>13,288</td>
<td>1,268</td>
<td>63</td>
<td>0</td>
</tr>
</tbody>
</table>

It is evident: (1) that the broth tuberculin proved to be more efficient than the special when the latter was used in concentrations below 10 per cent of O. T.; (2) that at 10 per cent concentration the special tuberculin gave results almost precisely identical with those obtained with the 25 per cent broth tuberculin, and (3) that, as the concentration of the special tuberculin was increased above 10 per cent O. T., there was a corresponding increase in efficiency over the broth tuberculin.

With respect to no-lesion cases, the agreement between the two tuberculins is astonishingly close and, as may be seen, the percentage of such cases seems to be uninfluenced by the strength of the tuberculin. This curious fact is further confirmed by the tests recorded in table V. Here again the percentage of no-lesion
cases seems to be uninfluenced by the tuberculin used. With respect to efficiency in detecting tuberculous cattle, we find from the data presented in this table that the special tuberculin of 10 per cent strength is less efficient than the same tuberculin of 25 per cent strength, while at 12 1/2 per cent and 15 per cent strength there is substantial agreement with the stronger 25 per cent tuberculin.

**Table IV—Results of comparative cattle tests of broth tuberculin and various dilutions of special tuberculins.**

<table>
<thead>
<tr>
<th>Tuberculin</th>
<th>Strength (% O. T.)</th>
<th>Cattle Tested</th>
<th>Reactors</th>
<th>N. V. L. Cases</th>
<th>Tuberculous Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broth</td>
<td>25</td>
<td>1,889</td>
<td>43</td>
<td>3</td>
<td>7.0%</td>
</tr>
<tr>
<td>Special</td>
<td>25</td>
<td>26</td>
<td>2</td>
<td>7.7%</td>
<td>0</td>
</tr>
<tr>
<td>Broth</td>
<td>25</td>
<td>1,505</td>
<td>48</td>
<td>5</td>
<td>10.4%</td>
</tr>
<tr>
<td>Special</td>
<td>5</td>
<td>45</td>
<td>5</td>
<td>11.1%</td>
<td>0</td>
</tr>
<tr>
<td>Broth</td>
<td>25</td>
<td>682</td>
<td>42</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Special</td>
<td>7 1/2</td>
<td>40</td>
<td>0</td>
<td>0.0%</td>
<td>2</td>
</tr>
<tr>
<td>Broth</td>
<td>25</td>
<td>4,781</td>
<td>131</td>
<td>17</td>
<td>12.9%</td>
</tr>
<tr>
<td>Special</td>
<td>10</td>
<td>130</td>
<td>16</td>
<td>12.3%</td>
<td>0</td>
</tr>
<tr>
<td>Broth</td>
<td>25</td>
<td>2,683</td>
<td>124</td>
<td>14</td>
<td>11.3%</td>
</tr>
<tr>
<td>Special</td>
<td>12 1/2</td>
<td>126</td>
<td>14</td>
<td>11.1%</td>
<td>2</td>
</tr>
<tr>
<td>Broth</td>
<td>25</td>
<td>3,857</td>
<td>121</td>
<td>4</td>
<td>3.3%</td>
</tr>
<tr>
<td>Special</td>
<td>15</td>
<td>132</td>
<td>5</td>
<td>3.7%</td>
<td>10</td>
</tr>
<tr>
<td>Broth</td>
<td>25</td>
<td>13,288</td>
<td>1,127</td>
<td>57</td>
<td>5.0%</td>
</tr>
<tr>
<td>Special</td>
<td>25</td>
<td>1,268</td>
<td>63</td>
<td>4.9%</td>
<td>135</td>
</tr>
</tbody>
</table>

It should be stated that in all of the comparative tests recorded in the tables the tuberculins were so labeled that the field inspectors did not know the composition of the tuberculins which they compared. This is illustrated by the last series of injections recorded in table V. Here 492 cattle were tested comparatively with two tuberculins which were identical in composition, but which bore different labels, yet we find two animals recorded positive to one, but negative to the other. This indicates that in comparative testing, with close reading, there is a small error, here less than one per cent, which cannot be ascribed to the tuberculin. Such differences are too small to be regarded as an indication of differences in potency between tuberculins.
### Table V—Comparative efficiency of special tuberculin at different concentrations.

<table>
<thead>
<tr>
<th>Strength (% O. T.)</th>
<th>Cattle Tested</th>
<th>Reactors</th>
<th>N. V. L. Cases</th>
<th>Tuberculous Missed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>Per Cent</td>
<td>No.</td>
</tr>
<tr>
<td>25 10</td>
<td>1,227</td>
<td>475</td>
<td>43</td>
<td>9.5</td>
</tr>
<tr>
<td>25 12½</td>
<td>846</td>
<td>314</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>25 15</td>
<td>2,830</td>
<td>279</td>
<td>19</td>
<td>6.8</td>
</tr>
<tr>
<td>25 25</td>
<td>492</td>
<td>208</td>
<td>5</td>
<td>2.4</td>
</tr>
</tbody>
</table>

### Summary and Conclusions

While a large amount of experimental work other than that here presented has been carried out, a discussion of it must be postponed to a future time. It is sufficient to say that we are endeavoring to determine the effect of dosage of tuberculin upon the results of testing and we have planned a study of the efficiency of concentrations of O. T. above 25 per cent. The latter field we have not been able, as yet, adequately to explore.

It appears, however, from the data thus far obtained, that, in the special tuberculin from the synthetic medium, we have not only a very pure product, from a chemical standpoint, but also one which, judged on the basis of practical field results, is more potent and reliable than the old glycerinated broth tuberculin.

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**President Faulder:** I feel confident we are more than pleased with this presentation by Dr. Dorset, and I suggest we give the Doctor a rising vote of thanks, and hope he will be with us again.

. . . The audience rose and applauded.

**President Faulder:** This paper will now be discussed by Dr. E. A. Watson, Chief Pathologist, Animal Diseases Research Institute, Hull, Quebec, Canada. (Applause.)

**Dr. Watson:** I am sure that you will all agree that a new and very significant chapter has just been read in the story of tuberculin, a story that was commenced about forty years ago with the somewhat tragic results and events that followed in the use of tuberculin in the cure and treatment of tuberculosis. The story is not yet complete. It is still in the writing.

At the present time several groups of highly trained investigators, biochemists, are contributing very important work to it. When it is
written out in its entirety, not the least among the brilliant achievements and work which will be recorded therein will be found a considerable part under or coupled up with the name of our distinguished colleague, Dr. Dorset.

When I received the invitation to open the discussion on Dr. Dorset's paper, I felt very much flattered and honored. I appreciate it. I only regret my inability to do proper justice to the occasion, or to give the reaction which such a potent paper calls for.

I think the essence of Dr. Dorset's paper is very briefly that tuberculin produced in a chemically pure medium has a much higher potency and is a more highly specific reagent than the tuberculin that has hitherto been employed, produced in the old, regular manner, on glycerinated peptone broth.

As Dr. Dorset has pointed out, the new synthetic medium contains no other proteins than that produced by the tubercle bacilli themselves during the course of growth, so that that product, when it is finally prepared, is free from those other peptones that are associated or bound up with the glycerinated broth. It is a very reasonable assumption, therefore, from the chemical aspect alone, that this new product, produced in a chemically pure medium, contains tuberculin in a purer and more specific form than the old.

The significance of the results of the comparative tests has been indicated in cattle as shown in the tables. There are one or two points in connection with that which I think lend themselves to a little discussion.

Table III, I think, shows over 13,000 cattle tested with the two tuberculins, and out of over 1,200 tuberculous animals, 135 of those, over 11 per cent, failed to react to the old broth tuberculin, given 25 per cent concentration. That group of cattle was included in the various groups given in the following table, table IV. There were one or two points there that puzzled me a little. You may have noted in that table that in the first four groups of cattle in which the old tuberculin was used in the concentration of 25 per cent, it did not miss any tuberculous animals, but the new tuberculin in the weaker dilutions did miss some.

When we got down to the point of 10 per cent of the new tuberculin and 25 per cent of the old, the results seemed to be equalized. The old still did not miss any tuberculous animals; neither did the new. But in the next three succeeding groups, for some reason that Dr. Dorset, I hope, will explain, the old tuberculin began to miss animals, starting from 0 in the next group to 1 or 2 per cent, to 7 per cent, up to 11 per cent, although used all through in the same concentration, 25 per cent. That is a little puzzling, although I have no doubt that Dr. Dorset has an explanation for it.

The thought that occurred to me, in all those tests, was that the same batch or lot of tuberculin was used. Or were they tested with different lots of both the old and new tuberculins? If the same lot of the old broth tuberculin was used in all those cattle, then, of course, it seems to me very difficult to explain why in the last three or four groups it began to become more and more inefficient though used in the same concentration of 25 per cent.

Again, in the succeeding table, with the new tuberculin, did that represent different lots of new tuberculin or the same? That was not quite as efficient as the new tuberculin shown in the preceding table. So the question seems to come down as much to the question of standardization as it does to the question of potency. Standardization and potency are not the same, as you can readily realize.
Our late, well-remembered colleague, Dr. Schroeder, for many years tested various lots of tuberculins, Bureau tuberculins and commercial tuberculins, and by certain guinea pig tests he classified those either as sub-potent, potent or super-potent, according to results obtained on guinea pigs. But it is quite evident he never disputed it that the potency of the tuberculin classified as potent is not the same as tuberculin classified as super-potent, and that neither one nor the other represents a definite standard.

It seems evident from this paper that the new tuberculin is a super-potent tuberculin. In fact, Dr. Dorset has said in his tests on guinea pigs that it had three or four times the lethal power of the old tuberculin and gave a very much more pronounced or severe reaction than the old.

I think it is evident, therefore, that that tuberculin is super-potent as compared with the old. So that the question that arises again is: Should we raise the minimum standard of what hitherto we have given as a potent tuberculin up to the standard of a highly super-potent tuberculin? That seems to me to be the question, if we are to get the maximum results of efficiency as indicated in the paper. The whole question of standardization is of supreme importance, I believe, not only in the efficacy of the employment of tuberculin but in all such comparative results.

You cannot compare the results, that is in some respects, of a potent and highly super-potent tuberculin with a tuberculin that only just qualifies as potent tuberculin. A lot of our work in the past, in trying to find out whether the subcutaneous or the ophthalmic or the intracutaneous test was better, did not bring very satisfactory results, probably for the reason that the product we were using was so unequally standardized.

One of the most important things we have to do, in my opinion, is to devise ways and means of introducing a method of standardization that will be a real standardization, and not just a rough classification as to whether tuberculin is potent or super-potent.

There is another aspect to these tuberculin reactions which Dr. Dorset has not touched upon in his paper, possibly intentionally so, because he has said there is so much to discuss that he would limit himself to a comparative testing of cattle.

However, in his two previous papers, with which many of you are familiar, it was a very striking feature, and I ask his pardon if I refer to it at this moment, that is the two principal or active substances present in tuberculin, that principle responsible for the lethal effect in guinea pig test inoculation, and that fraction or principle, molecule or whatever you like to call it, responsible for the cutaneous reaction. In fact, if I remember rightly, Dr. Dorset put the question in some such way as this: Is the lethal principle always present in the relative fixed proportion as the skin reaction? If it is always present in that fixed relative proportion, then it is reasonable that a potency test by the lethal method would indicate the potency of the cutaneous principle, but it is not by any means certain that they are present in the same fixed relative proportion. That there are two principles that can be separated by a certain technic, such means can no longer be doubted.

It has been confirmed by numerous investigators and by ourselves that the lethal principle can be separated from the skin-reacting principle, although it is so far almost impossible to separate entirely the skin-reacting principle from at least a portion of the lethal principle. But it seems to me that that is a very important aspect of the tuberculin problem.
There are indications, I think, that tuberculins will give quite efficient skin reactions if prepared in certain ways irrespective of the presence of the lethal effect.

We have followed Dr. Dorset's work for a long time, and one of my colleagues, Dr. Heath, has been for several years experimenting with and studying these active principles, the lethal and the skin-reacting principles, following a good deal of Dr. Dorset's work. In this connection we have employed not only the guinea pig lethal test and guinea pig cutaneous test, but also our complement-fixation method, and have studied the dialysate, diffusate, filtrate and residue from tuberculin production by these three methods. It is a striking feature, I think, that Dr. Heath has found that (we have been able in some respects to verify that) there is an extremely close correlation between the complement-fixation titration and the cutaneous or skin-reacting principle, and a very loose connection, often in quite disaccord, between the lethal reaction and the complement-fixation method. So there is no doubt whatever that there are two active substances in tuberculin which may be separated.

It would be out of place, as Dr. Dorset said, to go into a discussion of how those may be separated or the effect of hydrolysis and other things that may upset the balance. But now that tuberculin can be produced with a chemically pure medium under the conditions stated by Dr. Dorset, it would seem even possible to look a little further into the future and to visualize the possibility of preparing tuberculins so pure or so separate that one contains the active principle causing the lethal effect and the other only the cutaneous, and to go even further and to be in a position to prepare real, accurate, standard solutions of these tuberculins. If we can reach that point—there does not seem to be any reason why it cannot be reached eventually—there would even appear to be a possibility or hope that tuberculin might be employed not only for diagnosis but even for prognosis.

At the present time tuberculin reaction teaches us nothing more than that that animal is sensitive, has been sensitized with the tubercle bacillus. It tells us nothing of the stage or type of disease, whether active or inactive, progressive or retrogressive, latent or healing. It would be a godsend in some cases, I think, if we could know a little more about what the state of the disease is in an animal, and it is not beyond the possibility of hope and expectation with these purified, more highly specific tuberculins, that they will tell us far more in the future than they have in the past.

As regards the practical use at the present time, Dr. Dorset referred to the fact that in Canada we have been using tuberculin produced in synthetic media for some time. Actually we have been using it for a year and one-half or more. The bulk of the tuberculin we are now putting out is in this new form. But there is the question of standardization. Are we to reduce the concentration of that to the level of the old, standard tuberculins, of O. T., or are we to keep it up to the higher standard, super-potency? That I think is a really important question on which we must come to some agreement.

As to the results in our own experience, I cannot say very much. We have not conducted simultaneous tests on a large number of cattle with the old and the new, but we have conducted tests. Dr. Hall has reported privately some results in the field where they have used the two tuberculins, but we have no statistical evidence to show the value of one over the other. But the general impression is, I gather, though I don't know quite on what it is based, that the veterinarians in the field do prefer very much the new type of tuberculin produced in chemically pure media.
I don't think I have anything more to add to this paper. It is only repeating what I have said, that before you can standardize the reaction, you must standardize the tuberculin. That is the point I want to make.

In conclusion, may I again express the thanks of all of us to Dr. Dorset for the wonderful paper he has given us. (Applause.)

PRESIDENT FAULKNER: Dr. Dorset's paper will now be discussed by Dr. H. M. O'Rear, Tuberculosis Eradication Division, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

DR. O'REAR: As a member of the Tuberculosis Eradication Division of the Bureau of Animal Industry, I have been privileged the pleasure of working with Dr. Dorset, to some extent, in conducting field experiments with Special "F" tuberculin. Early experimental work with this product stimulated my confidence in tuberculin as a diagnostic agent, and the results obtained during the succeeding years serve only to strengthen that confidence. I feel quite sure that Dr. Dorset's untiring efforts in the field of tuberculin production are largely responsible for the development of a product superior in practically every respect to the tuberculin formerly used, and one which appears to be more ideally suited to meet the general needs in this campaign of tuberculosis eradication.

Personally, I am satisfied that much has been accomplished in this respect, and I think, Dr. Dorset, that I express the sentiments of a vast number of veterinarians engaged in tuberculin-testing when I say to you that your interest in our problems has been deeply appreciated, and we feel that the burdens encountered in the daily application of the tuberculin test have been greatly lightened as a result of your efforts. Yet, regardless of accomplishments achieved in the perfection and manufacture of tuberculin or any similar product, certain basic fundamental principles in their application must be observed if the desired maximum results are to be obtained. This is especially true when the human element becomes the important factor that it does in the application and interpretation of the intradermic tuberculin test. However, the construction of this statement is not intended to infer a lack of progress in the use of tuberculin.

As a matter of fact, much progress has been made in improving the technic and method of applying the intradermic tuberculin test since it was accorded official recognition. But, in connection with this phase of the work, it might be well to mention, briefly, two or three points that it is believed will be of material assistance in obtaining the best results.

It is naturally assumed, of course, that when launching upon a tuberculin-testing expedition the operator is provided with sufficient suitable equipment to complete the task undertaken with proficiency and precision. The first step, then, and one of tantamount importance, is the proper restraint of the animal. It is quite impossible to overemphasize this particular point, and in no instance should an operator modify the rule of absolute restraint in its most exacting sense merely to satisfy an owner or his agent who is not familiar with the basic principles involved in such a delicate test, and is, therefore, unable to understand or appreciate the importance of restraint as a relative factor in the accuracy of the ultimate results.

After the operative field has been properly prepared, the syringe, equipped with a 25-gauge needle exposed slightly less than one-half inch, is grasped in the hand in a manner that will permit the beveled edge of the needle to be turned outward, which will afford the operator
more control over directing the course of the needle, so that after it is
inserted the beveled edge will be next to the epidermis. The needle
should be inserted full length, exercising care to follow the grain of the
tissue, and guided superficially enough to permit the operator to see the
opening of the needle beneath the epidermis. In this manner a mini-
mum dose of tuberculin is deposited on the corium just beneath the
epidermis, care being taken to prevent breaking down or damaging the
tissues by the use of an excessive amount of tuberculin, or applying
sudden or unnecessary force in injecting the material.

A minimum dose of tuberculin of proper strength is quite as capable
of exciting a response in a tuberculous animal, possessed of any ability
to react, as may be expected from the use of a greater or excessive
amount of tuberculin. The use of a minimum dose of tuberculin is para-
mountly important in the non-tuberculous as well as the tuberculous
animal. Carefully injected, a minimum dose of tuberculin is amply
sufficient to bathe the walls of the channel cut by the needle, which is
all that is necessary. A small amount of tuberculin is absorbed quickly,
thus preventing a prolonged capillary congestion that may result from
mechanical injury due to extreme pressure or the distortion of tissues
caused by an excessive amount of tuberculin. This, in turn, will mini-
mize post-injection troubles usually associated with needle traumatism.
The elimination of post-injection traumatism, in so far as it is humanly
possible, will lessen confusion at the hour of observation, and will
assist in enhancing the operator’s ability to detect slight true responses
to tuberculin in tuberculous animals possessing a low reacting ability.
By the same token, non-tuberculous, non-sensitized animals may be
more accurately classified.

A statement frequently heard is that “generalized cases of tubercu-
losis often fail to react to the tuberculin test.” It is believed that a
broad statement of this kind should be qualified to prevent it from
conveying the impression that such instances are to be expected as a
common occurrence. Naturally, tuberculin has its limitations in direct
proportion to all other things similar in nature. There are individual,
obstinate, long-standing cases of generalized tuberculosis where it has
been found extremely difficult and occasionally impossible to excite a
tuberculin reaction. But, when viewed collectively, considering the
extent that tuberculin is employed, the number of cases involved and
some of the apparently unreasonable demands and expectations of
tuberculin, then it would seem that the individual cases referred to,
where reactions were not obtained, are exaggerated rather than under-
rated.

Hundreds of cases may be found in the records of the various field
offices to support the statement made here. For instance, one experi-
ment that was conducted some two years ago, on a small scale, may be
cited. Several herds located in a badly infected territory were selected
that were expected to yield a high percentage of reactors. Special “F”
tuberculin was applied by the double-injection method. During ob-
servations at the 72nd hour, each animal was classified according to
the evidence of reaction presented. Within ten days following, all
of the 305 animals were slaughtered at establishments where federal
meat inspection was maintained. From the entire lot of 273 reactors,
30 animals were condemned as a result of generalized tuberculosis,
and in each instance a positive reaction to the tuberculin test was
obtained.

Reports from the field frequently contain many interesting expe-
riences in connection with the use of Special “F” tuberculin that
reveal very gratifying results. To relate them here would probably
A COMPARISON OF TUBERCULINS

serve only to increase, numerically, some of the figures presented by Dr. Dorset.

The time is not far distant in this campaign when the tuberculin-testing of practically all dairy and breeding cattle will become a realization. Consequently, team work on the part of all concerned is still essentially important in attaining the success hoped for. Therefore, in conclusion, I feel convinced that a continued correlation of the efforts of those instrumental in the production of a tuberculin of greater potency, and the constant vigilance exercised to protect its qualities, together with the splendid efforts manifested by field veterinarians in improving their methods and technic of converting that product into practical use, will result in an amalgamation of effort that is bound to maintain and, as far as is humanly possible, increase the accuracy and efficiency of the tuberculin test.

Dr. Dorset: I know it is getting late, and I dislike to take more of your time, but Dr. Watson (I am sure it is not his fault, it is the fault of my paper, the way it was put together) has entirely misconstrued certain portions of the paper. I feel that I should bring that to your notice so that it may not be misunderstood.

Dr. Watson referred to the fact that the thing that disturbed him was that the broth tuberculin in the first series detected all of the tuberculous animals, whereas the broth tuberculin later on did not detect them all. That misinterpretation of what I intended to say is due to the title of the column which says "Tuberculous missed." All of the cattle that were tested were not slaughtered. We don't know how many tuberculous animals were in the herds that were tested. Where the special tuberculin of 2.5 per cent strength missed 40 per cent, and the broth apparently missed none, it means merely that the broth got 43 reactors, whereas there were only 26 reactors to the weak special tuberculin. Those 43 reactors, I judge from the table, were not all of the tuberculous cattle in those herds that were tested, but the broth detected more than the weak special detected. That is all that that difference means. It means that the broth was more potent than the weak special, and it detected more. The only tuberculous cattle we knew of were those, of course, that reacted and were slaughtered.

As we come down and increase the strength of the special, the two become identical when the special is 10 per cent and the broth is 25 per cent. As you go on up, it shows that the broth then fails well behind the special; in other words, the special is getting tuberculous animals that the broth did not get, and, as Dr. Watson says, the special tuberculin is a super-potent tuberculin. It is certainly a super-potent tuberculin when compared with the broth tuberculin. It seems to me from these tests that it is perfectly evident that that is what we need, that the tuberculin we have been using is not sufficiently potent, that we need a so-called super-potent tuberculin. It apparently did no harm. There was no increase in the no-visible lesion percentage in these cases, but we have a great increase in the number of tuberculous animals we detect.

It may be, as I attempted to indicate in this hasty paper, that even the broth tuberculin as we are using it at 25 per cent might, with advantage, be increased further.

There is one other thing I should mention. These animals missed by the broth tuberculin, indicating 11 per cent of tuberculous animals detected by the special and not detected by the other, does not mean that herds are not cleaned up by the broth tuberculin. It merely means that on a single test the broth tuberculin failed in these cases.
where the special succeeded, but with repeated tests, as is commonly practiced in the Tuberculosis Eradication Division, undoubtedly many of the cattle missed on the first test would be detected on the second. So the herds have been gradually cleaned up effectively, I feel quite sure, but evidently with considerably more labor and much more slowly.

One other thing. Merely because a tuberculin is a synthetic tuberculin, so-called, a tuberculin from a synthetic medium, does not mean it will do what this medium does. It has to have the potency of this particular tuberculin. I think probably it will not have it unless it will afford a development of the tubercle bacillus as abundant as we have been able to get here. So it should be remembered, that merely because a tuberculin is synthetic it is not necessarily better than the broth.

DR. W. A. HAGAN: I should like to refer to this last phenomenon. Some ten or twelve years ago, we happened to have a good many tuberculous guinea pigs on hand in connection with some pasteurization experiments that were going on. Dr. Traum was at Cornell at the time. We took the opportunity of testing simultaneously, by the skin test, a great number of these animals. We made this observation when we tested simultaneously with two or three tuberculins, any one of which would give good reactions when used alone: If one of the three or one of the two was considerably more potent than the other, the more potent tuberculin would frequently give strong reactions, whereas the other two tuberculins might fail utterly to give any trace of a reaction. In other words, we developed the idea that there is a distinct antagonism between two or more tests done simultaneously on the skin. It did not always work that way, but it did in a significant number of cases.

We tried to apply that to cattle. We did not have opportunity for many tests, but we thought at the time that we showed the same thing to be true there.

A thought has always been in my mind, therefore, since the double intradermal test or, not to confuse the English system, the tail and the vulva tests have been carried on simultaneously, whether or not we may not actually have some antagonism between those tests.

I think that that point would bear investigation, that there is a possibility the two tests are working against each other. I might say also that in another test done on the same group of guinea pigs, when we used two different injection sites, we frequently failed to get as good reaction with either injection site as we did with animals injected only once.

PRESIDENT FAULDER: Each year we look forward to the section on tuberculosis dealing with the status of tuberculosis eradication in the United States. For a number of years this report has been made by Dr. A. E. Wight, Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, United States Department of Agriculture, Washington, D.C. The report today covers the United States and Canada. Dr. Wight is sharing his time with Dr. Orlan Hall, of Canada, who will follow Dr. Wight and give us information relative to Canada.

I will now call upon Dr. Wight for his section of the report. (Applause.)

... Dr. Wight read his paper. ...
PROGRESS AND STATUS OF COÖPERATIVE TUBERCULOSIS ERADICATION WORK

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

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

The campaign to control and eliminate tuberculosis from livestock continues to make progress. Though impeded at times by various obstacles, this undertaking is gradually approaching a successful end. During the past twelve months, it has been necessary to curtail activities to some extent, owing to the lack of funds, but good progress has been made in spite of this. Since our last meeting, there have been many changes in the state officials in charge of this work, and it is desired to welcome the new workers to this important project.

LEGISLATION

The legislatures in practically all states have been in session during the past twelve months, and they have made it possible to continue the work of tuberculosis eradication in almost all of the states. The total state appropriations for this work during the present year amount to about $9,000,000, of which about $7,000,000 is for indemnity. The federal appropriation for this year was reduced to $4,170,000, of which $3,300,000 is available for indemnity. The largest appropriation was, as usual, made by the State of New York, where the sum of $2,500,000 was made available for indemnity. The legislature in Vermont appropriated $675,000 for indemnity for a two-year period, an amount sufficient to complete the initial testing of all herds in that State. In some of the states where infection has been reduced, it was possible to make a substantial reduction in the state appropriations and still carry on the necessary retesting work.

In Iowa, an attempt was made to nullify the present tuberculosis-eradication work by those opposed to it, but, through the efforts of leaders in many of the livestock interests, and with the valuable assistance of the medical profession, together with other organizations, the opposition was defeated. Much credit should be given the leaders of the livestock sanitary work in all the states for their untiring efforts to bring about the enactment of necessary laws and to obtain appropriations in order that tuberculosis eradication may proceed as rapidly as possible under present conditions.
TUBERCULIN-TESTING

During the fiscal year ended June 30, 1933, more than 13,000,000 tuberculin tests were applied to cattle in connection with the coöperative work. The degree of infection found was 2.0 per cent, which is slightly greater than that of the previous year, due to the fact that more intensive work was taken up in the heavily infected sections of the country. Since November, 1932, more than 1,000,000 tuberculin tests have been applied to cattle each month except during January, February, July, and August, which indicates the vast amount of effort being put forth to eradicate tuberculosis among cattle. The field workers coöperating with the stock-owners have conducted a very creditable piece of work. There is still some opposition to the work in certain sections, but it is decreasing each year as the public has a better understanding of the importance of the project, and realizes the benefits that follow eradication work. When a dangerous disease like tuberculosis threatens the live stock of this nation, the people are determined to conquer it, especially when such well-established and practicable means of eradication are available.

As tuberculosis eradication progresses, it becomes necessary to apply a great many tuberculin tests to herds of cattle in modified accredited countries. This is a very important part of the work in certain sections of the country where tuberculosis existed to a considerable extent at the beginning of the campaign.

AREA WORK

The greater part of the tuberculin-testing has been conducted under the area plan. Since November 1 of last year, 205 counties, in addition to ten towns in Vermont, have been designated as modified accredited areas. During the same time, only three counties, all in South Dakota, were removed from the modified accredited area. On November 1, 1933, there were 1,704 counties, or 55.5 per cent of all the counties in the United States, in the modified accredited area. There were, in addition, 75 towns in Vermont that had attained that status. There are now 13 states, namely, North Carolina, Maine, Michigan, Indiana, Wisconsin, Ohio, Idaho, North Dakota, Nevada, New Hampshire, Utah, Kentucky, and West Virginia, in which all the counties are in the modified accredited area. The work is nearly completed in four other states, which will make it possible for them to acquire this status probably within the next six months. There are modified accredited areas in all but five states, three of which are in the West, one in the South and one in the East.
The area plan has been continued in certain sections of the western states under the provisions of Section 27 of the Uniform Plan. Under the provisions of this section, 126 counties have been modified. In Florida it has been possible to make very rapid progress in applying the tuberculin test to cattle in counties where tick eradication has been completed, for the reason that the cattle are gathered at the dipping vats and handled through chutes already constructed. The cattle-owners in those sections appear to be very much pleased with the results of the work, and have furnished excellent coöperation. It is believed that this practice can be followed to advantage in some other southern states, and it will probably be adopted. The area work in certain localities has given employment to local men, who are assigned to assist the veterinarians in applying the tuberculin test. Funds provided the counties by the Reconstruction Finance Corporation are used to pay for such services.

**ACCREDITED HERD WORK**

The tuberculin-testing of cattle has also continued under the accredited-herd plan. There are now 214,341 herds, containing 3,283,994 cattle, in that status. This is an increase over the previous year. The retesting of accredited herds in New York continues to be conducted by accredited veterinarians at state expense. This practice is also being followed in Delaware. The field offices continue to make a careful study of the records of all accredited herds, and endeavor to determine the causes of occasional reinfection. In order to make some changes that are deemed desirable, it is proposed to rewrite the uniform rules for accrediting herds and establishing modified accredited areas. Copies of the new rules will be distributed to the various states as early as possible.

**ORDINANCES REQUIRING THE TUBERCULIN TEST**

We all appreciate the great assistance that has been rendered the tuberculosis-eradication campaign by ordinances that have been placed in effect requiring that all herds of cattle used in applying milk to municipalities be tuberculin-tested. More of such ordinances are now in effect than ever before, and during the past year several cities have required that butter and other dairy products shall also be obtained from tuberculin-tested herds or herds located in the modified accredited area. In the state of Washington there is a state regulation requiring that all dairy products sold in that State originate from tuberculin-tested cattle, or those located in the modified accredited area.
THE INTERSTATE SHIPMENT OF CATTLE

The number of dairy and breeding cattle shipped interstate during the past year is somewhat less than during previous years. Only a very few reactors have been found among dairy cattle presented for interstate shipment, owing to the fact that a great majority of them originate in sections comparatively free from bovine tuberculosis. The interstate shipments of dairy and breeding cattle during the last fiscal year amounted to about 208,000 head, most of which were tuberculin-tested by approved and accredited veterinarians.

APPRAISAL, SALVAGE AND INDEMNITY

Owing to the generally reduced cattle prices, the amount of salvage received for reactors at this time is very small compared to that received a few years ago. The average salvage for September, 1933, was $12.13. Appraisals have also been reduced, the average now being about $57. The average state payment is now about $25, and the average federal payment about $14. The maximum federal payment is $20 per head for grade cattle and $50 per head for purebred cattle.

JOHNE'S DISEASE

In a few states a number of herds have been tested for Johne's disease (paratuberculosis) by using johnin or avian tuberculin. This disease does not appear to be spreading to any great extent, but more work will probably be done to eliminate it when tuberculosis eradication is more nearly completed. During the last fiscal year, 2,552 cattle were tested for Johne's disease, resulting in 183 reactors being disclosed. This work was conducted in 13 states. The federal Bureau of Animal Industry has developed a johnin that can be used intradermically. The results of using this material and method thus far compare favorably with those obtained by the application of johnin or avian tuberculin intravenously. If the intradermic method can be used successfully, it will be much more practicable than the intravenous method.

AVIAN TUBERCULOSIS

Control and eradication of avian tuberculosis in poultry and swine were conducted during the last year in several middle western states, but, owing to a lack of funds, it was necessary to make some reduction in the force that had been assigned to that project. In reviewing the results thus far obtained, it is noted that the owners of poultry in infected sections, with few exceptions, are very much interested in eliminating the disease.
It has been possible, in several counties, to visit all the farms on which poultry are kept and, also, to make a reinspection of many of the premises. On the whole, reports indicate that most poultry-owners have followed the instructions given them to bring about the eventual eradication of this disease. In Michigan, where considerable avian tuberculosis-eradication work has been conducted during the last few years, the authorities in charge of the work believe that more attention should be given to the question of obtaining baby chicks from flocks free from tuberculosis, as their evidence indicates danger of introducing tuberculosis through baby chicks. More observations along this line in other states are desirable. I trust that it may be possible also for experimental work to be conducted in some of the states in order to obtain more information as to the danger of transmitting avian tuberculosis through baby chicks.

**Tuberculosis in Cattle and Swine Decreasing**

Reports received from the Meat Inspection Division of the Bureau of Animal Industry indicate that there is a gradual reduction in the amount of tuberculosis found among hogs and cattle that are given a postmortem examination in connection with meat inspection. It will be recalled that tuberculosis in hogs was increasing up to 1924, when 15.2 per cent of all the hogs slaughtered in the United States under federal meat inspection showed some evidence of tuberculosis, and at that time 2.7 per cent of all the hogs slaughtered were either condemned or sterilized. There has been a gradual decrease in the percentage of tuberculosis found in swine since that time. During the fiscal year ended June 30, 1933, 10.5 per cent of all hogs slaughtered under federal inspection showed evidence of tuberculosis, and only 1.5 per cent of the total number killed were extensively diseased. A large proportion of the hogs retained for tuberculosis are affected with the avian type of the disease; therefore, we cannot expect a very rapid reduction in this connection until more work can be taken up on the avian project. A large proportion of the hogs of this country originate in the central states, where avian tuberculosis is very prevalent.

The retentions for tuberculosis among cattle slaughtered under federal supervision, exclusive of known reactors, are also becoming less each year. Ten years ago, retentions for tuberculosis in cattle at establishments operating under federal supervision were 1.75 per cent, whereas, during the last fiscal year this figure had been reduced to 0.42 per cent. The percentage of cattle condemned or passed for sterilization in 1923 was 0.46, while last
year it was 0.11. Thus, only about a fourth as many cattle are now being condemned or sterilized because of tuberculosis as about ten years ago.

All this information has given encouragement to the workers engaged in the tuberculosis-eradication campaign. The employees of the federal Bureau of Animal Industry who are engaged in meat-inspection work are putting forth special effort to identify cattle and hogs found to be affected with tuberculosis in order that their origin may be traced. It is, of course, impossible to do this in many instances because of the many changes in ownership of the animals before they reach the packing-house. The tattooing of hogs in the field, so that they may be identified at the packing centers, is being followed to some extent, and is very helpful to the men engaged in the avian tuberculosis-eradication project. Tracing the origin of tuberculous cattle found at packing centers has been found to be a valuable aid to the tuberculosis-eradication follow-up work in modified accredited areas.

The identification of range and semi-range cattle found to be affected with tuberculosis upon postmortem examination is being carried on at several of the large packing centers with a view of locating the centers of infection among this class of cattle. During the last twelve months, 102,125 range and semi-range cattle were given postmortem examinations, of which number 222 showed some evidence of tuberculosis. Fifty-three of these were generalized cases, while 26 showed skin lesions only. These cattle originated in 82 counties in nine states. The Bureau employees at the packing centers have been unable to identify all range cattle that showed evidence of tuberculosis, but with the cooperation of the commission men, brand inspectors, and others, some very good work has been done. When a report of infection is forwarded to the state and Bureau officials in charge of the field work, an effort is made to locate the premises where the infected animals originated. In some cases the owners are ready to have the test applied to their herds at an early date, but others prefer to wait until a more opportune time, while there are still others who feel it would be best to wait until the general testing could be taken up in their county. It is rare for an owner to indicate that he is not at all interested in eradicating the disease, according to reports received from field stations.

As an indication of the value of the tracing of the origin of infected cattle found on postmortem examination, the following case is of interest. One cow contained in a carload of cattle received at a slaughtering-point operating under federal inspection
was found to be extensively affected with tuberculosis. Later, four more tuberculous cattle were found among a shipment made by the same person. These infected cattle originated in a county not a modified accredited area. Arrangements were made to apply the tuberculin test to all the cattle in the herd and those that had recently been dispersed from the herd. Some cattle from this herd had been sold to points in six different counties, but they were all tuberculin-tested, with the result that 46 reactors were found, one or more being in each lot.

PUBLICITY AND BULLETINS ON TUBERCULOSIS

Favorable publicity has been received from the press in most sections of the country during the past year. This has been a valuable aid to the progress of the work. An article by Dr. J. Arthur Myers, Minneapolis, Minn., on the subject, “The Eradication of Tuberculosis from Cattle as a Public Health Measure,” appearing in the magazine *Hygeia*, published by the American Medical Association, in July, 1933, is a very valuable contribution to the publicity on this subject. Several of the states have prepared and distributed important literature on the subject of tuberculosis eradication during the past year.

The federal Bureau has revised Farmers’ Bulletin 954 on the disinfection of stables. Farmers’ Bulletin 1069, on the eradication of tuberculosis, is being revised, and will be ready for distribution within a short time. Leaflet 102, on avian tuberculosis, will soon be available, and should be of value in connection with the avian eradication work.

CONCLUSION

In order that you may have more complete information regarding the work that has been done in connection with tuberculosis eradication in the United States, a statistical report has been prepared, and will be distributed at this meeting. Additional copies, if desired, may be obtained by addressing the Bureau of Animal Industry at Washington.

I wish to thank you for your most kind and appreciative attention.

PRESIDENT FAULDER: Dr. Orlan Hall will now tell us about the status of tuberculosis eradication in Canada. (Applause.)

DR. HALL: From the report which has just been presented, I am sure you will agree with me that the time is not far distant when practically all of the cattle in the United States will at least have one status. You are without doubt making progress, and I should like to point out that progress is being made in tuberculosis eradication also in the Dominion of Canada. If you will refer to your geography for a moment, you will recall that Canada is a country which extends from
the Atlantic to the Pacific, a distance of approximately 3,000 miles, and instead of being divided into some forty-odd states, is divided into nine provinces. Five of those provinces are again subdivided into counties. The balance, the three prairie provinces and the Pacific Coast province, are divided into municipalities and districts.

We believe the restricted area plan to be the most practical and economical method of tuberculosis eradication, both from the point of view of the stock-owners and the Department.

I should like to speak to you for a few moments on the progress of restricted area work. In the maritime district, which is in the East, of course, on the Atlantic Coast, we have one entire province in which all cattle have been tested, and the incidence of infection has been reduced to a little more than a quarter of one per cent.

In an adjoining maritime province, Nova Scotia, which, of course, is separated from Prince Edward Island by water, all of the cattle have been once tested with the exception of those on Cape Breton Island, and the incidence of infection ran about 2.3 per cent.

In the third maritime province, approximately half of the cattle have undergone tests and the infection there runs around 3 per cent. At the present time we are retesting those cattle and we hope that when completed the incidence of infection will be one-half of one per cent or less.

Coming, then, to the old province of Quebec, a large number of counties have been placed under the restricted area plan. The incidence of infection has ranged from a little less than 1 per cent, in some counties, up to 30 per cent. While some of these counties have the infection reduced to less than one-half of one per cent, there is a large number which are now due for a retest or are being retested.

The same thing practically holds good for the province of Ontario, which is contiguous to Quebec, making a solid area along the boundaries of Vermont and Quebec and a portion of Maine and up through New York, divided, of course, by the St. Lawrence River.

In Manitoba, which, of course, is one of the prairie provinces, we have an area extending by municipalities from Lake Manitoba to the international boundary line. While the incidence of infection in some of those areas ranges higher than 7 per cent, I am glad to report that all of those areas at the present time have less than one-half of one per cent, and some of them as low as 0.01 per cent.

In the province of Saskatchewan, which is another prairie province, we have a number of municipalities which are dealt with under the restricted area plan. The incidence of infection has never been more than 1.1 per cent, and some of these municipalities are now on what you would term the modified accredited list.

In the province of Alberta, we are not doing any restricted area work at the present time. But in British Columbia, on the Pacific Coast, the whole of the Fraser Valley, which is principally a dairy district, has been tested on three or four different occasions, and the incidence of infection there has been reduced to within practical limits.

Our accredited herd plan is being continued. It is essentially a purebred cattle plan. While we have been unable to take on many new herds during the present year, yet there is a demand for that work. Through economic conditions, with which I presume you are all acquainted, it has not been possible, the past two years, for us to satisfy the demands of the stock-owner for the initial test of herds. A condition has developed whereby many stock-owners are desirous of having their herds tested without compensation. That is, I think, a most unusual development. Today we are testing herds throughout the entire dominion with the exception, of course, of those which are
all dealt with under the restricted area plan, and in those portions of provinces which are dealt with under the restricted area plan, we are dealing with individual herds without compensation. We are giving these people the same service we would give under the accredited herd plan, minus compensation. I would say, however, in the province of Quebec the government does compensate the owner to a small extent.

This, in brief, Mr. President, gives you a miniature survey of conditions in Canada. (Applause.)

President Faulder: Dr. Wight's paper will be discussed by two members, the first of whom is Dr. H. A. Seidell, Chief, Division of Animal Industry, State Department of Agriculture, Des Moines. I now have the pleasure to call upon Dr. Seidell. (Applause.)

Dr. Seidell: Being one of the new officials referred to by Doctor Wight, I was rather hesitant to be placed on your program and would have much preferred to be allowed to remain in the background. However, as I have been connected with this work of eradicating tuberculosis for the past thirteen years, I will talk briefly on the progress of the work in Iowa this past year, as I think you will admit Doctor Wight's paper covers very well the progress throughout the United States as a whole.

The work in Iowa has been somewhat impeded, due to the fact that our last legislature cut the appropriation for control of contagious and infectious diseases. This was not our greatest handicap, however, as a large percentage of our county funds has been tied up in closed banks and those operating under Senate File 111. The boards of supervisors of various counties throughout the State did not in all cases make sufficient levy to carry on the work as rapidly as desired, but impeded as we have been, still we have tested approximately 100,000 head per month with the exceptions of February and March, when work was halted temporarily due to the impending bill that was before the Legislature to repeal our compulsory testing law. The bill was defeated by approximately 80 to 20. We still have some opposition throughout our State in various counties, especially in the district where we were forced to send the militia in the fall of 1931 to complete the first tests in those counties. In Black Hawk County, where opposition first originated and where injunction after injunction had been granted against us, we finally have succeeded in getting all of these few remaining herds tested and now with a small amount of retest work it will also be eligible to be placed on the modified accredited list, along with five other counties that are nearing completion.

This past year we have reaccredited 14 counties, and with the exception of four in which 50 per cent of the cattle population was tested in addition to previously infected herds, a 100 per cent test was applied for reaccreditation. We have also accredited nine additional counties. The highlight of this achievement was accrediting Delaware County on September 1, where approximately 10,000 reactors to the tuberculin test were eliminated at a great cost to the Bureau, State and County. This County made the full three-mill levy year after year until the work was completed.

The bulk of the actual testing in our state is being done by the local accredited veterinarian under the supervision of a few state and federal inspectors. There are some points for and some against this procedure but the public as a whole and the practitioners favor this method.

The average indemnity paid by the State for this past year for reactors has been greatly reduced, even though the salvage returns are less.
One of the greatest problems that we have to contend with is the importation of feeder cattle. Many people do not realize that over 1,000,000 head of cattle a year are fed in Iowa. The bulk of these cattle are maintained under quarantine until shipped to market for slaughter purposes. The time will come perhaps in the very near future when we will also require a tuberculin test on feeder cattle not originating from accredited areas. This will undoubtedly require considerable testing as rather a large percentage of the feeding cattle we received come from South Dakota, in which very little testing has been done.

With Iowa situated as it is, in the heart of the Corn Belt and having 8,000 miles of surfaced primary roads and the large number of trucks in operation, it is exceedingly difficult to prevent entirely the illegal transportation of live stock into the State from the adjoining states, but the past year we have been bending every effort to curtail this as much as possible. Our inspectors have been halting trucks loaded with cattle and other live stock crossing into the State and checking their health certificates. In cases of untested cattle, the truck driver is required to show the special permit from our office allowing these animals to be brought into Iowa under quarantine.

Another step that we have made this past year in control work has been that of placing an accredited veterinarian in charge of our live stock community sales to inspect all live stock offered for sale and demanding that a health certificate accompany these animals at the time they enter the sales yard. Cattle not originating in accredited herds or clean herds from accredited counties when originating in the State of Iowa must be tuberculin-tested before being removed from the sales yard, or if they are to be used for feeder purposes only, they may be released by branding females and bulls with the letter F on the right jaw, and the purchaser signs a feeder's agreement whereby he agrees to maintain them as a separate unit from his dairy and breeding cattle. Strictly feeder cattle, shipped into Iowa under a special permit from our office, when consigned to certain live stock community sales, may be handled in the same manner. Many people may criticize this method of procedure but many of our feeders prefer this method rather than going to central markets or the western range.

We have tested a very limited number of cattle in our State this past year for Johne's disease and I doubt very much if we have a great many herds that are infected. Iowa does not pay indemnity for reactors to tests for Johne's disease.

We are making considerable progress in the control and eradication of tuberculosis in poultry. Each inspector, at the time that the test is applied to a herd of cattle, is required to make an inspection of the poultry on the farm, posting as many of the diseased birds as possible and giving instructions to the owner. In flocks that show marked degree of infection, the owner is advised to dispose of the entire flock and not allow new birds to be placed on the premises until a thorough cleaning and disinfection has followed. They are further advised to make a practice of ridding themselves of all birds every fall that are one and a half years old.

Reports from slaughter establishments show a gradual decrease of retentions for hogs shipped from Iowa. However, we have instances where there has been considerable infection in some droves. Not long ago I received a letter from a veterinarian who had been called to inspect the carcasses of ten hogs that had been slaughtered by a local butcher. Eight were found to have generalized tuberculosis. On receiving this report, I asked one of our veterinarians to apply the tuberculin test to the farmer's herd of cattle from whom the hogs
had been purchased. The results of the test were that the entire herd of 18 head reacted, with the exception of two small calves. It was found that this man had purchased some cattle in an adjoining county from an untested herd. However, these are rare cases. The veterinarian who applied this test also reported that the chickens were badly infected but the hogs apparently seemed healthy which is often true in young hogs but which on postmortem would show considerable infection.

On reaccrediting our counties, we often find quite a number of reactors that show skin lesions only; many of the others being slightly affected; very seldom one that is condemned. This is quite a contrast to the earlier years when often as high as 20 per cent or more of the reactors found on a farm would be condemned as unfit for food.

Dr. J. A. Barger, B. A. I. inspector-in-charge of our State, keeps a very accurate record of all the identification tags used and when he receives a report from the Meat Inspection Division of the Bureau of Animal Industry of cattle affected with tuberculosis other than those shipped to slaughter as reactors, he can readily determine upon whose premises the animal originated. He sends this information to the inspector-in-charge of that district and the herd is classified as an infected herd if not so classified.

In conclusion I might say, we, who are in charge of tuberculosis-eradication work in Iowa, sincerely hope that some plan may be worked out in the very near future whereby sufficient funds will be made available by the government to pay the indemnity ordinarily paid by state or county for tuberculous milk cows, so that within the next year all such cows will be eliminated, thereby cutting down the overproduction of dairy products.

PRESIDENT FAULDER: I will now call upon Dr. J. L. Axby, State Veterinarian, Indianapolis, Ind.

DR. AXBY: I hereby acknowledge having derived much pleasure and information from the reports as given by Drs. Wight and Hall.

Again Dr. Wight has given an account of his stewardship in his usual and convincing and incomparable manner, always to the point and definite in conclusion, pursuing the tenor of his way, befitting the position he occupies, with a degree of certainty, and perpetuity of position many of us do not have assured. For all we know, we are only incidents of life that come in the ebb and flow of human endeavor, after many years of rooting from the sidelines, only to be chosen for a stated interval, to lead the forces of disease control, enforce the rules, laws and regulations, acquire the good will of the varied interests of a given constituency and accomplish results with as little objection as possible. I, personally, feel fortunate indeed, when I think of the close relationship that exists in this work between the states and the Bureau of Animal Industry, and recall that the admonition given by Indiana's Chief Executive, was: "The job is yours, you run it." In no way do I recognize the personal element as I do the professional recognition, for which we are greatly appreciative and fortunate indeed.

I said I realized the close relationship between the states and the B. A. I. and to neglect to mention the pleasant, friendly, enjoyable associations we in Indiana have with the present B. A. I. inspector-in-charge, in the person of Dr. H. Busman, would brand me as guilty of neglect to mention able, meritorious service and cooperation.

I have watched the progress of tuberculosis eradication in the United States, more particularly in Indiana, and whether or not it just happened, I have the honor of having lived all my life, and practiced for exactly thirty years in good old Dearborn County, Indiana, the first
county in Indiana to be declared a Modified Free Area, and when I
view the wonderful panorama of progress this activity has made, the
good it has done to humanity and the live stock industry, it is then
that I can begin to realize why it has not been opposed and curtailed
more than it has, especially during the long, lean, dark years of this
continuing depression, out of which, let's hope, we are soon to view
the radiant glory of the rising sun of a new day, and, that our in-
dividual happiness may be greater by our having resolved every day
in every way to do our part.

It is true that in some sections, nullification of this program has
been sought. We are inclined to pass judgment quickly; maybe we
see it only from afar and our vision is blurred. At any rate progress
is being made, and our faith being well founded, we shall go on. We
must expect smaller appropriations, reduced salaries, more work, and
the practice of every economy; the times demand it, we must meet it;
per the event we cannot, then we should get out, giving the job to
someone who can, lest the whole program be jeopardized by our in-
ability to meet the unescapable demand of the times.

The area plan is very appealing to me, for under this plan the
heights we now occupy have been attained. I would recommend we
go slowly even in its amendment. We must recognize that a differ-
ence does exist between the Corn Belt states and range states. What
benefits one, injures another, and to work out a program of control
fair, just and equal to both, may be difficult to solve, but by concen-
trated effort and honest, fair, unbiased, repeated trial, it can be solved.

Dr. Wight tells us accredited herds have increased during the year.
While I am surprised, in view of conditions, I am indeed pleased, as
I am inclined to consider an accredited herd as worth three times as
much as a herd in a modified area. Then, it seems to me that we
should regard the accredited herd plan as the father of the area
plan and so give it credit. I am neither a prophet, nor the son of a
prophet, but in Indiana I can see on the municipal legislative horizon
a public desire, backed by the State Division of Public Health and the
State Veterinary Department, for a program demanding that all milk
and milk products originate from yearly tested herds, or modified
accredited areas, and in many municipalities freedom from Bangs' dis-
ease as well.

As few reactors are found previous to shipment, it seems to me
that there is but little danger in the present interstate shipment regu-
lations, especially among dairy and breeding cattle. As to feeder
cattle, I will withhold expression of opinion, as a more favorable op-
portunity may present itself. While appraisals have decreased, they
are still too high in Indiana, even though we continue to instruct our
department personnel to bring down the value. This is one case where
the stockman asks for decrease in governmental expenditure and
lower taxes, but refuses to see the logic of it when he has a reactor.
It is my opinion that the buyers for packing-houses, where reactors
are slaughtered, should be educated along the line of fairness and
common respectful consideration of values, as in too many instances
carcasses of good quality, passing for food, are, under the guise of
being reactors, all but stolen from the owner.

We are interested in Johne's disease in Indiana. We have it, more
than we are aware of, I am sure, and as a diagnostic agent, I am
hopeful the time will soon be here, when with assurance we can de-
pend on intradermal johnin.

We are in hearty accord with the avian tuberculosis eradication
program. Recognizing the viability of the type, I am of the opinion
we have not worked out a satisfactory, resourceful method as regards
environs, especially the disinfection of soil. In cattle I have seen many later infections develop as a result of inadequate or inefficient disinfection among herds that had been tested until found free. Avian and swine tuberculosis undoubtedly are many times of common type. Everything points that way; therefore, their eradication must go hand in hand.

Tracing the origin of tuberculosis from postmortem reports often proves interesting and is of value, turning up many unexpected cases. As eternal vigilance is the price of liberty, just so is it the price we must pay for disease control, and as our studies become more extended, as research, investigation and observation develop more capable and more efficient sanitary officials, may I suggest the hope that the public will keep pace in its appreciation.

PRESIDENT FAULDER: The title of the next paper is “Some Observations and Comments on Area Tuberculosis Eradication Under Range Conditions,” by Dr. C. C. Hisel, State Veterinarian, Oklahoma City, Okla. (Applause.)

. . . Dr. Hisel read his paper. . . .

SOME OBSERVATIONS AND COMMENTS ON AREA TUBERCULOSIS ERADICATION UNDER RANGE CONDITIONS

By C. C. Hisel, Oklahoma City, Okla.

State Veterinarian

Of the achievements in the study and control of diseases, both in man and animals within the present age, none even remotely approaches the amazing progress made in the eradication of bovine tuberculosis in the short space of time that has elapsed since the inception of the County Area Plan of eradication. Nor is it possible to name a public project which is of greater or more lasting benefit to mankind. Ridding the nation's live stock of this scourge, the same which prompted Moses to prescribe the first meat inspection regulations of which we have any knowledge, and which has gone down the ages exacting a perpetual toll in economic loss, premature death, maimed bodies, suffering, and impaired efficiency, was an idea so vast that it staggered the imagination. There were “Doubting Thomases” at that time who said it could not be done. There still are, but happily their number is rapidly diminishing. Led on by a handful of men with vision and courage, the movement grew by leaps and bounds. From the Atlantic to the Pacific, and from Canada to the Gulf, there is not a state, or scarcely a community that has not made some effort to rid its live stock of a disease which is not only wasteful, but a constant real and potential menace to human
health. It has grown until today twelve of our states have attained the enviable status of Modified Accredited Areas, while many other states are rapidly approaching this goal.

The program of tuberculosis eradication has gone on efficiently, rapidly, and with only minor interruptions. Fostered and supported by the national government through the Bureau of Animal Industry, practically every state in the Union is today contributing in some measure to this nationwide movement. The combined efforts of the national and state governments, aided by counties and municipalities, have taken us far past the half-mile post. The goal is almost in sight. The pioneers in this great undertaking and those who have labored unselfishly and faithfully in the interest of this cause are about to realize their hopes and ambitions—a live stock industry freed from the menace of tuberculosis.

While we have been successful far beyond our early fondest dreams in the fight on bovine tuberculosis, and victory is almost within our grasp, there is still danger that it may elude us if we permit ourselves to be diverted from our purpose by dissensions in our ranks or deviate from the course pursued with such striking success for the past ten years. The method which has proved so eminently successful in detecting and removing more than two and a half million tuberculous cattle from the herds of this nation is too well known to need comment at this time. Tuberculin, plus training, experience, and a modicum of good sense have shown themselves to be very potent agencies in diagnosing bovine tuberculosis in all stages. Its reliability is accepted by acknowledged authorities both here and abroad. Nothing which could be said here would add to or detract from what has already been achieved by this method. The results speak for themselves in eloquent language.

We have been successful thus far because we have proceeded along definite lines and maintained a uniform policy, demanding as a minimum condition for accreditation that all dairy and breeding cattle within a county or other given area be tuberculin-tested under state and federal supervision and the infection reduced to one-half of one per cent or less. Proceeding along this line county was added to county and state to state without friction or serious opposition until a vast area containing the heaviest infection was cleaned up.

It so happens that this area, largely in the Corn Belt, is unable to produce feeder cattle in sufficient numbers to supply the demand. Consequently it is dependent on the western plains and
mountain states, where range and semi-range conditions still exist, for its source of supply. The livestock sanitary authorities, and many feeders as well, in those states which have completed their program of tuberculosis eradication, took stock of the situation and looked about for ways and means of protecting themselves against the invasion of infection from outside their own borders. Quite naturally they, of the Corn Belt states, asked themselves these questions:

Is it safe to bring these untested feeder-cattle into our state, permitting them to mingle with our cattle which we know to be free from tuberculosis? If we permit this, are we not in grave danger of re-infecting our herds, thus setting at naught all that has been accomplished at a tremendous cost in public funds and labor? They further reasoned:

It is perhaps true that the range cattle of the West and Southwest are relatively free from tuberculosis, but as yet very little or nothing has been done to determine to what extent they are free, and as long as this condition obtains we have no delusion that we are smart enough or lucky enough to pick only cattle that are free from infection. Until and unless we have ample proof, attested to by the proper state and federal authorities that such range cattle are free from tuberculosis as ascertained by the tuberculin test, we shall regard them with suspicion and permit them to enter our farms and feed-lots only under certain restrictions.

The result was that various rules and regulations governing the importation of all cattle not from accredited areas were adopted by feeder states. The requirements of these regulations vary from jaw-branding and segregation to tuberculin-testing of all cattle, including steers, for any and all purposes. So much for the Corn Belt and other cattle-importing states.

Going now to the West and Southwest, sections where feeder cattle are produced under range and semi-range conditions, we find that quite opposite views are held by some. Maintaining that the percentage of tuberculosis is so rare in their cattle, especially in their range cattle, as to be of no consequence, they chafe at any restrictions or interference with the marketing of their product. Just how well their contentions are founded will be examined and discussed later in this paper.

As more and more of the eastern states enforced restrictions on this class of cattle, the producers of the range states found themselves face to face with the situation of either accrediting their cattle on the official plan or suffering the consequences reflected in reduced prices, diminished output, delay and inconvenience in marketing.

Protracted discussions in which each side maintained the soundness of its position followed, both on the floor of this con-
vention and elsewhere, the feeder interests demanding only accredited cattle, and the producers' representatives insisting that they were being unjustly and unnecessarily discriminated against. The burden of their argument was that inasmuch as cattle produced under prevailing range conditions were relatively free from infection, the tuberculin testing required for accreditation was placing an uncalled for burden on the industry. Here we have all of the elements of a deadlock, which, if allowed to develop, could seriously interrupt the orderly progress of the tuberculosis eradication program. To prevent this a trade or compromise was effected and the question disposed of by adding Section 27 to the "Uniform Plan," also known as the "Range Area Plan of Accreditation."

The plan which was proposed by representatives of the western states provides as a condition for accreditation the tuberculin testing of all range bulls, purebred breeding cattle, milk cows, and at least ten per cent of the semi-range breeding females, and such other cattle as may be considered necessary by the state and federal departments, cooperating in counties where range and semi-range cattle are handled in considerable numbers. It was approved by this Association, adopted and put into effect by the U. S. Bureau of Animal Industry. While this was a distinct victory for the range states, the other side was disposed to accept it on the theory that the known incidence of tuberculosis in range cattle was comparatively slight and that under the operation of this plan, existing centers of infection would be disclosed and speedily cleaned up. Harmony was again restored and everybody was satisfied for a time. But for a time only.

The plan had hardly been put in operation—certainly not given a fair trial—when complaints again were heard that it also imposed unsurmountable difficulties and unreasonable burdens on the western cattlemen. Spokesmen for certain western cattle interests are now asking that this plan also be abolished, substituting therefor a plan under which range counties are to be accredited on the basis of postmortem findings at slaughtering centers under government meat inspection. The objections to the ten per cent plan which have been advanced are in substance the following:

1. It is claimed that testing on the ten per cent plan is a long, expensive procedure which, in view of the low incidence of infection in range herds, is out of all proportion to the value received.
2. It is claimed that it is an arduous undertaking, if not a physical impossibility, to gather for testing the range bulls and the required ten per cent of the breeding females. This, coupled with outlay for equipment which the rancher is put to and the resultant shrink of the handled cattle, is given as a valid reason for the discontinuance of the plan.

3. It is claimed that the method of accreditation through packing-house records is far more efficient and the only logical and infallible method of eradicating tuberculosis by tracing it to its origin.

In this same connection, it is noted that the reliability of the tuberculin test has been questioned. The arguments advanced for discontinuing the ten per cent plan of range accreditation are not convincing. They suggest the suspicion that the western cattlemen's interest in tuberculosis eradication is only passive. The inference is left that they believe tuberculosis eradication is a good thing for the other fellow, but under no circumstances must any part of the burden be borne by them.

A careful analysis of the objections offered to the Uniform Plan now being followed will, in most cases, show them to be unfounded. Considering first the matter of public expense involved in accrediting range counties under the ten per cent plan, figures from four Oklahoma counties which are fairly representative of the average range county are cited. In accrediting these four counties the Uniform Plan was strictly followed. The cattle population of the four counties totaled 166,878. The total cost to all agencies, i.e., federal, state and county, was $15,251.72, or an average of nine cents per head. Figures from other states are not at hand, but if they were, they would no doubt show great similarity. Surely this is not a prohibitive expense or too high a price for real tuberculosis eradication. It has not yet been satisfactorily demonstrated that it can be done any cheaper. The physical difficulties of testing cattle under range conditions, which are said to be impossible to overcome, were not encountered in any one of the four Oklahoma counties. And it may be significant or not, that not a single objector to the test was found among the ranchmen. However the work was so arranged that the larger herds were tested before they went to or after they returned from summer pasture, hence no extra labor or expense was necessary.

If any further evidence is required to prove that it is not impossible to test not only ten per cent but 100 per cent of the range cattle, it is only necessary to point to four representative western states—Idaho, Nevada, Utah and North Dakota, which
have demonstrated beyond any possible doubt that it can be done.
Reports from W. A. Naylor, secretary of the New Mexico Cattle Sanitary Board, indicate that range testing in that state is progressing rapidly and satisfactorily. Not only is there no opposition to the work in New Mexico, but the ranchmen are squarely behind the program. The Board is unable to keep pace with the demand for testing by counties and individual ranchmen. Several counties are constantly on the waiting list, says Mr. Naylor, and his statements are supported by several letters from ranchmen in his state, which are herewith quoted in part as follows:

The requirements for accreditation of this program are such that little expense is involved and the cattle subjected to a very slight shrink if properly handled in complying with the test. In the process of accrediting the herd on the Bell Ranch last spring, of over 15,000 cattle, we tested over 1,600 cattle in eight days with no additional cost in operation and a very little apparent detriment to the cattle. I feel that the program that has been outlined for conducting this work in the range states is both practical and efficient. I feel that there is some justice in the demand of the eastern states that had been to tremendous expense in attempting to clean up tuberculosis that we prove that there was no tuberculosis in range cattle.

(Signed) Albert K. Mitchell, Manager
Bell Ranch, Albert, New Mexico.

* * * In the first place, I wish to assure you that I am a firm believer in the importance of endeavoring to supply the buyer with the kind of cattle most desired and to put these cattle up to him in a shape that they will be entirely acceptable under the sanitary regulations of any state to which they may be destined. I am putting forth effort to raise good cattle and to enable me to market them with the least inconvenience. Being in competition with others of equal trade, I want my cattle to be in shape to meet any inspection required. As I understand it, the eastern states are asking for clean cattle as far as tuberculosis is concerned, and it has seemed to me at the outset that if our cattle should become acceptable through the testing under the ten per cent plan, this was certainly one of the simplest ways to put them in the clear. I did not believe that any material hardship would result in subjecting my cattle to the test, and I have proven this to be so to my entire satisfaction as I wish to explain.

(Signed) Lee S. Evans,
Marquez, Mexico.

Last fall when I got ready to sell my cattle, they had not been tuberculin tested and consequently the buyer who looked at them—and would have taken my cattle—would not do so on this account. As a result, I lost the sale and was later obliged to sell them for three dollars a head less. The Leguna Indians have had their cattle tested this year so will be able to go out under inspection this fall without any trouble, for which I am very glad as I am sure that this will help us a great deal, as it would have done last
fall could we have had the necessary inspection papers at that time.

(Signed) JOHN J. ALONZO,
Paquate, New Mexico.

Are conditions in New Mexico, physical and otherwise, so greatly different from the remaining western states?

In support of the proposed substitute plan, it is stated that the U. S. Bureau of Animal Industry regards the packing-house inspection records as a reliable index to the incidence of bovine tuberculosis throughout the country. Granted that this is true, it by no means follows that it may be safely substituted for a thorough farm-to-farm and ranch-to-ranch survey and the tuberculin testing of even a small percentage of the cattle. Discovering centers of infection via the packing-house route is largely a matter of accident which may happen or may not. Are we prepared to entrust a matter as serious as tuberculosis eradication to the whims of chance?

The infallibility of the proposed method is easily disproved by check records made at various slaughtering centers during the past year. One important western packing center reports that out of 46 range cattle retained, it was possible to identify only 27, or 58 per cent, as to ownership. To trace the devious and often tortuous route which many cattle follow from the home ranch to the slaughterhouse would require nothing less than the full-time services of a Bureau of Investigation. There is no assurance that because cattle are shipped to market they will be immediately consigned to slaughter. Many such cattle find their way into the hands of speculators and are sold and resold many times before they are finally slaughtered. Each change of ownership complicates the difficulty of identification until in time it becomes practically impossible. In addition to this, a large portion, estimated at 40 per cent, is slaughtered in unofficial establishments from which no records are available.

Referring again to the packing-house postmortem records from one of our largest western live stock markets and packing centers, some very significant information is revealed. It was found at this market that 0.8 per cent of identified range cattle were retained for tuberculosis and 0.19 per cent were condemned, while at the same time only 0.2 per cent of non-range cattle were retained and 0.04 per cent of this class condemned. In view of these figures it will become increasingly difficult for the rest of the nation to accept the statement that tuberculosis in range cattle is too infrequent to warrant aggressive eradication measures.
SUMMARY

1. The eradication of tuberculosis from our live stock is the most important project confronting the live stock sanitary authorities of this nation. Its importance as a human health measure alone justifies any means to the end. It should be prosecuted relentlessly until the final goal—not 0.5 or 0.1 per cent, but 100 per cent eradication has been achieved.

2. The ten per cent method of accrediting range cattle is both practical and economical and the maximum concession which is consistent with safety. Section 27 of the Uniform Rules must not be attenuated if we are to succeed.

3. When it is desired to exchange methods which have been tried and approved for something new, common prudence dictates that the new holds out prospects of improvements over the old. The proposed substitute plan offers no such assurance, and would probably discredit all area accreditation.

4. In closing I desire to express my sincere appreciation to Dr. Cotton and the other members of the Committee on Tuberculosis for the privilege of presenting their thoughts. The subject is vital. It is, I am certain, of sufficient importance to invite your most earnest consideration. Nothing less than the future of tuberculosis eradication is in your hands. Yours is the privilege—yours is likewise the responsibility of deciding what the future shall be. Shall the name “Modified Accredited Area” remain the symbol of security and confidence, as it has been in the past, or shall it become a meaningless phrase, a mere scrap of paper?

PRESIDENT FAULDOR: This excellent paper will be discussed by two gentlemen, Mr. J. Elmer Brock and Dr. Walter Wisnicky. I will call on Mr. Brock, who is chairman of the Special Committee on Tuberculosis Eradication, American National Live Stock Association, Kaycee, Wyo. (Applause.)

MR. BROCK: Dr. Hisel’s history of bovine tuberculosis, the progress in its eradication and the benefits derived by mankind are, in my opinion, both instructive and correct. That mankind, as well as our industry, owes a debt of gratitude to your organization and your profession we cheerfully admit. The method for the eradication of bovine tuberculosis in the farming and dairy sections is without doubt the most practical method yet devised for that area. When tuberculosis eradication work was extended to the range and semi-range areas, you found that bovine tuberculosis was rare in the range or beef breeds of cattle and that a modification of the regulations governing this was justified. These facts are both conclusive from Dr. Hisel’s statements.

We believe that the almost entire absence of bovine tuberculosis in the range areas in due in part to the manner in which these cattle are maintained. Cattle on the open range are not closely congregated,
which, along with an abundance of sunshine, together with the fact that they go without shelter throughout the entire year, all tend to prevent spread of the disease. Data procured from the Wyoming Tuberculosis Society, reveals that 45 per cent of the people of my State harboring tuberculosis come there seeking health.

Dr. Hisel's statement, "The feeder interests demanding only accredited cattle," is one which I challenge. I have met many hundred of feeders and have yet to meet the first man who had any fear of loss through tuberculosis infection in range or semi-range cattle of the beef breeds.

I also challenge the statement of Dr. Hisel when he refers to the western cattlemen, stating, "They chafe at any restrictions or interference with the marketing of their product." I think Dr. Hisel magnifies the interference as it applies to our healthy range cattle. Numerous buyers comb the western states annually seeking stocker and feeder cattle. I have never yet had an inquiry from one of these men as to whether these cattle were free from this disease or whether or not they had ever been tested for tuberculosis. They evidently find a broad outlet for these cattle elsewhere, hence our objections are not because of restrictions on our output, but rather on the expense and damage to our stock in complying with Section 27 of the Uniform Methods and Rules for the Establishment and Maintenance of Tuberculosis Modified Accredited Areas.

Dr. Hisel attempts to show that we have not presented a uniform front, by quoting three range men. I happen to know one of these men who is a purebred breeder and would have to test under any plan. Have these three letters proven his point, when you have had appear before you representatives of western live stock organizations having a membership of many thousands?

That there is a low percentage of infection in the western cattle is proved by the following report of the Bureau of Animal Industry:

Summary of postmortem records of range cattle slaughtered under federal supervision during the period from November, 1932, to October, 1933, inc., at Butte, Montana; Chicago, Illinois; Denver, Colorado; Kansas City, Kansas; Omaha, Nebraska; Sioux City, Iowa; South Saint Joseph, Mo.; South Saint Paul, Minn.; Spokane, Wash., and Tacoma, Wash.

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<td>79,432</td>
<td>4,000</td>
<td>13</td>
<td>1</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Totals</td>
<td>507,115</td>
<td>102,125</td>
<td>222</td>
<td>53</td>
<td>151</td>
<td>82</td>
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</table>
Calling your attention to Dr. Hisel's own state, where 25,511 range cattle were autopsied with no single disclosure of tuberculosis, I ask you if the range man is not justified in objecting to needless and expensive handling of his stock.

Dr. Hisel gives certain figures as to cost, indicating a test of 166,878 cattle for a total cost of $15,215.72 or an average of 9 cents per head. This may seem a trifling sum to Dr. Hisel, but I will call to your attention the fact that this sum is equal to one-third of the total sum available, for a biennial period, to our State Sanitary Board in Wyoming for the control and eradication of infectious and contagious diseases of all live stock. A special session of the Legislature now being called in the state of Wyoming, to bring about further economies in government, does not indicate the probability of any increase in this appropriation. This condition is paralleled by those of many western states at this time.

To those of you who are really interested in the eradication of disease, rather than the maintenance of a certain fixed rule or regulation, our proposal of utilizing the services of the postmortem work of the Bureau of Animal Industry should be welcome. It provides a method whereby disease may be detected and cleaned up at once and we believe this is a marked improvement over Section 27 of the present regulation in expediting the eradication of tuberculosis. This would be but a continuation of a method of detecting infected centers, which was used by the Bureau of Animal Industry prior to the adoption of the intradermal tuberculin test.

Dr. Hisel states that the postmortem work was started by Father Moses. While I admit this was before I became involved in this controversy, I can see great merit in continuing the work Father Moses started.

In attempting to set up costs in testing, Dr. Hisel omits the expense to the owner in the handling of the stock. I speak advisedly on the damage in handling live stock, as a new government loan agency admits they have caused many thousand dollars worth of damage to some stockmen by requiring two separate counts on their live stock. In one instance in Wyoming this amount is estimated at ten thousand dollars. This factor was so important that when a double count is now required they furnish two men, so the stock is handled only once. Compare the damage in galloping by a string of cattle which are not even corralled for a count, to that sustained in putting them through a squeeze-chute twice in 72 hours!

It is as absurd for Dr. Hisel to contradict the stockmen's claim to heavy loss through damage in handling of stock as it would be for a cowpuncher to attempt to compound a concoction of drugs to cure a sick cow.

Dr. Hisel attacks the proposed method of using the packing-house records as being inefficient because of not being able to trace infected cattle to their source. He cites a case of where 46 range cattle were retained and it was possible to identify the ownership of only 27.

Quoting Dr. Mohler, of the Bureau of Animal Industry, under date of November 10, 1933, as follows:

"During the months of August, September and October, 1933, the Bureau officials at the larger packing centers furnished reports showing the number of branded cattle affected with tuberculosis which could not be identified by the brand inspector. There were 57 such range or semi-range cattle that could not be identified during that period."

This excited my curiosity as to the origin of these cattle and Dr. Houck's reply to my inquiry on this point was:
"Most of these unidentified range cattle were reported from Omaha, Nebraska, and while the reports do not indicate the state of origin in all cases, they do indicate that some of the animals came from Nebraska and South Dakota."

I would further direct your attention to the fact that most of these cattle seemed to originate from two states which are only about half range or semi-range areas, namely: South Dakota and Nebraska. These cattle could easily have originated east of the brand inspection line, which area would not be included in our proposed plan of modification.

It has been definitely proven that these branded cattle can be traced, as evidenced by one infected herd in Wyoming which was traced from five different shipments, to three different markets and billed under different ownerships. Any branded cattle from a herd so small and obscure that they could not be traced would not come under our proposed change of plan.

As to tracing of cattle reported to our brand inspector, a form has been adopted by Colorado, Nebraska, South Dakota, Montana and Wyoming Brand Inspection Service, which service is under the jurisdiction of the Packers and Stock Yards Administration. It is futile to question the efficiency of this service in tracing tuberculous cattle when it is relied upon solely as a means of proving ownership of millions of cattle annually. This method is not only relied upon by the owners but also by many banks carrying live stock mortgages, and by some of the federal loan agencies.

Apparently Dr. Hisel is not familiar with paragraph 20, section (b), of the proposed plan for the Establishment of Tuberculosis Modified Accredited Areas of the Range and Semi-range Districts, which provides that an area may be modified "when all bulls, purebred breeding cattle, milk cows, barnyard cows and what western men call 'the hospital bunch' are tuberculin-tested, and properly identified postmortem reports are produced showing that at least 10 per cent and not less than 25 animals of the breeding herd have been slaughtered within a year, and that such postmortem examinations failed to disclose lesions of tuberculosis." You will note that this regulation clearly states that a certain percentage of any herd included in an area for modification must be tuberculin-tested in addition to the postmortem findings.

We urge the adoption of the plan set forth in paragraph 20, section (b), which we assume will be offered by your Committee on Tuberculosis.

We laymen do not question the merits of the tuberculin test for detecting tuberculosis. We are confident it is the best method yet devised and the extent of its efficiency is a technical question which we do not raise. We are also confident that if the profession discovers a more practical and efficient method, this organization will immediately urge its adoption. In making these concessions on technical questions we assume you will be equally broad-minded and grant that we may have meritorious suggestions in a practical application of your scientific findings, particularly when applied to conditions which are peculiar to our range and semi-range areas; which conditions are unfamiliar to many of the eastern live stock sanitary officials.

We take it that your work is a progressive science. We also believe that you people, like ourselves, are interested in clean, healthy cattle more than the maintenance of specific regulations. As to humanity, we certainly claim the ability to have the same kind feelings as those carried in the bosom of a professional man. Most certainly you will grant that we have at least an equal interest with you in both the health of our live stock and its potential sale value, for, after all it is our property and our livelihood.
I want to thank the United States Live Stock Sanitary Association for the many courtesies extended my associates and myself and for the privilege of appearing on your program to present our reasons for urging the adoption of the plan we feel is so vital to our industry.

If our proposals are adopted, I think I can promise resolutions from the American National Live Stock Association, my own and numerous other live stock associations urging that funds be made immediately available from the Public Works Administration for the purpose of expediting the eradication of bovine tuberculosis.

PRESIDENT FAULDER: The paper by Dr. Hisel will now be discussed by Dr. Walter Wisnicky, Director, Live Stock Sanitation, Department of Agriculture and Markets, Madison, Wis. (Applause.)

Dr. Wisnicky: I want to commend Dr. Hisel on his paper. I think it was a very well-written paper. It showed evidence of deep thought and careful consideration of the various points which he discussed. He perhaps holds viewpoints with which others do not agree, but, nevertheless, it is very evident that he has presented a most excellent paper to this Association.

I do not want to enter into the controversy which has been commenced here in regard to this paragraph 20, section (b). I think last year I rather got my foot into it a little bit. The president of this Association at that time called on me (I happened to be sitting somewhere near the front) to give a few remarks on the subject, and in an impromptu way I expressed myself as I saw the situation pertaining to the modification of rules so as to facilitate matters in tuberculosis control on the western range.

I think my remarks were somewhat along this line: That, if it were possible for the people in the western area to send a definite number of animals for slaughter, and the federal government could inspect those animals by postmortem examination and send a report back to the owners of those cattle, in my opinion that report would be as accurate an indicator of herd infection—mind you, I am saying herd infection, not individual infection—as a tuberculin test on a similar number of animals. I hold that opinion today.

I believe that it is as efficient to examine these animals and detect herd infection by postmortem examination as it is to test the animals by means of the tuberculin test. I admire the conservative spirit of Dr. Hisel. I think we need men like him, because in this era of fast-changing times, when even a paper will be outdated in the course of a few hours, I think we do need men with conservative attitudes.

I was interested also in the remarks of Dr. Axby, in his leaning toward the conservative side. I think the western people who are asking for these concessions should note this conservative tendency of the members of this Association. I think they are here with a just request, and I think that request is being considered fairly. But I think they should keep in mind also that their request should be of such a nature that there will not be demands upon this Association to be changing the rules and regulations continually. We must have rules of procedure. Those which we have been following in the control of bovine tuberculosis in America have led us to a marked success.

I do believe, however, that we should be open-minded enough and fair enough so that we will reconsider those rules of procedure when some worthy proposition comes to us for consideration. I think we should not close our eyes to progress.

I feel that I can go home from this meeting with information that makes me realize more than ever before that we are making progress in tuberculosis eradication. That splendid paper by Dr. Dorset this afternoon brings to our attention so vividly the progress being made in one phase of this tuberculosis eradication work. I think we should
also consider further extending our activities in the various parts of this country, in the control of bovine tuberculosis.

You know, this country has a vast area. Different conditions exist in various parts of it. The cattle industry is not similar throughout. We have different types of cattle industry throughout the various parts of this country, and, therefore, we must expect that there should be different methods to be applied.

I think the problem presented to you today is not a new one, this so-called paragraph 20, section (b). I think Dr. Butler made a remark last year to the effect that he has been advocating that very proposition, or the substance of it before this Association for a good many years. So, you can readily understand that this proposition has received the thorough consideration of those who have been interested in it.

I think we should regard what the Committee on Tuberculosis places before us as something that has been worked out very carefully, and that their recommendations are based on sound premises.

I just want to say that in any endeavor we must continually be looking forward to making progress and to revising our procedure if it will bring advantages to us. I think that the revision which is being proposed will bring us distinct advantages, in that it will stimulate activity in tuberculosis control in the western states. I think they need that little encouragement and that additional help, and we should revise the regulations to enable them, in a more practical way and, still in an efficient way, to carry on their program of bovine tuberculosis eradication. (Applause.)

Dr. Hisel: Mr. President, if I were the diplomat that Dr. Wisnicky is, I would have no trouble in getting the job done. He has argued my side of this question, and he has at the same time most beautifully argued the other side. (Laughter.) And that isn't all. He is directing the animal industry in an accredited state.

I don't want to argue this case, because, regardless of what you write into the regulations, Oklahoma is going to eradicate tuberculosis (applause) because if I had never been convinced before, I would have been convinced this afternoon in hearing this discussion and in looking at the pictures presented here this afternoon by Dr. Myers. That would be sufficient for me, regardless of regulations or anything else.

In closing, Mr. President and gentlemen, I want to read a letter from the largest ranchman in this country. This letter is from the S. M. S. Ranch, Stamford, Texas, under date of November 11, 1933, addressed to me:

"We have your letter of November 9 regarding the testing of range herds for tuberculosis. We had our cattle tested by a federal veterinarian about a year ago and found it both practical and inexpensive.

"Any ranch which gathers its bulls in the fall can have these bulls tested with a minimum amount of work, and the 10 per cent of the cow herd required can easily be rounded up for the test. We prefer to have an accredited herd as against the post-mortem reports from packing-houses. For instance, if a calf is shipped from the range in Texas, from a tuberculosis-free herd, he may contract tuberculosis while being fed in the Corn Belt. Therefore, a postmortem examination may be entirely erroneous as regarding the origin of the disease, and it seems to us that the actual testing of herds is the only method of eradication which is fair to the ranch breeder and which accomplishes the end in view."

Dr. Wisnicky, you have a hard time getting over that statement. (Laughter.) I have a letter from the secretary of the Cattle Sanitary
Tuberculosis

Board of New Mexico. I read you part of the letter from the Bell Ranch, from Alfred K. Mitchell in New Mexico, also a letter from John J. Alonzo. These are all ranchmen, who are for tuberculosis eradication on the present plan; Lee Evans, George Egger, a member of the Cattle Sanitary Board of New Mexico, Howard L. Cohen, another New Mexico rancher. Likewise, I have twelve letters from twelve state veterinarians holding to the same position that I maintain in this. Of course, I shall not take your time to read them.

Gentlemen, it is in your hands.

Dr. T. E. Munce: Inasmuch as the paper and the discussions which have taken place pertain to paragraph (b) of section 20, I am going to suggest (I don't know whether a motion is necessary) that the chairman of the Committee on Tuberculosis, Dr. Cotton, present his report, which will cover the amendment which has been discussed, but that, in presenting it, he separate that particular section from the other and consider the report with that particular phase of the report separately, to give a clear-cut opportunity for full discussion when it comes before the house.

President Faulden: I will call upon Dr. C. E. Cotton to present the report of the Committee on Tuberculosis.

Dr. Cotton: Mr. President and Gentlemen: You will recall that at the last two sessions of this organization your Committee recommended (and the recommendations were adopted) that we thought it necessary to have the uniform methods and rules for the establishment of the individual accredited herds as well as the modified area, which had been in existence since they were initiated in the early twenties, re-edited or re-codified, for the reason that they had been amended quite frequently.

As a result of this recommendation, your present Committee has given a good deal of thought and time to the re-editing and re-codification of these uniform rules.

At a meeting of this Committee in Chicago, in August, it was decided that we would request Dr. Wight to prepare proposed amendments or changes to both of these plans for our Committee. Dr. Wight did this, and, as chairman, I had the revised code printed and mailed to all of the state control officials, and to the federal inspectors in the various states. I asked them to study the proposed changes and, if they could not attend this meeting, to communicate with me, and I would gladly present their views to the Committee.

As a result, the Committee has been in session since yesterday morning. We have given a hearing to everyone who requested one. We have not had time to prepare a complete report, but I propose to submit, as the Committee's report, the re-editing of these uniform methods and rules as they were prepared by Dr. Wight and as they have been agreed to and amended by all of the members of our Committee, with the exception of sub-paragraph (b) of section 20, which is the item in question, and to which Dr. Munce just referred. That met with the approval of all of the members of the Committee present, with the exception of Dr. Munce and Dr. Hisel. I don't know, in justice to this proposed plan, what we can do other than to read it complete, as we recommend that it be adopted by the Association.

Dr. W. J. Burtis: I think it would save Dr. Cotton considerable trouble if he would read simply the summary of changes at the end of the report. I would so move you.

Dr. Corroon: I rise to a point of order. The summary of changes we furnished was on the material prepared by Dr. Wight, and your Committee has made numerous changes.

If there is any question in your mind, or in the minds of any of you, relative to the changes, I wish to explain that the paragraphs are
REPORT OF COMMITTEE ON TUBERCULOSIS

Dr. C. E. Cotton, Chairman, Saint Paul, Minn.

Dr. L. Van Es, Lincoln, Neb.      Dr. C. C. Hisel, Oklahoma City, Okla.
Dr. T. E. Munce, Harrisburg, Pa.  Dr. J. R. Brown, Chicago, Ill.
Dr. George Hilton, Ottawa, Ont.   Dr. W. J. Fretz, Saint Paul, Minn.
Dr. J. H. McNeil, Trenton, N. J.  Dr. A. E. Wight, Washington, D. C.

Part I. Individual Accredited Herd Plan

1. (a) A tuberculosis-free accredited herd of cattle is one in which the entire herd has passed two negative, successive, annual, physical examinations and tuberculin tests, or, upon disclosure of infection, three semi-annual, successive, physical examinations and tuberculin tests applied by a veterinarian regularly employed by the United States Bureau of Animal Industry, or by an accredited veterinarian who has passed an examination conducted by the proper state live stock sanitary official and the Bureau of Animal Industry, and who is approved by the proper official of the state in which the herd is located.

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

(1) The tuberculin test shall be applied on dates approved by the proper state live stock sanitary official or the inspector-in-charge of the Bureau of Animal Industry in the state wherein the herd is located.

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

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

(4) The amount of federal indemnity funds for use in the payment for reactors in herds being tested by an accredited veterinarian shall be limited to 15 per cent of the total amount of federal indemnity allotted to any state, unless an additional allotment for this purpose is made available.

2. The Tuberculin Test:

(a) The official test shall be the intradermic by the single injection, or the double injection of the caudal fold and vulva, or the subcutaneous, or either or both of these methods in combination with the ophthalmic.

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

3. The entire herd, or any cattle in the herd, shall be tuberculin tested or retested at such times as deemed advisable by the cooperating state and federal authorities.
4. No animal shall be presented for the tuberculin test which has been designated as a reactor at any time.

5. Reactors to the tuberculin test shall be promptly removed from the farm, and, after their removal, the infected premises shall be thoroughly cleaned and disinfected with a disinfectant approved by the U. S. Bureau of Animal Industry.

6. Herd-owners are required to house, feed and care for the cattle under such sanitary conditions as will tend to promote good health, and to follow such recommendations as are made by cooperating state and federal authorities.

7. Calves shall not be fed milk or other dairy products except: (1) When such milk or other dairy products have been produced by a herd that is under the plan, or (2) when the milk or other dairy products from outside or unknown sources shall have been pasteurized by heating to 145° F. for 30 minutes.

8. Herd Records:
   (a) The herd-owner is required to establish satisfactory evidence of the identity of each registered or grade animal, the grade animal to be marked by a tag or other marking satisfactory to the cooperating state and federal authorities.
   (b) Each herd-owner is required to keep a record of all additions and removals of cattle from the herd by sale, death or slaughter.

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

10. Added Cattle:
   (a) Cattle may be added to an accredited herd in accordance with the following provisions:
       Originating from an accredited herd.
       Originating from a once-tested free herd or from a modified accredited area on one additional test applied in from 60 to 90 days, and during such period kept separate from the herd.
   (b) Cattle may be added to once-tested free herds in accordance with the following provisions:
       From accredited herds, once-tested free herds, or modified accredited areas, without further test.
       Cattle added to other herds under this plan, unless originating in accredited, or once-tested free herds, or modified accredited areas, are required to pass a negative tuberculin test within 60 days prior to entry.
   (c) Any cattle remaining in infected herds shall not be added to herds under supervision except under special permits.

11. If a retest of an accredited herd discloses not more than one reactor, such herd may be reaccredited, provided the entire herd shall pass a retest applied not less than four months from the date of the previous test. If a retest of an accredited herd discloses more than one reactor, the regulations governing the tuberculin-testing of infected herds shall apply.

12. An accredited herd certificate shall be valid for one year, and shall be issued by the cooperating state and federal authorities.

13. Cattle from an accredited herd may, subject to regulation of state of destination, be moved interstate on a certificate of health and tuberculin test chart, which will be issued by the cooperating state or federal officials.

14. Failure on the part of an owner to comply with these methods and rules shall constitute sufficient cause for the cancellation of the agreement.
Part II. Modified Accredited Area Plan

15. The provisions of the Individual Accredited Herd Plan that relate to testing, removal of reactors, cleaning, disinfecting, and sanitation, shall apply to the Modified Accredited Area Plan. All infected herds shall be required to pass three negative tuberculin tests not less than 60 days apart.

16. The extent of the area shall be determined by the state and federal authorities, and when the testing is begun the area shall be placed under quarantine.

17. If, as a result of one complete tuberculin test within the designated area, the total number of reactors is less than one-half (1/2) of one (1) per cent of all the cattle within the area, the area shall then be declared an official modified tuberculosis-free accredited area for a period of three years by the cooperating state and federal officials.

18. If, as the result of a complete tuberculin test of all the cattle in the area, the number of reactors is one-half (1/2) of one (1) per cent, and not more than one (1) per cent, the infected herds shall be quarantined and retested. If the total number of reactors found as a result of this retest within the area is less than one-half (1/2) of one (1) per cent of the entire cattle population within the area, the area shall then be declared an official modified accredited area for a period of three years.

19. If, as a result of one complete tuberculin test of all the cattle within an area, the total number of reactors exceeds one (1) per cent, all the cattle in the area shall be retested.

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

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

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

If, under paragraph (a) or (b) of this section, a reactor or any other evidence of infection is revealed in any herd by postmortem reports, etc., including postmortem inspection at packing-plants of those branded cattle that are sold direct from the range for immediate slaughter, then all of the cattle in that herd or associated with the diseased animal shall be immediately tuberculin-tested in accordance with the provisions of the Modified Accredited Area Plan. The area may then become a modified accredited area and be reaccredited at the expiration of three years, if the total number of reactors and cattle found tuberculous upon postmortem examination from the area is not more than one-half (1/2) of one (1) per cent of all the cattle tested in the area.

21. Modified accredited areas in which, on the original tuberculin test of all cattle in said areas, the extent of infection did not exceed one-half (1/2) of one (1) per cent, may be accredited (and also modified accredited areas that have been reaccredited in which, on the last complete tuberculin test of all the cattle in said areas, the extent of infection did not exceed one-half (1/2) of one (1) per cent may be reaccredited) if not more than one-half (1/2) of one (1) per cent react as
the result of retesting all of the herds in which infection was disclosed at any time and such other herds as the state live stock sanitary officials and the federal inspector-in-charge may designate, and which shall include, as far as possible, all herds in which cattle from other than accredited herds or modified accredited areas have been added.

22. Modified accredited areas, in which on the original test of all cattle in said areas the extent of infection did not exceed two (2) per cent, and also modified accredited areas that have been reaccredited, in which on the last complete tuberculin test of all the cattle in said areas the extent of infection exceeded one-half (½) of one (1) per cent, and was less than one (1) per cent, may be reaccredited if less than one-half (½) of one (1) per cent react as the result of retesting at least twenty (20) per cent of the total number of herds, in addition to the herds in which infection was disclosed at any time.

23. Modified accredited areas in which the degree of infection exceeded two (2) per cent on the original test may be reaccredited by retesting all the cattle in such areas in accordance with paragraphs 17 and 18.

24. Modified accredited areas, in which a complete area retest of all the cattle in said area indicates a degree of infection not exceeding two-tenths (0.2) of one (1) per cent, may remain in the modified accredited status for a period of six years from date of remodification, provided that all cattle in such areas are retested at the expiration of such remodification.

25. Movement of cattle into modified accredited areas or areas under quarantine.

(a) Cattle not under quarantine originating in modified tuberculosis-free areas, or those originating in tuberculosis-free accredited herds, or herds in the process of accreditation wherein the entire herd has passed a negative tuberculin test within a nine-month period to entry, may enter modified accredited areas or areas under quarantine, without being subjected to an additional tuberculin test, provided such cattle are apparently healthy, and are accompanied by a health certificate and proper identification approved by the live stock sanitary official or authorized agent of the state of origin.

Other cattle, except those provided for in paragraphs (b), (c) and (d) of this section, shall be required to pass a tuberculin test prior to entry, and if any reactors are disclosed none of the cattle shall be allowed to enter the modified or quarantine area until they have passed a retest applied in not less than 60 days. They shall be accompanied by a tuberculin test chart and health certificate issued by a duly authorized agent of the state of origin.

(b) Steers, range cattle, or semi-range cattle of recognized beef types, not originating in modified accredited areas, except those originating in herds known to be infected with or exposed to tuberculosis, may enter the modified or quarantine area for feeding or grazing purposes without being subjected to a tuberculin test prior to entry, provided permission for such movement is granted by the proper state live stock sanitary official of the state of destination, such cattle to be held separate from other cattle in the modified or quarantine area. Cattle of this type for feeding or grazing purposes, originating in herds known to be infected with or exposed to tuberculosis, shall be required to pass a negative tuberculin test before movement under the provisions of this paragraph, provided permission for such movement is granted by the proper state live stock sanitary official of the state of destination, and shall be accompanied by a tuberculin test chart and health certificate issued by a duly authorized agent of the state of origin.
(c) Apparently healthy cattle of strictly slaughter types, and to be used only for immediate slaughter, may enter a modified or quarantine area without an examination and tuberculin test. Cattle entering a modified or quarantine area under this clause (c) must be slaughtered within ten days after their entry into such areas, except when the ten-day period is extended by a special permit from an officer or authorized agent of the live stock sanitary official, provided that such cattle shall not be diverted for other purposes.

(d) Purebred cattle may enter a modified or quarantine area to be kept therein temporarily for exhibition, or to be bred, providing the cattle are accompanied by a tuberculin test chart and health certificate approved by the live stock sanitary official of the state of origin.

Dr. Cotton: Gentlemen, those are the proposed amendments. Your Committee wishes to recommend that a note, rather than another paragraph, be appended to these rules, to read as follows:

"NOTE: The movement of cattle interstate under any and all conditions shall be subject to the approval of the proper live stock sanitary official of the state of destination."

Your Committee has a recommendation to offer:

"Your Committee recommends that the Secretary of the United State Department of Agriculture and all state live stock sanitary authorities make provision whereby all cattle imported into modified accredited areas shall originate from non-quarantined herds located in modified accredited areas or areas in process of accreditation."

President Faulder: Gentlemen, you have heard the report of the Committee on Tuberculosis. The report includes the amendments as read, a note and a recommendation.

Dr. Munce: I move that we adopt the report as submitted by the chairman, with the exception of the changes in paragraph (b) of section 20, which changes will be considered separately.

Dr. Hiskel: I second the motion.

President Faulder: Is there any discussion? The voting will be limited to members in good standing. There is a motion before the house to accept the report as read by Dr. Cotton, with paragraph (b) of section 20 omitted. Are you ready for the question? Those in favor of accepting the report, with paragraph (b) of section 20 out, will signify by saying "Aye"; opposed, "No." It is carried.

Now the vote is upon whether this report will include paragraph (b) of section 20. Is there any discussion? Are you ready for the question? Those in favor of accepting, as part of the report, paragraph (b) of section 20 will signify their approval by saying "Aye"; opposed, "No." It is carried. The report is accepted.

... The session adjourned at 6:40 p. m. ...
LEUKOSIS OF THE COMMON CHICKEN

By WILLIAM H. FELDMAN and CARL OLSON, Jr.*

Division of Experimental Medicine
The Mayo Foundation, Rochester, Minn.

Notwithstanding the prevalence and economic importance of the blood dyscrasia of chickens, popularly known as leukemia or "big liver disease," there appears to exist, in the minds of many, no little confusion concerning the essential pathologic changes and diagnostic characteristics of the malady. Much of the difficulty experienced in obtaining an understandable and practical concept of the disease is due in part to an ambiguous and misleading nomenclature which has burdened the literature during the past 25 years. Although the lack of a consistent and logical classification has prevented comprehensive understanding of the condition, elucidation of the disease has been retarded also in no small measure by a certain superficiality of many who have been engaged in the routine postmortem examination of chickens, many of which are affected with leukosis.

The explanation that an exact diagnosis is not essential, and of little meaning and of less solace to the owner of the flock, is hardly sufficient. If a searching examination is made at necropsy, and a conscientious effort is made to reach the fundamental disturbance that ultimately resulted in the sickness and death of every bird, the pathologist concerned with poultry diseases would not only contribute immeasurably to the welfare of the individual owner of a flock, but at the same time would contribute materially to the store of knowledge which, as most of us know, is not oversupplied with precise information. If more truths are to be assembled, and a better understanding consequently obtained, it can be accomplished only if we maintain perpetual scientific inquisitiveness, coupled with conservative enthusiasm. The field is tremendous, and the expected results are worthy of our best efforts.

The importance of the subject indicated by the title of this paper is evident to all who are interested or acquainted with diseases of poultry. Without quoting statistics, it seems sufficient to say that this disease, which we prefer to call leukosis, is one of the commonest diseases affecting chickens. Although it does not cause the spectacular and immediate losses characteristic of some of the acute infectious diseases, its incidence, behavior, and

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persistence in certain flocks, and the difficulty of its control, qualify the disease as one of much significance to the poultry industry.

Information available indicates that the disease is wide in its geographic distribution, occurring generally over the United States, the British Isles, and Continental Europe. Although no breed can be considered immune, the disease seems to show a relative predilection for individual strains of certain breeds. In chickens of the Barred Rock breed, the disease seems to show a higher incidence than in others. The inherent resistance and susceptibility of different breeds is difficult to understand, and emphasizes the need for properly controlled investigation into this phase of the subject.

Before attempting a description of the more salient features of leukosis of fowl, we desire to point out that our views on some aspects of the disease are to some perhaps unorthodox. We have attempted, however, to base our concepts of the pathologic changes of this condition on personal observations, which included studies of the gross and microscopic changes, with proper consideration given to the hematologic aspect of the disease. We do not wish to imply that our views are final and not subject to criticism and revision. However, certain facts have been obtained which, when properly correlated, provide what we believe to be a logical and acceptable understanding of this entity which we feel is often undetected, or perhaps confused with other pathologic conditions from which it should be separated.

**ETIOLOGY**

There is at present impressive evidence that the disease is due to an agent that is capable of passing through filters. It has been shown experimentally that the substance responsible for transmission of the disease will pass through all types of silicon filters, and will even pass through a collodion membrane. Since bacteria of ordinary dimensions will not go through such filters, it is obvious that the provocative agent of leukosis of fowls must be exceedingly small or of such a physical character as to permit passage through filters which prevent the passage of microscopic forms.

The precise nature of the substance is unknown, although Jármai was of the opinion that the provocative substance was not an independent living organism, but perhaps an enzymatic product of certain immature blood cells. Although but little is known concerning the true nature of the infective substance, certain facts pertaining to its biology have been recorded. The
infective substance, which is present in the immature blood cells of an affected chicken, and to a less extent in the blood plasma, is very resistant to drying and will survive extremely low temperatures for long periods. If retained in the incubator at 37.5°C, the substance becomes innocuous after 14 days.

Briefly, then, we know that the cause of leukosis of fowls is a provocative substance of uncertain physical structure, occurring in the abnormal constituent of the blood of affected birds, and which is capable of inciting the disease in normal chickens experimentally inoculated. Transmission is a significant characteristic of leukosis of fowls, and a fact of considerable value in distinguishing the condition from other disease with which it may be confused.

Although leukosis is transmissible by the direct inoculation of normal birds with fluids or emulsions of tissue containing the infective substance, it is problematic whether the disease is transmissible spontaneously from one bird to another. Although the possibility of such transmission by contact must be admitted, proof of such is not available. Blood-sucking parasites were at one time considered responsible for dissemination of the disease, but experimental studies have shown the fallacy of this contention. The natural secretions of the body are devoid of the provocative agent. Taken in all, it is difficult to explain the occurrence of several cases of the disease in the same flock on the basis of contagion.

**CLASSIFICATION**

Whether leukosis of fowl should be considered a variety of neoplasm is uncertain, although some aspects of the disease simulate neoplasia to a marked degree. There are, however, some neoplastic diseases from which the condition must be separated, and the nomenclature we prefer for these other conditions can best be understood if the respective terms are defined.

**Leukosis**: This term refers to a flooding of the blood-stream with immature cells derived from the hemopoietic tissues of the bone-marrow. It is possible to subdivide the disease into two varieties, dependent on the character of the cell which predominate in the particular form of leukosis under consideration. Both forms are transmissible to healthy chickens: (1) Myeloid or myeloblastic leukosis is characterized by exuberant proliferation of the granuloblastic elements of the bone-marrow to such an extent that the blood-stream eventually contains immature myeloblastic cells in sufficient number to constitute leukemia. Anemia is characteristically present. (2) Erythroleukosis is char-
characterized by leukemia in which there is a predominance of immature erythroblastic cells. Severe anemia usually is present, and the excessive intravascular accumulation of premature erythroblastic cells frequently causes marked enlargement of the liver and spleen. Occasionally, in a chicken affected with leukosis, there will be a mixture of myeloblastic and erythroblastic cells, in which case a designation of leukosis, mixed type, will suffice.

**Lymphocytoma:** The conditions just defined may be confused with the malignant lymphoblastic neoplasms of chickens known as lymphocytoma. This disease is characterized by the occurrence of pinkish-gray to grayish-white, diffuse masses or nodules of undifferentiated lymphocytic cells distributed in the abdominal viscera; the liver and other tissues often are affected. In lymphocytoma the cells have an extravascular relationship. The blood is not leukemic and the disease is not transmissible.

**Myelocytoma:** Uncommonly another malignant neoplastic process occurs, composed largely of diffuse collections of differentiated myelocytes situated extravascularly. This is the condition referred to by Mathews as “leukochloroma.” The type cell is distinguished by the presence in the cytoplasm of moderately large, globular granules that stain intensely with eosin. Tumors occur in various parts of the body after involving the bones. In contrast to myeloid leukosis and erythroleukosis, myelocytoma has not proved to be transmissible.

Although there has been a disposition on the part of some investigators to consider so-called range paralysis, or neurolymphomatosis gallinarum, as closely related to, or as one of, the manifestations of a complex phenomenon which may become manifest as leukosis of fowls, we prefer to consider these neuropathic disturbances as conditions which are separate and distinct from myeloid leukosis and erythroleukosis. The possibility of these diseases occurring simultaneously in the same individual in a reasonable assumption, but their occurrence in a single bird by no means justifies the belief that they had a common or a related etiology.

**SYMPTOMS**

It is sometimes difficult to correlate the severity of the pathologic changes with the objective symptoms of a bird with leukosis. None of the symptoms of birds that we have observed can be considered pathognomonic for the disease. Frequently, the first indication that a chicken is affected will be pronounced paleness of the comb and marked loss of weight. While the appetite remains good, gradual muscular weakness occurs and finally the
bird is unable to stand. Some of the sick chickens exhibit general debility and dullness, stand with feathers ruffled, neck retracted, eyes closed, and, when disturbed, arouse sluggishly as though from a stupor. When blood is obtained from such a chicken it is frequently relatively pale and watery, and has poor coagulability.

The course of the disease is difficult to estimate, since the inception of the disease is insidious and difficult to detect. The lesions are usually well established before symptoms of illness are apparent. Although the disease may run a more or less protracted course, with periods of apparent recovery as judged by examination of the blood, instances occur in which the disease becomes manifest in an acute form. In certain cases of leukosis, significant loss of weight does not occur. The chickens suddenly become anemic, and die within a few days.

Altogether, the symptoms of chickens affected with leukosis cannot be considered reliable or final criteria in the diagnosis of the disease. Morphologic changes of the organs and of the hematopoietic tissues, together with proper examination of the blood, are usually essential before a definite conclusion can be reached.

LESIONS

The organs most often revealing gross lesions of leukosis are the liver, spleen, bone-marrow, kidneys and intestines. Gross and microscopic characteristics will be described in this paper. For more detailed information, certain other articles should be consulted.1-10

The liver is usually enlarged, often tremendously, which accounts for the term "big liver disease" that is sometimes used to designate the condition. It is usually reddish-brown, and small, irregular, creamy yellow foci are scattered indiscriminately over its surface. The friability of the hepatic tissue is increased, and rupture of the capsule, with subsequent hemorrhage into the peritoneal cavity, is not uncommon.

The spleen is likewise markedly enlarged, its consistence is somewhat softer than normal, and a characteristic reddish-violet color is usually apparent. On cross-section the usual histologic landmarks are absent, and the organ appears homogeneous, due to the diffuse and excessive accumulations of the infiltrated cells. Focal lesions are seldom seen.

The color of the bone-marrow varies from a light yellowish-red to a dark purple-red, and although in the majority of instances it has a pulpy or pasty consistence, cases occur in which
the gross appearance of the marrow is not significantly different from that of normal marrow.

The kidney is not constantly affected, and if involved small, pin-point, creamy or yellowish foci may occasionally occur, distributed irregularly throughout the organ.

Hemorrhagic foci in the mucosa of the intestines, and particularly in the duodenum, are commonly seen at necropsy of chickens with leukosis. This condition is often profound, and the gross appearance of the involved intestine is striking. The hemorrhage may be petechial or ecchymotic, and usually decreases in severity toward the terminal portion of the intestines. The hemorrhage occurs in the vascular structures of the subepithelial and epithelial tissues, and free blood may occur in the intestinal lumen.

**PATHOLOGIC HISTOLOGY**

In those cases of leukosis in which the predominating feature is an excess in number of erythroblastic elements, the essential histopathology usually consists of marked flooding of the various blood-channels of the parenchymatous tissues by the immature cells. In sections stained with hematoxylin and eosin the immature erythroblastic cells are characterized by a narrow, rim-like, acidophilic cytoplasm and a large, coarsely granular, basophilic nucleus. Immaturity is suggested by mitotic figures and the hyperchromatic state of the nucleus.

Aside from the blood-stream, the liver offers the best opportunity for observing the specific changes characteristic of erythroleukosis. The larger vessels reveal an enormous number of erythroblastic cells, and it is not unusual for the mature erythrocytes to be so outnumbered as to represent only a small percentage of the total cellular element within the vessel. The lumens of the intralobular capillaries are frequently gorged with the unripe cells, and it is the presence of these cells in such enormous numbers which accounts for the gross increase in the size of the liver in many cases of the disease. The erythroblastic cells retain their intravascular relationship with considerable tenacity, and are seldom observed to form focal accumulations outside the blood-stream.

Although the smaller channels of the blood-vascular system of the liver usually reveal engorgement due to the presence of excessive numbers of immature cells, occasionally cases of leukosis may be encountered in which the capillary spaces contain but few of the unripe cells, although they may be present in significant numbers in the larger vessels of the different organs. In the spleen, marked engorgement of the ill-defined vascular spaces
frequently attains such proportions as to alter or obliterate practically all of the normal structural landmarks, with the exception of the splenic corpuscles and the larger blood-vessels. The septums are widely separated and the capsule is thinned.

The kidneys of chickens affected with leukosis seldom reveal serious injury or impairment of the parenchymatous tissue. Occasionally, if the leukemia is marked, the interstitial capillaries may become somewhat distended, due to the increased cellular content.

The bone-marrow is the seat of a vigorous and unstrained production of the immature cells of erythroblastic lineage. The hemopoietic properties of that portion of the marrow that normally gives rise to adult hemoglobin-bearing erythrocytes are strikingly evident, and every stage of immaturity usually can be seen. Many immature cells of the myeloid or granulocytic series also occur.

In the intestine, due to the enormous infiltration of the capillary bed and the adjacent tissue space by the erythroblastic cells conveyed there by the blood-stream, the mucosa may become so hyperplastic as practically to close the lumen. There is much congestion of the delicate capillaries of the villi of the small intestine, and fragility of these structures often results in striking extravasation of blood, which is noticeable grossly.

In myeloid leukosis the most significant abnormalities are to be observed in the bone-marrow and the blood-stream. Since the disease originates in the developmental granuloblastic myeloid elements, a histologic examination of the bone-marrow of a chicken affected with the disease will reveal marked hyperplasia due to the proliferative overgrowth of immature cells of myeloblastic lineage. The relationship of the myeloid tissues to the blood-vascular system provides a favorable opportunity for many of the unripe cells to enter the general circulation, and cross-sections of the larger blood-vessels usually reveal a striking predominance of unripe myeloblastic cells and a marked reduction of the number of erythrocytes which can be correlated in most instances with the anemia that is often a striking characteristic of the disease.

In such vascular organs as the liver and the spleen, the blood-vessels may become filled with the immature cells in a degree comparable to that seen in erythroleukosis, and although the majority of the immature cells are intravascular, small diffuse, extravascular groups of granuloblastic cells may occur. Generally speaking, in myeloid leukosis the essential and most significant
morphologic changes occur in the granuloblastic elements of the bone-marrow.

THE BLOOD

As leukosis is primarily a dyscrasia of the blood-forming elements, this disturbance must necessarily reflect its character in the circulating blood. The elements to be noted deviating from the normal are the red blood cells, the granulocytes and the thrombocytes. On the reasonable assumption that the provocative agent exerts its action on the stem cells in the bone-marrow, which have the propensity for development in either the erythroblastic series or the granuloblastic series, and in consideration of the profound upset of normal function of the myeloid tissue, one may expect to observe, in the circulating blood, cells of any given state of development of either of these two lineage. Such is demonstrable on careful study of the blood. The relative numbers of the immature elements may vary with the individual case and the period of observation of the disease.

The number of immature cells in the blood is of interest, but the conclusive factor in diagnosis is the degree of immaturity. Cases of secondary anemia associated with parasitism have been observed in which the number of polychrome erythroblasts has been very striking; yet the more immature erythroblasts and stem cells of erythroleukosis were absent. Also a few cases of leukosis have been observed in which severe anemia, stem cells, and but few immature intermediary forms were noted. The condition in cases in which the immature cells of the erythroblastic series predominate is termed erythroleukosis and that in which immature cells of the myeloblastic series are in excess is termed myeloIeukosis. In either case immature forms of both lines of development may be observed.

The thrombocytes are affected early in leukosis. In experimental, transmissible leukosis the first indication of reaction evidenced in the blood-stream is a decrease in the number of thrombocytes. This decrease is progressive until the death of the fowl. The thrombopenia accounts for the poor coagulability of the blood, and may well be responsible for the continued hemorrhages from the smaller blood-vessels.

Leukosis is evidenced in the circulating blood by profound anemia, thrombopenia, and immaturity of both erythroblastic and granuloblastic elements; the immaturity usually can be traced back to the stem cells.

DIAGNOSIS

If leukosis of fowls is to be recognized and diagnosed correctly, the facilities of the laboratory are essential. If the af-
An affected animal is subjected to a careful physical examination, typical cases usually exhibit features that might be considered characteristic of the disease, but before a definite and final opinion is given the pathologist should perform complete necropsy, and should know the results of a study of the blood. Histologic preparations of the various tissues and organs are indispensable if a comprehensive understanding of the disease is to be attained, and there is no way to estimate correctly the degree of anemia and to recognize the character of the leukemic state except by proper study of the blood.

If a bird is affected with leukosis, diminution in the hemoglobin content of the blood is usually marked, and anemia is manifested by a bleached condition of the comb, wattles and mucous membranes. Anemia secondary to parasitism, infectious diseases, and neoplasms is known to occur in chickens, and if anemia is present, care should be exercised in interpreting its significance.

In every case possible, a blood-smear should be prepared and stained by Wright's method in order that the cellular constituents of the blood-stream be observed. Smears must be properly prepared while the bird is living; smears made from clotted blood noted at necropsy are of little if any value. Satisfactory preparations can be made of the bone-marrow of the femur if the outer sheet of bone is broken away and a portion of the marrow is scooped out with the point of a scalpel and placed in 10 percent solution of formalin, or Zenker's solution, for fixation. This is preferable to fixation of the intact femur, which must be decalcified before sections can be prepared. In all cases, in addition to other tissues that may be grossly affected, portions of the liver, spleen and bone-marrow should be preserved as a routine for subsequent histologic study.

Examination of the blood is of the greatest importance, and in the absence of information pertaining to possible morphologic changes in the liver, spleen and bone-marrow, a diagnosis of leukosis can be made from a study of the blood only. The presence of primary anemia, marked thrombopenia, and the finding, intravascularly, of numerous immature cells of erythroblastic or granuloblastic lineage are features which should enable one to recognize leukosis with a sense of confidence. In the event of inability to study the changes of the blood, one must resort to a consideration of possible lesions that may be revealed during a study of the liver, spleen and bone-marrow. Of these tissues the changes in the liver and bone-marrow are of the greatest value in distinguishing leukosis from certain other conditions which commonly occur in chickens. In leukosis the vascular channels
of the liver are likely to be filled to the limit of engorgement with the immature blood-cells, and few, if any, proliferative foci are situated extravascularly.

In the condition known as lymphocytoma, which is perhaps the most common of all neoplasms affecting chickens, the tumor cells, which are undifferentiated lymphoblasts, occur in the liver in alveolar groups, or as diffuse proliferations always situated extravascularly. The blood-stream is aleukemic, and significant activity of the myeloid tissue is not apparent. In lymphocytoma young as well as old birds may be affected, while leukosis occurs in young adults or in chickens one year or more of age.

Another tumorous condition which may occasionally be encountered and which should be recognized as a separate entity is myelocytoma. This condition may affect birds of any age, and it is best distinguished by the highly granular acidophilic cytoplasm of the more or less mature myelocyte which constitutes the type cell. The tumorous foci may occur as single or multiple nodular masses in variable situations, and the keel bone is said to be frequently affected. The disease is aleukemic.

For diagnostic characteristics of leukosis and differentiation of this condition from other diseases with which it may be confused, table I may prove useful.

It is hardly necessary to mention that the appearance of leukosis, like most other diseases, varies with the individual case.

| Table I—Differentiation of leukosis. lymphocytoma and myelocytoma. |
|-----------------|-----------------|-----------------|
| **Leukosis**    | **Lymphocytoma**| **Myelocytoma** |
| Age of predilection | One year or more; seldom less than 9 months | Any age, but rarely less than 4 months | Any age |
| Type cell Leukemia | Myeloblast Present | Lymphoblast Absent | Myelocyte Absent |
| Type cell Anemia  | Primary | Secondary, if present | Secondary, if present |
| Type cell Vascular relationship of type cell | Intravascular | Extravascular | Extravascular |
| Distribution and character of lesions | Hyperplasia of bone-marrow, liver, spleen; hemorrhages of intestinal mucosa | Diffuse or multiple nodular masses in liver or ovary, intestines, skin and subcutaneous tissues | Nodular masses, single or multiple, in variable situations: frequently, keel bone |
| Transmissibility  | Transmissible | Not transmissible | Not proved |
and only experience and continued study of the disease as it occurs spontaneously will enable one to obtain knowledge concerning it. The condition represents one of the common and most widespread ailments of the domestic chicken, and the fact that it is invariably fatal and not infrequently responsible for rather striking losses in certain flocks makes it imperative that we obtain all the information possible concerning its natural history and pathologic characteristics.

SUMMARY AND CONCLUSIONS

Rather frequently among domestic chickens there occurs a fatal blood dyscrasia in which there is commonly profound anemia associated with leukemia. The leukemic state is due to excessive numbers of myeloblastic cells, among which cells of the erythroblastic and granuloblastic series may be recognized. Aside from the blood-vascular changes the most significant lesions are hyperplasia of the bone-marrow, liver and spleen. The disease is readily transmissible to other animals of the same species, but little is known of the physical characteristics of the factor or substance capable of transmission.

The disease has many features common to neoplasm, and we are inclined to believe it should be classified with this group of diseases.

REFERENCES


DISCUSSION

PRESIDENT FAULD: I know we are all pleased with this paper, and we are deeply indebted to Drs. Feldman and Olson for their splendid presentation. We hope they will be with us again.

DR. A. F. SCHALK: I should like to ask Dr. Feldman if this subendothelial invasion of the cells is a common characteristic in lymphocytoma.

DR. FELDMAN: The subendothelial involvement occurs, I think, in that one picture in which we have lymphocytoma, in which the cells
destroy the liver tissue and gradually work under the endothelial tissue.

**Dr. Schalk:** Is that a common occurrence?

**Dr. Feldman:** Yes.

**Dr. Schalk:** Is all the increase in cells in leukosis of myeloid origin?

**Dr. Feldman:** They do come from the myeloid tissue of the bone-marrow; that is, we assume that is where practically all of the normal cells in the circulating blood have their origin. That is the greatest source of the hemopoietic system.

**Question:** Was that confined to the Barred Rocks?

**Dr. Feldman:** In our experience most of our spontaneous cases, not all of them, have occurred in a particular strain of Barred Rock chickens that we have at the Institute. It isn’t limited to the Barred Rock breed by any means.

**Dr. R. L. Conklin:** Do you make your estimation of anemia by blood smears only?

**Dr. Feldman:** Dr. Olson has done that work. I will ask him to answer that.

**Dr. Olson:** In most of the spontaneous cases, where possible, there has been a complete blood examination made. That has included a total red-cell count and also a hemoglobin determination by the photo-electric hemoglobinometer. It is quite an accurate method and works well with blood of this type.

**Dr. Conklin:** How do your hemoglobin readings compare with the Sahli?

**Dr. Olson:** I have not compared it directly with the Sahli.

**Dr. Conklin:** What would be the average hemoglobin percentage?

**Dr. Olson:** It would vary greatly. It may be very low. Some experiment birds have been as low as 0.5 grams of hemoglobin per 100 cc of blood. In contrast, the normal of the chicken ranges around 9 grams.

**Dr. Conklin:** Do you find the hemoglobin content of any value in leukoses which give a similar clinical picture?

**Dr. Olson:** In secondary anemias the diminution of hemoglobin will not be nearly so marked. The hemoglobin value may be perhaps around 4 grams.

**Dr. Conklin:** Will that not vary with the nearness of death?

**Dr. Olson:** Yes and no. In some birds (I am speaking of the transmission experiments and some few spontaneous cases that we have had a chance to study over a period of time) the hemoglobin may vary. It will be low in leukosis and there may be periods of remission in which the hemoglobin value will rise, but this rise is not continuous. It will soon drop again. The rise will not be marked. In the secondary anemias the drop in hemoglobin is not to the extremely low levels.

**Dr. Schalk:** I believe you stated, Dr. Feldman, that transmissibility has not been proved in myelocytoma. How do you feel about the possibility of that?

**Dr. Feldman:** Frankly, we have not had a sufficient number of cases of myelocytoma really to draw definite conclusions. It is my belief, however, that since this represents a more mature type of cell, which is located extravascularly, the likelihood of transmission would be rather remote, basing it on a conception of lymphocytoma which is also an extravascular condition. This is not transmissible.

**President Faulder:** The next paper is “Mycosis in Fowl Caused by Yeast-like Fungi,” by Dr. Erwin Jungherr, Agricultural Experiment Station, Storrs, Conn. (Applause.)

... Dr. Jungherr read his paper...
Mycosis in fowl caused by yeast-like fungi

By Erwin Jungherr, Storrs, Conn.
Storrs Agricultural Experiment Station

Introduction

Although it has been known for a long time that certain fungi are potential causes of disease in men and animals, during the era of the epoch-making discoveries in bacteriology the study of the etiologic significance of fungi has received comparatively little attention. Aside from the greater hygienic importance of bacterial diseases, one reason for the lag of scientific advance in fungous diseases must be sought in the difficulties pertaining to the proper identification and classification of the organisms involved. In recent years, definite progress has been made in the branch of systematic mycology which is of especial interest to the sanitarian. Among the milestones which bear testimony to this advance may be pointed out the classification of the Aspergilli and the differentiation of so-called "lumpy jaw" into two etiologically distinct entities, namely actinomycosis and actinobacillosis.

In birds the fungous diseases or mycoses can be divided into three main groups, according to their principal point of attack in the body. Favus is a primary cutaneous mycosis which is characterized by yellowish white, scutular lesions caused by Achorion schoenleini variatio gallinae. Aspergillosis, or brooder pneumonia, invariably brings about a systemic involvement, especially of the lungs and air-sacs, and is due to invasion by Aspergillus fumigatus. The third clinical type of fungous diseases affects the mucous membranes of the upper digestive tract, although systemic infections may occur. These mucous membrane infections, which are popularly known as "sour crop" conditions, are caused by yeast-like fungi of the genera Monilia and Oidium, and the corresponding diseases are termed moniliasis and oidiomycosis. Since recent reports from California\(^1\) and Connecticut\(^2\) indicate that outbreaks of these diseases may assume epizootic proportions, it was thought advisable to present to this group a discussion of the mycotic affections of fowl caused by yeast-like fungi.

Etiology

The organisms spoken of as yeast-like fungi are loosely grouped together because they appear in certain stages of development as oval or spherical cells resembling yeast cells, which reproduce by asexual budding. The subdivision of the group is made on the
basis of the formation of mycelial threads and sexual ascospores. These latter structures are special endospores which are surrounded by a membrane known as the ascus and contain a constant number of spores. The organisms of the genus Saccharomyces, comprising the true yeasts, form ascospores but no mycelium. The organisms of the genus Torula form neither ascospores nor mycelium. The organisms of the genus Monilia lack ascospores, but form a septate mycelium in old cultures and in animal tissues. The organisms of the genus Oidium are characterized by well-developed mycelial threads which, for the purpose of reproduction, break up into yeast-like cells of various shapes, the so-called oidia.

Before entering upon a description of the species of Monilia and Oidium which are of special interest here, it must be pointed out that it has become customary to qualify the generic term Monilia by speaking of so-called "medical monilias." This usage is contrary to the rules of nomenclature, but necessary in the present state of our knowledge because the long-established botanical genus Monilia comprises numerous, mostly chromogenic, species which are not parasitic in the higher animals, but cause the rotting of fruits and leaves and are regarded to be the conidial stages of ascospore-producing forms, especially of Sclerotinia.

In regard to the specific identification of the organisms belonging to the medical monilias, some uncertainty has prevailed because a large number of insufficiently defined species have been described. Recent studies by Benham and others have shown that most of the monilias parasitic on man are indistinguishable from the type species Monilia albicans Zopf, the cause of thrush and various dermatoses of man. Similar systematic studies of the organisms associated with the mycotic infections of the mucous membrane of fowl have shown that only a few well-defined species occur and that the formerly supposed multiplicity of species has to be challenged. The conception presented below, of the organisms that are important from the standpoint of avian pathology, is based upon the detailed morphologic and biochemical study of over 100 strains of yeast-like fungi isolated from field outbreaks of mycosis.

Monilia albicans: It is of widespread occurrence in gallinaceous birds, pathogenic to birds and also to rabbits on intravenous injection, and is indistinguishable from strains isolated from human sources. On Sabouraud agar it produces a whitish, creamy, high-convex colony after incubation for 24 to 48 hours at 37°C. Young cultures consist of oval budding yeast-cells, about $5\frac{1}{2}$ by $3\frac{1}{2}$ microns in dimension. Older cultures show septate
hyphae and occasionally spherical, swollen cells with thickened membrane, the so-called chlamydospores. In Dunham's peptone water containing 1 per cent fermentable substance and 1 per cent Andrade's indicator, the organism produces acid and gas in dextrose, levulose, maltose and mannose, slight acid in galactose and sucrose, and does not attack dextrin,* inulin, lactose and raffinose. Gelatin stab cultures show short, villous to arborescent outgrowths without liquefaction of the medium. The non-pathogenic species Monilia candida Hansen, which also occurs in man and animals, is distinguished by its production of acid and gas in sucrose broth but resembles Monilia albicans in morphology, fermentative ability, and serological characters.

Monilia krusei: This organism occurs widely in man and birds and is considered to be non-pathogenic. The colonies on Sabouraud agar appear dry, low convex, and grayish; young cultures consist of long elliptical, yeast-like cells, about 6 by 2 microns in dimension; older cultures show branching mycelial threads. It produces acid and gas in dextrose, levulose and mannose and is incapable of attacking dextrin, galactose, inulin, lactose, maltose, raffinose and sucrose. Gelatin stab cultures show fine, dense, villous outgrowths, long in the upper half of the stab and diminishing in length toward the butt of the tube.

Oidium: In general the oidiums produce a spreading, adherent, non-emulsifiable growth on Sabouraud agar and can thereby be distinguished from the monilias; the detailed differentiation must be based upon morphologic characteristics in slide cultures. The average dimensions of the hyphae and especially the shape and width of the oidia are highly characteristic and constant for the species. The genus is almost devoid of fermentative power and gelatin stab cultures develop non-characteristic surface growth which is followed by peptonization of the medium.

Oidium pullorum n. sp.: This term is suggested here for the Oidium species* which is frequently isolated from mycotic affections of the mucous membrane of chicks. It may occur in association with Monilia albicans, but pure cultures of it have been shown to be pathogenic to chicks. Its growth on solid media is characterized by a finely granular, dry, yellowish, corrugated appearance (fig. 1); young cultures consist of numerous septate hyphal elements, yeast-like cells and chlamydospores. In slide cultures, the terminal hyphae may be slightly club-shaped; the fertile hyphae containing the oidia are about 3.2 microns in width; the individual oidia are elliptical in shape so that their arrangement resembles the beads of a rosary (fig. 3). The organ-

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*Variable according to brand.
ism grows well at 37°C. and is capable of splitting the glucoside aesculine.

*Oidium sp. type 2:* This organism has been isolated occasionally from normal chicks and is not considered to be pathogenic. The growth on Sabouraud agar appears as a uniform grayish carpet; terminal hyphae are not club-shaped; the fertile hyphae are about 3.7 microns in width and break up into oidia of long, rectangular shape.

![Fig. 1 (left). *Oidium pullorum n. sp.* Ten-day-old Sabouraud-agar culture (x 1/3).](image1)

![Fig. 2 (right). *Oidium lactis* (American Type Culture 4798). Ten-day-old Sabouraud-agar culture. Growth characteristics similar to those of *Oidium sp. type 2* (x 1 1/3).](image2)

Both *Oidium* species from birds resemble to some extent a common contaminant of dairy utensils and sour milk, namely *Oidium lactis.* In view of the extensive practice of milk feeding in poultry husbandry, it was imperative to establish the differential characters of parasitic and non-parasitic species. *Oidium lactis* produces a grayish, fuzzy growth on solid media, somewhat like *Oidium sp. type 2* (fig. 2). Better growth is obtained at incubation temperatures between 22 to 30°C. than at 37°C.; the
organism can not split the glucoside aesculin, and in slide cultures consists predominantly of mycelium; the fertile hyphae are about 4.7 microns in diameter; the oidia are of medium length and rectangular (fig. 4) and thus appear much coarser than that of *Oidium pullorum*.

Fig. 3 (above). *Oidium pullorum* n. sp. Three-day-old slide culture, incubated at 37° C. (x 400).

Fig. 4 (below). *Oidium lactis* (American Type Culture 4798). Three-day-old slide culture, incubated at 22° C. (x 400).

**PATHOLOGY**

With the recognition of yeast-like fungi as causes of chick losses, it should become an established practice to examine the mucous membranes of the crop, proventriculus and gizzard on gross pathologic examination; for the purpose of diagnosis it is
essential to demonstrate lesions and to obtain heavy initial growth of pathogenic yeast-like fungi in the primary culture. The characteristic changes may be seen in the mouth and especially in the crop and proventriculus; the corneous lining of the gizzard may show superficial ulceration. The lesions consist of whitish, slightly raised, circular ulcers, which may become confluent and form ridges along the folds and finally slough off into the lumen of the affected organs. Occasionally the proventricular wall appears markedly swollen and glossy on its serous aspect. The latter changes may occur also in cases of lymphomatosis so that the isolation of the causative organism is a prime requisite for differential diagnosis. Histologic changes in the liver consisting of periportal necrotic foci would indicate that the organisms exert a certain toxic action upon the system.

**EPIZOOTY**

From the clinical and epizootic standpoint, it is noteworthy that principally young and growing birds become affected during the late spring and early summer, especially if the atmospheric precipitation is unusually heavy. Epizootics have been observed in chicks, pheasants and grouse, ranging in age from two to 60 days. Turkeys under the age of four weeks have been seen to succumb rapidly to mycotic infections, but epizootic outbreaks of pendulous crops, caused by *Monilia albicans*, were observed at the age of three months, terminating in a high percentage of recovery. The pathogenesis of the diseased conditions is only slightly understood as it is not known where and how long the organisms can persist outside the animal body. Plaut\(^5\) reported that he had isolated a monilia-like organism from a museum specimen which had been kept in dry storage for ten weeks.

Personal observations would indicate that the organisms can be introduced onto a premise through the agency of infected hatching eggs, presumably on the shell. On the other hand, the diseases seem not to be perpetuated by immune carriers, because the examination of over 800 pathologic specimens other than mycotic affections showed a surprisingly low incidence of all types of yeast-like fungi. Some idea about the tenacity of the organisms was gained from certain fungicidal tests carried out with denatured alcohol, coal-tar mixtures and iodin preparations. The former two preparations were practically valueless, while iodin was toxic for monilias in high dilutions and to oidiums in somewhat lower dilutions. From these studies it would appear that simple disinfection procedures, as practiced on the average poultry farm, are inadequate against yeast-like fungi.
SUMMARY

In summarizing our present knowledge of mycotic infections in fowl, caused by yeast-like fungi, it can be said that the diseases affect principally the mucous membranes of the upper digestive tract. The infections occur in all domesticated birds and in game birds raised in captivity, and predominate during wet, early summer seasons. In very young birds the infections may be accompanied by heavy mortality. Immune carriers of the maladies seem to be uncommon, but the organisms appear to be capable of maintaining life in a non-parasitic state. The organisms are probably widespread in nature, but it is not known under what set of conditions they assume invasive properties; they are resistant to disinfection with common coal-tar derivatives. *Monilia albicans* is the principal cause of moniliasis and *Oidium pullorum* n. sp. of oidiomycosis in fowl.

REFERENCES


DISCUSSION

Dr. A. F. Schalk: The condition mentioned in turkeys is a very common condition in the Northwest, particularly in North Dakota, where I was located for a number of years. I was very much interested in hearing that there are a lot of recoveries in the young turkeys in the late spring and summer infections. As a matter of fact, we did not find very much of it in that country until later on in the season, beginning in September, October, and even later, and continuing throughout the winter in the birds hatched that year.

I am wondering if it is possible that these cases are the left-overs from those that recovered earlier in the year, and whether they pass through the epizootic unnoticed and then crop out later on as older birds.

Dr. Jungherr: We considered such a possibility, but we never were able to demonstrate immune carriers. We cultured a large number of older birds and were not able to find yeast-like fungi in older birds. We have no proof for it, but we are rather of the opinion that the organisms may live on plants or in a non-parasitic state, and that the infection comes from outside the animal body. It is very difficult to trace the condition because we do not know where the parasites live while they are outside the animal body.

Dr. Schalk: Have you succeeded in reproducing this artificially?

Dr. Jungherr: Yes. This condition has been artificially produced with both organisms, *Monilia albicans* and *Oidium* species type 2, but *Monilia albicans* is much more pathogenic than the *Oidium* species.

President Faulder: The next paper is "The Administration of Heated Oocysts of *Eimeria Tenella* as a Means of Establishing Resistance and Immunity to Cecal Coccidiosis," by Drs. Harry A. Jankiewicz and R. H. Scofield. It will be read by Dr. L. M. Hurt, County Live Stock Inspector, Los Angeles, Calif. (Applause.)

... Dr. Hurt read the paper....
THE ADMINISTRATION OF HEATED OÖCYSTS OF EIMERIA TENELLA AS A MEANS OF ESTABLISHING RESISTANCE AND IMMUNITY TO CECAL COCCIDIOSIS*

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INTRODUCTION

The study of the control or prevention of coccidiosis in the chicken has been approached through numerous avenues. They may be briefly outlined as follows:

1. The attempt to keep down the numbers of oöcysts which may infect the chicks.
   a. By applying sensible sanitary measures.
   b. By using chemical disinfectants on the litter (Andrews).
   c. By using chemicals on the organic-free surfaces (Chandler).
   d. By employing physical agents (heat, drying, violet rays, etc.) (Fish).

2. The treatment of clinical cases.
   a. Chemotherapy (Allen).
   b. Dietary changes (Beach and Davis, Chandler, and Allen).

3. The prevention of the disease by carefully controlled subclinical inoculations of oöcysts.
   a. Using unheated oöcysts in 15 daily feedings in the ration (Johnson).
   b. Using oöcysts kept for long periods at a low temperature (Chandler).
   c. Using oöcysts heated after segmentation has been completed (48 degrees C., 15 to 30 minutes) in two or three dosages at five-day intervals, and oöcysts heated before segmentation begins (48 degrees C.) followed by feedings of unheated oöcysts at five-day intervals (Jankiewicz and Scofield).

The methods outlined under 3 will probably be aided in their effectiveness by supplementing with the procedures outlined under 1. Which combination of procedures, as outlined, will prove the most satisfactory, still remains to be investigated.

In this paper the problem of controlling coccidiosis is approached from the standpoint of preventing clinical symptoms and establishing a tolerance. In a previous experiment by the Department it was found that capsule feedings of oöcysts in gradually increasing doses at intervals of four to nine days proved very effective as a means of establishing resistance to large infecting doses containing the six species of Eimeria ordinarily capable of infecting chickens. Two, or preferably three, such feedings given at the stated intervals proved sufficient, especially

*This experiment was done under the supervision of the Los Angeles County Live Stock Department, Dr. L. M. Hurt, County Live Stock Inspector, and was carried out at the Poultry Demonstration Plant, Pomona, Calif., directed by Dr. R. H. Scofield and managed by Mr. Irving Denny.
to *E. maxima*, *E. acervulina* and *E. tenella*. The study also indicated that the sole feeding of oocysts heated before their segmentation, at five-day intervals was not especially effective in developing resistance to subsequent infection, but must be followed by the feedings of controlled numbers of unheated oocysts before they offered complete and satisfactory resistance.

In the previous experiment, the six recognized species of *Eimeria* of chickens as reported by Tyzzer and Johnson were employed. In the present studies, however, in order to better study the effect of applying heat before or after sporulation and the problem of dosages, it was thought advisable to use a single pathogenic species. For this purpose a pure culture of *E. tenella*, the species which is mostly restricted to the ceca, was used in this study.

**History**

The view that properly controlled previous infections do make chicks more tolerant and resistant to heavy dosages of oocysts is held by Beach and Corl, Johnson, Tyzzer, Theiler and Jones. The experimental evidence of this group is far more extensive than that of Young and Fish investigators who doubt resistance.

Beach and Corl reported that chicks surviving one severe infection acquired a definite tolerance to a fatal dose given later. In fact, not one of 33 chicks so tested showed symptoms or died, whereas 16 chicks, or 34 per cent of the control group, died. Daily feedings of 2,000, or less, oocysts, species not named, on 15 consecutive days, were given chicks by Johnson, who found that resistance was definitely developed by such feedings. Immunity against infection was shown to last at least six and one-half months. Age in itself, he further showed, does not account for resistance; for cage-reared birds kept free from any noticeable infection are definitely susceptible, even as hens.

The discovery by Tyzzer and Johnson that the *Eimeria* of the chicken could be classified into six distinct species, namely: *E. praecox*, *E. mitis*, *E. acervulina*, *E. maxima*, *E. necatrix* and *E. tenella*, of which the latter three are at times acutely pathogenic, has made possible better controlled studies in immunity. Most significant was the demonstration by these same investigators that the immunity is specific for each of the different species. The feeding of *E. praecox* oocysts can be so controlled that the chick will be totally immune to further infection with *E. praecox* but as susceptible as before to infection with the cecal type, *E. tenella*. 
In Johnson's later studies in immunity, seven of the six species of chicken Eimeria (E. necatrix not included) were fed by mixing numbered doses into a wet mash. One group fed daily for 15 days, with cultures in which the oocyst count of E. tenella varied between 1,303 and 1,335 in each feeding, showed deleterious results; whereas, in the group fed daily between 50 and up to 907 oocysts of E. tenella no such damage occurred. Both groups later showed distinct protection against heavy coccidial infection from these same species.

Tyzzer stated that Barred Plymouth Rocks, Rhode Island Reds, and Single Comb White Leghorns display no difference in their promptness of acquiring immunity or in their degrees of natural resistance. Together with his co-workers, Tyzzer concludes that species which penetrate deeply and tend to be retained in the tissues like E. maxima and E. tenella excite prompt parasitological immunity. The rapid immunity developed by E. praecox is explained by them to be due to the deep penetration of many sporozoites which later fail to develop. However, E. maxima, when present in a mixed infection reacts similarly to E. mitis, E. acervulina and E. necatrix, in that complete immunity is obtained only after repeated reinfections. They found also that a single dose of from 2 to 5 oocysts of E. tenella leaves chicks susceptible clinically to a large test dose administered 15 days later, but that the survivors of this test, when fed 13 days later with a huge dose, displayed no symptoms or other evidence of infection. This reveals that very light single doses fail to protect, but that light doses, followed by a huge dose of oocysts, result in a complete immunity among the survivors. A possibility, that under certain conditions daily dosages of E. necatrix oocysts can build up an infection so severe as to prove fatal, was demonstrated. However, when a small dose was used initially and followed by increasing doses, it was possible to protect the chick against E. necatrix without loss.

Working on the mechanism of immunity in coccidial infections, these same investigators demonstrated that up to 24 hours sporozoites of E. necatrix were present in both the cells of the control and immune chicks. In the controls, the invaded cells and nuclei enlarged and adjusted themselves to the further nourishment of both parasite and cell. Consequently, the sporozoites increased in size, became plump and displayed structural detail. In the immune cells, however, the nuclei and protoplasm failed to enlarge and accommodate the sporozoite, which became frail, shrunken and structureless. The cytoplasm of the host cell
showed evidence of injury and the nuclei became pyknotic. This eventually results in the death of both the cell and the parasite.

It is now generally agreed that immunity to coccidiosis does not depend upon humoral antibodies (Tyzer, Theiler and Jones\textsuperscript{13}), but is local, cellular and specific. Unsuccessful attempts to establish passive immunity were made by the latter group by the subcutaneous and intraperitoneal injections of serum of \textit{E. tenella}-immune stock. Intravenous injection of great numbers of merozoites of \textit{E. tenella}, together with hemorrhagic exudate found in bowel discharges, likewise failed to confer immunity. Using oöcyst antigen, the absence of a precipitins in infected chickens, recovered chickens, or in immune chickens, was proved. From a practical standpoint for commercial farms, they agree with Johnson that where losses occur from acute coccidiosis they can be attributed to initial large numbers of pathogenic oöcysts being ingested by an animal which has not harbored earlier protective infections.

**MATERIALS AND METHODS**

One hundred and fifty White Leghorn day-old chicks were obtained January 18, 1933. They were separated into groups of 25 and placed into wooden battery brooders constructed with wire-mesh floors. Each of the six brooders had an electric heating unit. The chicks were kept in the brooders throughout the experiment, a period of nine weeks. All equipment was washed and then sterilized by the use of a fire torch. Every effort was made to keep the control brooders free from contamination with oöcysts from the outside or with oöcysts from treated chicks. No equipment that might become contaminated by contact with treated groups was ever handled before caring for the controls. Feed and water were given unaltered by any treatment. The droppings of the control chicks were examined periodically and never showed merozoites or oöcysts, indicating that the sanitary precautions employed were satisfactory.

The oöcysts for this experiment were procured by taking a culture from a previous experiment, containing a predominance of \textit{E. tenella} oöcysts and lesser numbers of \textit{E. praecox}. This culture was fed to six cockerels, six weeks of age, each getting about 750 oöcysts of \textit{E. tenella}. Three of these chickens, killed on the ninth day after infection, harbored huge numbers of oöcysts in the cecal mucosa. The cecums were amputated near the openings into the intestine and scrapings of the cecal wall were placed in petri dishes containing 2.5 per cent potassium
dichromate solution. Without concentration, it was possible to get 25,000 oocysts of *E. tenella* in a drop of culture. Oocysts from these three birds were mixed and fed to two chicks. Autopsy of one of these on the fifth day failed to show any infection in the small intestines, the only coccidial forms seen being the huge schizonts and merozoites of *E. tenella* in the cecal scrapings. This chick had both cecums blood-filled and enlarged. The cecal walls contained stages of *E. tenella* only. The other chick passed slight amounts of blood on the sixth day, but on postmortem on the seventh day the cecums were only slightly enlarged and contained a moderately sized hemorrhagic core.

The oocysts, when recovered from these birds, were mixed and divided into three portions. The first portion was placed in a wide-mouthed bottle and heated before segmentation began at a temperature of 48° C. for a period of 15 minutes. To insure a constant temperature, the container was placed in a double water-bath. The second portion first was allowed to sporulate fully for four days. Not until sporulation had been completed was this portion heated to 48° C. for 15 minutes. The final portion was left to sporulate at room temperature and was not heated as were the preceding cultures.

The culture heated before sporulation commenced will be frequently referred to in this paper as the H.B.S. culture and the culture heated after sporulation was completed will be referred to as the H.A.S. culture. The culture exposed to room temperature only will be referred to frequently as the UNH. culture.

All immunizing inoculations were administered in gelatin capsules. No. 4 capsules are satisfactory for chicks over two weeks. All oocyst dosages were determined by the single drop technic. A drop from a ball-pointed medicine-dropper was placed on a slide and the count was made by examining the entire drop under the microscope. In all cases the counts were made just prior to the feeding of the capsules (obviously it is necessary to use the same calibrated dropper when the capsules are filled with drops of the culture).

**ADMINISTRATION**

During inoculations, the chick's beak is opened by placing the thumb and the forefinger in the corners of the mouth. The capsule just filled with the calibrated drops is placed into the pharynx by the aid of long blunt forceps. The capsule is pushed directly into the esophagus. Inoculations may be made by placing the medicine-dropper deep in the esophagus and expelling the contents, previously calibrated per drop.
For observation of the amount of hemorrhage in the individual chicks, a wooden cage divided into 12 compartments was utilized. Fecal samples were collected on replaceable sheets of strong smooth paper. The earliest appearance of oocysts could be observed in this way by microscopic examination.

**Testing for Immunization**

To observe better the effects of doses of different numbers of oocysts, the successive readings were given at five-day intervals. Since the symptoms and hemorrhage usually become apparent early on the fifth day, such a period is considered sufficient to distinguish the effect of each separate inoculation.

The controls and immunized chicks were tested all at the same time under the same conditions. The lethal doses of coccidia were given by placing 40,000 oocysts of *E. tenella* of the original UNH. culture into the individual capsules fed to each chick. The chicks then were divided into groups of 12 or 13 and given a supplementary feeding of 60,000 oocysts (per chick) of *E. tenella* of newly prepared UNH. cultures incorporated into a wet mash. The infective moist mash was fed after the chicks had fasted for eight hours.

**Discussion**

*Effect of heat on segmentation:* While studying a species survey of rabbit coccidia, Kessel and Jankiewicz noted an abnormal segmentation of oocysts exposed early to sublethal period temperatures. This atypical segmentation has been noted in chicken coccidia. Oocysts heated, within two hours after their collection of 48°C for a period of 15 minutes are especially favorable as a means of demonstrating these atypical forms. At a temperature of 48°C the lethal period is over an hour and oocysts heated for 15 minutes suffer approximately a 5 per cent mortality. About 10 per cent of the segmenting oocysts are of the abnormal morphology. Isospora-like forms containing but two sporoblasts or sporocysts are the most common forms (fig. 1). Oocysts containing three sporoblasts or sporocysts are fairly numerous. A few of the oocysts having four sporoblasts were abnormal in that the sporoblasts varied in size and shape, and only one or two of the sporoblasts would reach the sporocyst stage. The new forms containing five or more sporoblasts never reach the sporocyst stage. The isospora-like sporocysts are elongated, extending nearly the length of the oocyst, some measuring 17 microns. Whether these sporocysts contained two or four sporozoites could not be determined. Some of the oocysts...
attempted to develop without segmenting, but made a poor attempt to form sporozoites without forming sporocysts.

Whereas H.B.S. cultures regularly contain these forms, they occur only occasionally in H.A.S. or UNH. cultures. Probably

less than one in 25 UNH. cultures, as usually prepared, will show an occasional oöcyst of this type.

**Experimental Studies**

*Group 1. Oöcysts heated before sporulation—1 dose*: This group was given one dose of the H.B.S. culture. Thirteen of
the chicks were fed a 4,000-oocyst dose, while the remaining 12 were given 18,000 *E. tenella* oocysts. These chicks were all inoculated February 7, 1933, and tested 34 days later for the presence or absence of immunity or resistance to a 100,000 UNH-oocyst dose. Table I summarizes the findings.

Both of these dosages proved to be sublethal, but contained oocysts in sufficient numbers to produce hemorrhage. On the average the hemorrhage appeared first on the seventh day with the 4,000 dose and on the fifth day with the 18,000 dose, being more profuse in the chicks fed the larger dose. Five of the 13 chicks fed the 4,000 dose passed bloody feces, whereas six of the 12 chicks fed the 18,000 dose showed hemorrhage.

The degree of infection and the slight amount of blood lost by the chicks getting the smaller dose did not alter the activity of the chicks nor cause the usual droopy appearance of typical acute coccidiosis. Only one of the chicks getting the larger dose lost enough blood to cause a paling of the comb, but the condition of this cockerel was fair and could not be classed as typically droopy. Thus we see that none reacted seriously and none died as a result of these dosages.

The time required for the first appearance of oocysts in the feces was found to be similar to that when unheated oocysts were used. Slightly less than seven days, or 165 hours, elapsed before the oocysts were discharged. Motile merozoites were seen in the feces on the fifth day of infection. With the use of the simple smear method, the oocysts were detected more easily in the group fed the 18,000 dose. No oocysts were seen in the droppings after 21 days until after the test dose was fed.

The feeding of the test dose was followed by a 23.1 per cent mortality in the 13 chicks previously inoculated with the 4,000-H.B.S. dose and a 16.7 per cent mortality in the 12 chicks given the 18,000-H.B.S. dose. When the mortality in these chicks from acute coccidiosis is compared to the 62.5 per cent mortality in control chicks, it will be seen that the chicks did gain a fair but incomplete resistance to the effects of massive doses of *E. tenella*. Considering the fact that a 62.5 per cent mortality rate would have occurred in these chicks if they had not been previously inoculated, the percentage protection conferred by the 4,000-H.B.S. dose against mortality is 63.1 per cent and that of the 18,000-H.B.S. dose is 73.1 per cent.

Of the ten survivors of the 4,000 group, seven passed blood on the fifth day after the test date. In the 18,000 group only two of the survivors passed blood. From all these indications, together with the condition of the chicks after the test, it is evi-
<table>
<thead>
<tr>
<th>Group</th>
<th>Date of Inoculation</th>
<th>Method of Immunization</th>
<th>Chicks Used</th>
<th>Mortality</th>
<th>Protection (%)*</th>
<th>Immunity</th>
<th>Average Weight of Females</th>
<th>Hemorrhage After Test†</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2-7</td>
<td>4,000 H. B. S. (1 dose)</td>
<td>13</td>
<td>3</td>
<td>23.1</td>
<td>63.1</td>
<td>3 4 6</td>
<td>27.6 oz.</td>
</tr>
<tr>
<td></td>
<td>2-7</td>
<td>18,000 H. B. S. (1 dose)</td>
<td>12</td>
<td>2</td>
<td>16.7</td>
<td>73.1</td>
<td>8 1 3</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>2-8 2-13 2-18</td>
<td>658 H. B. S. 1,170 H. B. S. 3,200 H. B. S. (3 doses)</td>
<td>25</td>
<td>6</td>
<td>24.0</td>
<td>61.6</td>
<td>4 7 14</td>
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<tr>
<td>III</td>
<td>2-9 2-14 2-19</td>
<td>649 H. A. S. 1,100 H. A. S. 3,300 H. A. S. (3 doses)</td>
<td>25</td>
<td>0</td>
<td>0.0</td>
<td>100.0</td>
<td>22 3 0</td>
<td>29.4 oz.</td>
</tr>
<tr>
<td>IV</td>
<td>2-9 2-14 2-19</td>
<td>649 H. A. S. 560 UNH. 1,800 UNH. (3 doses)</td>
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<tr>
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<td>Controls</td>
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<td>24</td>
<td>15</td>
<td>62.5</td>
<td>0 0 0 24</td>
<td>21.0 oz.</td>
<td>++++</td>
</tr>
</tbody>
</table>

*Calculated thus: \( \frac{100\% - (\text{Mortality} \% \text{ of Group} \times 100)}{\text{Mortality} \% \text{ of Controls} \times 100} \) = % Protection.

†Number of + denotes degree of hemorrhage.
dent that the larger number of H.B.S. oocysts offers better clinical resistance than that gained by using lesser numbers.

However, the use of a single large dose of heated oocysts (H.B.S.) does not seem to immunize thoroughly enough to warrant its sole use. Although there is a chance that chicks raised under the ordinary farm conditions would strengthen this resistance by the usual reinfection that occurs, still there is the chance that they would ingest a massive number of sporulated oocysts soon after the initial feeding, thereby producing clinical symptoms before sufficient tolerance could be established.

**Group 2. Oocysts heated before sporulation—3 doses:** The 25 chicks of this group were given three inoculations of successively larger doses of the H.B.S. culture at intervals of five days. An initial dose of 658 oocysts was followed by a second inoculation of 1,170 oocysts and a third feeding of 3,200 oocysts. None of the three inoculations was large enough to cause hemorrhage or symptoms. However, eight days after the last inoculation, a stringy, fibrous, orange exudate was present in the droppings of all but two of the chicks. The nature of this exudate was not determined.

The oocyst production began 165 hours after inoculation but was difficult to detect by the direct smear method, fewer oocysts being passed than when the doses used in group 1 were employed. The last immunizing feeding was administered February 18, and after 22 days all chicks ceased to pass oocysts. The group was tested for resistance in the same manner as group 1 on March 13, 23 days after the final feeding. Six of the 25 died from acute cecal coccidiosis, a mortality of 24.0 per cent to the test. Considering the mortality of 62.5 per cent in the controls, this indicates a 61.6 per cent protection against mortality. As a whole, this group was protected rather poorly from the clinical standpoint. All but four of the surviving chicks passed blood in the feces and showed the typical symptoms. Eight of the surviving 19 chicks passed considerable blood and became pale and droopy like the control chicks. Although the amount of hemorrhage was most abundant in the control group, still this test group given three H.B.S. inoculations nearly approached the controls in amount of blood appearing in the droppings.

A series of three subclinical doses of H.B.S. oocysts as given, therefore, confers only a limited resistance, insufficient for practical application. It seems that the use of such heated oocysts alone is not very effective and needs to be supplemented by feedings of unheated oocysts.
Group 3. Heated after sporulation—3 doses: Differing from group 2, which received oocysts heated before sporulation, these chicks were inoculated with oocysts of *E. tenella* heated after they had sporulated. An initial dose of 649 H.A.S. oocysts was followed in five days by a 1,100-H.A.S. dose and then followed by a final feeding of 3,300 H.A.S. oocysts. A total of 5,049 H.A.S. oocysts therefore was fed each individual of this group, practically the same as the 5,028 H.B.S. oocysts given each chick of group 2. The only significant difference in the material used for inoculating groups 2 and 3 was in the time at which the heat was applied to the oocysts.

The initial dose of 649 oocysts brought about a trace of hemorrhage in two of the 25 chicks but in no way altered their condition or appearance. No hemorrhage followed the 1,100 dose of the second inoculation. Only one chick passed a trace of blood after the third 3,300 dose. Oocysts were easily detected by the smear method within seven days after inoculations. Five of this group passed a scanty amount of the orange, fibrous exudate seven days after the final capsule inoculation. Careful examination failed to reveal any oocysts passed on March 12, the day before the test dose was applied.

The group was tested 23 days after the feeding of the final inoculation. As a whole, the chicks proved to be protected excellently against the lethal dose. Not a death resulted and there was a complete absence of droopiness. The typical roughening of the feathers did not occur and the activity of the chicks was unaltered. Three of the chicks did pass a trace of blood on the sixth day, but the slight loss of blood was not sufficient to cause a paling of their combs. The contrast between the appearance of these chicks, the controls and the chicks in groups 1 and 2 was striking, the protection of inoculation in this group being complete from the mortality and clinical standpoints.

These results indicate that three inoculations of H.A.S. cultures at five-day intervals, employing dosages as outlined, are very effective in producing immunity to cecal coccidiosis.

Group 4. Heated after sporulation—1 dose and unheated—2 doses: After receiving an initial dose of 649 H.A.S. oocysts, the 25 chicks of this group were inoculated with a second dose of 560 UNH. oocysts five days later. A final dose of 1,800 UNH. oocysts was fed after another interval of five days. A slight hemorrhage was seen in four chicks, five days after the final feeding, and one chick passed a trace of the orange exudate previously described, on the seventh day after the 1,800 dose.
Oocysts can be detected easily by the smear method, 165 hours after infection.

This group was tested 23 days after the administration of the final inoculation, on March 13, 1933. The day before the test, the feces of all the chicks in this group were negative. The condition of the chicks after the test was comparable to that of group 3. Not a loss resulted and the chicks lacked the droopiness, inactivity, weakness, and roughened feathers of the controls. There was, however, a trace of hemorrhage in the excreta of three chicks after six days. In addition to a 100 per cent protection against mortality, the chicks were well protected clinically. All the groups excreted a watery discharge from 7 to 11 days after the test. This diarrhea apparently was due to excessive secretion from the small intestine.

**SPECIAL OBSERVATIONS**

The total amount of hemorrhage present in each group as a whole after the administration of the test dose was a very good index of the completeness of the immunity in that group. Blood first appeared on the fourth day in the controls and in the chicks fed three H.B.S. doses. It was very heavy during the fifth and sixth days in group 2, but never as abundant as in the controls. (See table I.) There was only a moderate amount of hemorrhage in group 1, which began on the fifth day. Groups 3 and 4 were free from hemorrhage the fourth and fifth days, but on the sixth day a slight amount of blood was passed. The droppings from many of the controls and from birds in the second group were composed almost entirely of blood. The slight amount of blood passed by groups 3 and 4 was only a part of the formed feces excreted.

There was a very noticeable difference in the weight of the chicks 11 days after the test. Table I indicates the average weights of the surviving females at the age of nine weeks, three days. It will be noticed that the weights of the chicks, after having been given the test dose, is directly correlated with the degree of resistance in the chicks. There was a difference of 8.5 ounces in the average totally unprotected control chick and the average fully protected chick in groups 3 and 4. There was only a difference of 5.9 ounces between the average control and the average chick fed three doses of the H.B.S. cultures. These figures would have more significance if weights had been taken at regular intervals before and after the test, but since the correlation was so apparent they are mentioned.

The chicks appeared normal the first three days after administration of the lethal test dose. The first clinical sign from
this dose was the profuse hemorrhage late on the fourth day in susceptible chicks. Those that died on the fourth day generally did not show any great amount of symptoms. Beginning with the fifth day, the chicks became pale and inactive, with head drawn in and eyes closed, with a dull appearance and roughened feathers. Feed consumption was greatly reduced. After the seventh to the ninth day, the chicks gradually improved but paleness was the last symptom to be corrected.

**Autopsies of the Chicks Dying with Cecal Coccidiosis**

Reference to table II indicates that deaths occurred on the fourth to the eighth day after the test inoculation but that a great majority of the deaths occurred on the fifth day. The three chicks that died after the fifth day were the only ones that died which could transmit the infection to other chicks, for obviously the others had died before the oocyst stage had been reached. The coccidia in the chicks that died late on the fourth day or on the fifth day were for the most part still in the large schizont stage. Those dying early on the sixth day contained coccidia in the macrogamete or early oocyst stages. Every chick that died had blood-filled or core-filled cecums. In none did scrapings of the small intestine, duodenum to ileum harbor any stages of Eimeria. This culture evidently was restricted to the cecums.

**Table II—Dates of deaths after inoculation test.**

<table>
<thead>
<tr>
<th>Day</th>
<th>Deaths</th>
<th>Day</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third</td>
<td>0</td>
<td>Sixth</td>
<td>1</td>
</tr>
<tr>
<td>Fourth</td>
<td>2</td>
<td>Seventh</td>
<td>1</td>
</tr>
<tr>
<td>Fifth</td>
<td>26</td>
<td>Eighth</td>
<td>1</td>
</tr>
</tbody>
</table>

**The Development of Immunity**

Two cockerels were taken from each group, one of which had passed hemorrhage and another which had shown neither hemorrhage nor oocysts following the test feeding. These were autopsied nine days after the test-feeding date. Oocysts of *E. tenella* were recovered in moderate numbers from each pair of group 1, group 2, and the controlled group.

One of the two cockerels of group 3, given three feedings of the H.A.S. cultures, contained a great abundance of oocysts; so numerous, in fact, that a smear made of the cecal contents contained 25,000 oocysts per drop. In spite of this heavy infestation, the appearance was normal and his activity and
strength were unimpaired. The blood loss, moreover, was too slight to bring about any paleness. The cecums were found to be of normal size, although they did contain a tiny cecal core which was entirely colorless. The crumpy center of the core was not red like the cores associated with profuse hemorrhage. The cecal mucosa was not dry or bare as in the control chicks but was moist with a normal amount of secretion of the cecums. This chick is a good example of the tolerance of an immunized chick to a very heavily established infection.

The other cockerel of this group proved to be totally immune from every standpoint, clinically and parasitologically. No stages of the life cycle of *E. tenella* were found in the cecal mucosa. Both the appearance and the contents of the cecums were entirely normal. There was lack of evidence that hemorrhage of any degree had occurred. The condition in this cockerel indicates that a portion of chicks receiving three subclinical dosages of H.A.S. culture of *E. tenella* become totally immune to further infection from the parasite.

The chick from group 4, which passed hemorrhage after the test dose, was found upon autopsy to possess normal-sized cecums containing a medium-sized cecal core with a crumpy center. Microscopically, a very large number of oocysts were seen in the cecal mucosa. Here, again, a huge number of coccidia had gone through the schizogony cycle with only a slight local pathological effect and with no serious damage to the host, denoting a rigid resistance to a heavily established infection with *E. tenella*. The chick from group 4, which had not passed oocysts or blood in its droppings after the test, was entirely immune parasitologically. The cecums were normal in size, shape and content. Scrapings from different portions of the cecal mucosa proved to be free from infection from coccidia. The initial feeding of an H.A.S. dose, followed by two feedings of an UNH. dose, confers a total immunity to a portion of the chicks so immunized.

**PATHOLOGICAL FINDINGS IN GROUPS**

Necropsy studies showed great differences in the size of the cecums and their contained cecal cores in controlled chicks as compared with immunized chicks. Huge cecal cores, completely filling the distended and enlarged cecums, were found regularly in the controls which survived the test doses. The cecums on the average were between two and three times the volume of the cecums of the survivors from the immunized groups; whereas the cecal cores were nearly six times the size of those receiving the immunizing inoculations.
RESULTS

These findings indicate that oöysts heated after sporulation given in three separate doses at five-day intervals or given in a single initial dose followed by two separate feedings of unheated oöysts in small numbers will confer either a resistance to heavy re-infection or a total parasitological immunity, preventing re-infection. Chicks fed oöysts heated prior to their sporulation in three separate dosages or in one large dose do not seem to develop a parasitological immunity and receive only a limited resistance to re-infection.

COMPARATIVE VIRULENCE OF HEATED AND UNHEATED CULTURES

Three groups of six chicks each were respectively fed oöysts as indicated in table III. Sixty thousand UNH. oöysts fed in capsule proved more virulent than 80,000 H.A.S. or H.B.S. Three of the six fed UNH. oöysts died within seven days, five of the six passing considerable hemorrhage. All but one showed typical acute symptoms.

TABLE III—Virulence of different types of E. tenella cultures.

<table>
<thead>
<tr>
<th>Number and Type of Oöysts</th>
<th>Chicks Tested</th>
<th>Died</th>
<th>Condition of Survivors</th>
<th>Chicks Having Hemorrhage</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>60,000 UNH.</td>
<td>6</td>
<td>3</td>
<td>2 poor 1 fair</td>
<td>6</td>
<td>Virulent</td>
</tr>
<tr>
<td>80,000 H. B. S.</td>
<td>6</td>
<td>0</td>
<td>2 good 4 fair</td>
<td>3</td>
<td>Low virulence</td>
</tr>
<tr>
<td>80,000 H. A. S.</td>
<td>6</td>
<td>1</td>
<td>1 poor 4 fair</td>
<td>4</td>
<td>Moderate virulence</td>
</tr>
</tbody>
</table>

None of the six chicks fed 80,000 H.B.S. oöysts died or displayed the characteristic appearance of chicks suffering from acute cecal coccidiosis. The hemorrhage passed was but moderately heavy and did not result in excessive paleness; two of the chicks in fact retained their normal color. H.B.S. cultures evidently are of low virulence.

H.A.S. cultures are more virulent than H.B.S. cultures but less virulent than UNH. cultures. One of the six chicks fed 80,000 H.A.S. oöysts died on the fifth day. The hemorrhage was fairly heavy and one of the six chicks displayed typical droopiness while the four others were but slightly affected.

Although H.B.S. cultures are the least virulent, still they cannot be used alone because they do not incite protective responses sufficient to prevent clinical symptoms unless followed by UNH. oöysts.
SIZE OF IMMUNIZING DOSES

The studies so far have yielded indications as to the limits of safety in successive inoculations of oocysts. Considering *E. tenella* solely, the results indicate, as tables IV and V show, that up to 150 unheated oocysts can be administered safely initially, but that dosages higher than this incite hemorrhage, and that deaths result when numbers greater than 1,000 oocysts are employed. As the table indicates, oocysts kept at room temperatures in 2.5 per cent potassium dichromate solution are very virulent, and hence care must be exercised in keeping inoculations below the clinical dosage. As low as 1,500 UNH. oocysts give a definite clinical case of cecal coccidiosis.

### Table IV—Effects of different counts in cultures of *E. tenella*.

<table>
<thead>
<tr>
<th>Oocysts</th>
<th>Hemorrhage</th>
<th>Symptoms</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-150</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>150-500</td>
<td>Slight to moderate</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1,000-3,000</td>
<td>Fairly heavy</td>
<td>Fairly heavy</td>
<td>Light</td>
</tr>
<tr>
<td>3,000-5,000</td>
<td>Very heavy</td>
<td>Severe</td>
<td>Moderate</td>
</tr>
<tr>
<td>Over 5,000</td>
<td>Very heavy</td>
<td>Very severe</td>
<td>Heavy</td>
</tr>
</tbody>
</table>

Using H.B.S. oocysts, 1,000 *tenella* can be given safely, 4,000 such oocysts causing hemorrhage but without the typical droopiness of acute coccidiosis. Dosages of as high as 80,000 oocysts have failed to kill chicks, though causing clinical symptoms which are of a lesser severity than when UNH. oocysts are used. The virulence of H.B.S. oocysts is considerably lower than that of UNH. oocysts, as can be seen by looking at table III.

As high as 700 H.A.S. oocysts initially fed are entirely safe. Dosages of 800 and over cause decreased feed consumption and actual loss of weight. A dose of 13,000 H.A.S. oocysts is fatal to 9 per cent of chicks so inoculated, but half of the chicks are not visibly affected clinically. Increasing the dose to 80,000 oocysts increases the fatalities to 17 per cent and increases the amount of hemorrhage and symptoms. These oocysts can be termed moderately virulent when compared to H.B.S. and UNH. cultures.

Preliminary tests were made previously to determine the virulence of unheated cultures. When the sporulated count of *E. tenella* in the culture (also containing the five other species) varied, the effects were as indicated in table IV.

Table V indicates that dosages can be larger in successive inoculations. Section B of table V shows the tentative recommended dosages, using different types of oocysts.
Table V (A)—Dosages of E. tenella for successive inoculations.

<table>
<thead>
<tr>
<th>TYPE OF OOCYST</th>
<th>FIRST INOCULATION</th>
<th>SECOND INOCULATION 4- TO 7-DAY INTERVALS</th>
<th>THIRD INOCULATION 4- TO 7-DAY INTERVALS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unheated (virulent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>150—safe</td>
<td>750—safe</td>
<td>Less than 1,000—safe</td>
</tr>
<tr>
<td></td>
<td>Over 200—hemorrhage</td>
<td>1,000—hemorrhage</td>
<td>Over 1,000—not safe</td>
</tr>
<tr>
<td></td>
<td>Over 1,000—fatal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over 5,000—60+% fatal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. B. S. 48° 20 min. (low virulence)</td>
<td>1,000—safe</td>
<td>1,170—safe (upper limit unknown; probably over 2,000)</td>
<td>3,200—safe (upper limit unknown; probably over 4,000)</td>
</tr>
<tr>
<td></td>
<td>4,000—hemorrhage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>80,000—not fatal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. A. S. 48° 20 min. (moderate virulence)</td>
<td>600—safe</td>
<td>1,200—safe (upper limit unknown; probably over 1,500)</td>
<td>3,000—safe</td>
</tr>
<tr>
<td></td>
<td>700—hemorrhage</td>
<td></td>
<td>3,500—hemorrhage</td>
</tr>
<tr>
<td></td>
<td>13,000—fatal 1-11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>80,000—fatal 1-6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE V (B)—Recommended dosages for immunization

<table>
<thead>
<tr>
<th></th>
<th>FIRST DOSE</th>
<th>SECOND DOSE</th>
<th>THIRD DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H. B. S. 48° 20 min. 200–700</td>
<td>UNH. 400–700</td>
<td>UNH. 700–900</td>
</tr>
<tr>
<td>2</td>
<td>H. A. S. 48° 20 min. 500–700</td>
<td>H. A. S. 48° 20 min. 800–1,200</td>
<td>H. A. S. 48° 20 min. 1,600–3,000</td>
</tr>
<tr>
<td>3</td>
<td>UNH. 100–150</td>
<td>UNH. 400–600</td>
<td>UNH. 600–800</td>
</tr>
</tbody>
</table>

CONCLUSIONS

1. Chicks become effectively resistant and in some cases totally immune to further infection with *E. tenella*, the cause of cecal coccidiosis, by the capsule feeding of three doses of oocysts given at five-day intervals.

2. Oocysts exposed to temperatures slightly below the lethal death periods exhibit atypical segmentation, resulting in formation of two, three, five, or more atypical sporoblasts, as well as the usual number of four sporoblasts. Oocysts heated at 46° C. for 15 minutes yield very few such atypical forms; while oocysts heated for ten minutes at 48° C. yield over 10 per cent such abnormal forms.

3. A dose of 100 UNH. *E. tenella* oocysts, if fed five to nine days previous to a dosage of 500 *E. tenella* oocysts, prevents the slight hemorrhage which ordinarily follows initial feedings of the latter dose. This fact makes possible the use of increasingly larger successive feedings in the immunizing procedure.

4. The virulence of oocysts kept at room temperature, of those heated before their segmentation, and of those heated after their sporulation differ considerably. Unheated oocysts are the most virulent. Oocysts heated before their segmentation are the least virulent, while those heated after their sporulation are intermediate in virulence. Furthermore, sporulated oocysts of these heated cultures can be fed in greater numbers than unheated cultures without the appearance of hemorrhage, other clinical symptoms or deaths. This fact makes them desirable for use in initial inoculations.

An initial inoculation of 649 oocysts of *E. tenella* heated after their sporulation for 15 minutes at 48° C., a second dose of 1,100 such oocysts and a final dose of 3,300 such oocysts administered in capsules and fed at five-day intervals leave chicks either resistant to heavily established later infections or totally immune parasitologically to *E. tenella*. The chicks are completely protected against death or the usual symptoms of cecal coccidiosis.
6. The original feeding of 649 oocysts of *E. tenella* heated after their sporulation, followed at five-day intervals by a second feeding of 560 unheated oocysts and a final feeding of 1,800 UNH. oocysts, confers a resistance against cecal coccidiosis just as effective as that outlined in conclusion 5. No deaths or severe symptoms result from subsequent tests with *E. tenella* in mass dosage. A portion of the chicks develop a complete parasitological immunity, entering sporozoites being unable to reach the oocyst stage. The remaining chicks are sufficiently resistant to prevent an established heavy re-infection.

7. The sole feeding of sporulated oocysts of *E. tenella* heated prior to their segmentation for 15 minutes at 48° C. does not yield complete immunity or resistance to cecal coccidiosis, although such a feeding does lower the mortality appreciably. Clinically, however, this is far from satisfactory. An 18,000 single dosage of such oocysts initiates a moderate hemorrhage and lowers the mortality of chicks tested 34 days later from the expected 62.5 per cent to 16.7 per cent. A 4,000 dosage of such oocysts causes slight hemorrhage and the mortality of such chicks tested 34 days later was 23.1 per cent. Increasing the number of H.B.S. dosages to three, giving a first feeding of 658 such oocysts, a second feeding of 1,170 such oocysts, and a final feeding of 3,200 such oocysts at five-day intervals, did not improve the subsequent immunity. Twenty-four per cent of chicks so inoculated died with acute cecal coccidiosis when tested and symptoms of infection were present in many of the survivors.

8. Most of the chicks died during the fifth day after testing. None died before the fourth day or after the eighth day of the test. A great majority of these experiment chicks died while the coccidia were still in the large schizont stage and hence do not pass oocysts prior to their death.

9. Infections do not produce, in effectively resistant chicks, the enlarged cecums noted in controls or susceptible birds or distend them with the débris from copious hemorrhage noted in control chicks. Even heavy infections result in the production of only small cecal cores which partially fill the cecums. In control chicks such infections regularly result in the formation of huge cores filling the entire distended cecums, except of course where death occurs before the seventh day and the core has not yet had time to form.

References


STUDIES ON PULLORUM DISEASE*

I. The Influence of Different Temperatures in Brooding

By J. M. Moore, W. L. Mallmann and L. R. Arnold

Departments of Poultry and Bacteriology

Pullorum disease is still a perplexing problem in the poultry field. It is particularly difficult to control because of its many modes of transmission. Not only is this disease passed from the infected hen through the egg to the resulting chick, but the infected chick may transmit the disease to the non-infected stock during hatching and the first few days of brooding. Mortalities of chicks from the same hatching, when shipped to various points,
may vary considerably. Charges for responsibility for the incidence of the disease are passed to the buyer by the hatcheryman and to the hatcheryman by the buyer. When the purchaser of baby chicks experiences a high mortality during the first two weeks of brooding, he naturally suspects pullorum disease and when the bacteriological examinations prove that *Salmonella pullorum* is present, he blames the hatcheryman. While considerable of the blame is justly placed, it must be remembered that the hatcheryman has little control of the management of the chicks after they leave the hatchery. Conditions affecting the chicks during the first two weeks of brooding may have a direct influence on the spread of the disease and the resulting mortality.

![The Brooder](image_url)

*Fig. 1. Photograph of experimental brooder showing front view with doors in place.*

The work herein presented is the first of a series to determine the influence of various factors on the incidence of pullorum disease in chicks during brooding. This study concerns the influence of brooding temperatures upon infected and non-infected chicks and non-infected chicks that have been exposed to the disease by contact with infected stock.

**PROCEDURE**

In order to study the influence of various temperatures upon brooding, it was necessary to build a special compartment brooder in which temperatures could be regulated accurately. The brooder used in these experiments is presented in figures 1 and 2. This brooder was divided into four compartments, each with a separate thermostat. The heat was brought into the compartments through a cylinder placed in the middle of each compartment. This cylinder was thoroughly insulated with asbestos so that no heat could pass through its walls and cause the chicks to crowd toward the center. Crowding was never observed. The tempera-
ture of each compartment was taken one inch above the litter. Throughout the experiments the temperatures taken anywhere at the same level in a compartment varied less than 1° F. Shavings were used on the floor as litter. The following temperatures were used: Pen 1—72° F.; Pen 2—80° F.; Pen 3—88° F.; and Pen 4—96° F.

The chicks were hatched in a still-air incubator, the infected and non-infected stock being hatched in separate compartments to avoid any incubator transmission. When the chicks were 24 hours old, they were transferred to the experimental brooder where they were kept at the various temperatures for seven days. At the end of this period, they were placed in a battery brooder heated with hot water for the second seven days where an op-

![Fig. 2. Photograph of experimental brooder showing interior.](image)

timum temperature was maintained. The experimental brooder was carefully cleaned and disinfected each time prior to the introduction of the chicks.

All chicks dying during the experiments were subjected to a careful autopsy. The heart, liver and retained yolks were examined bacteriologically for the presence of *S. pullorum*. All tissues were smeared upon brilliant green-liver infusion agar as recommended by Mallmann, Thorp, and Semmes. Typical colonies of *S. pullorum* were reported as positive without further identification. All atypical colonies were studied by planting into lactose, maltose, mannite and dextrose broth fermentation tubes. Repeatedly typical colonies were isolated and tested in a similar manner as a check on the procedure. A record of the autopsies was maintained by means of wingbands which were attached to each chick at the time of removal from the brooder.

The Michigan State College S. C. Rhode Island Reds were used as a source of non-infected chicks. This flock has been blood-tested for the past six years. This year (1932-33) they were
blood-tested twice, the first time with the rapid agglutination test and the second time with the slow agglutination test. In 1932, in the first test, there was 1 per cent reactors while on the second test, no reactors were obtained. When the word "clean" is used it refers to this stock.

The infected stock was obtained from two sources. During the season of 1932, the chicks from an infected flock were purchased from a local hatchery. These were also S. C. Rhode Island Reds. During the 1933 season, the infected stock was hatched at the Michigan State Poultry Plant. The eggs for the infective chicks were obtained from a Michigan poultryman who kept his Rhode Island Red reactors for hatching at our request. These birds were tested twice. In 1933, both clean and infected stock was hatched in the same incubator, but in different compartments.

EXPERIMENTAL

As soon as the chicks were 24 hours old, they were placed in the brooder, each brooder receiving from 25 to 35 chicks, depending upon the success of the hatch. To determine the influence of infected stock on non-infected chicks, at the various temperatures used, each compartment received half clean and half infected stock. The chicks were kept for one week at the desired temperatures when they were removed to a battery brooder kept at optimum temperatures. After a week under optimum conditions, the experiment was concluded. To obtain significant figures these experiments were repeated at irregular intervals over the hatching season. In 1932, the experiments had to be discontinued in May, due to the fact that the temperature of the room was higher than the minimum temperatures used for brooding. In 1933, a cooler room was selected so the experiments could be continued into June. As control experiments, clean stock was brooded separately at the various temperatures to obtain data on "normal" mortality for comparative purposes. These latter experiments were conducted in both years. Due to the fact that the diseased stock was obtained from different sources the last year, the data for each year are treated separately. For convenience in the discussion, the non-infected stock is designated as lot "A" and the diseased chicks as lot "B."

The results of brooding clean and infected stock together during the 1932 season are presented in table I. It will be observed that in both the clean and infected stock the total mortality from all causes was highest in the stock brooded at the lowest temperature, namely 72\(^\circ\) F. As would be expected, the total mortality in the infected stock is considerably higher than in the clean stock.
It will be observed also that the percentage of autopsies in which *S. pullorum* was found was nearly three times higher in the infected stock than in the clean chicks. No relationship between total deaths and those caused by *S. pullorum* is evidenced at any particular temperatures.

**Table I**—The mortality of clean and reactor chicks brooded together in 1932.

<table>
<thead>
<tr>
<th>Temperature of Compartment F.*</th>
<th>Clean Stock</th>
<th></th>
<th>Reactor Stock</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chicks</td>
<td>Mortality</td>
<td>Pullorum Infection (%)</td>
<td>Chicks</td>
</tr>
<tr>
<td></td>
<td>Number Per Cent</td>
<td></td>
<td></td>
<td>Number Per Cent</td>
</tr>
<tr>
<td>72</td>
<td>120</td>
<td>45 37.5</td>
<td>25.0</td>
<td>138</td>
</tr>
<tr>
<td>80</td>
<td>124</td>
<td>19 15.3</td>
<td>11.8</td>
<td>137</td>
</tr>
<tr>
<td>88</td>
<td>125</td>
<td>17 13.6</td>
<td>28.6</td>
<td>137</td>
</tr>
<tr>
<td>96</td>
<td>122</td>
<td>7 5.7</td>
<td>14.3</td>
<td>137</td>
</tr>
<tr>
<td>Total</td>
<td>491</td>
<td>88 17.9</td>
<td>22.0</td>
<td>549</td>
</tr>
</tbody>
</table>

In table II are presented the data showing the influence of temperature of brooding upon clean stock for the year 1932. Of 124 chicks brooded, only two deaths occurred and neither of these was due to *S. pullorum*. The temperature of brooding in this experiment failed to cause an increased death-rate. The spread of *S. pullorum* infection from the infected chicks to the clean stock is vividly depicted by comparing the data of tables I and II. In the clean stock brooded separately the total mortality for 124 chicks was 1.6 per cent and no pullorum infection, while the exposed clean stock showed a total mortality of 17.9 per cent and incidence of 22 per cent pullorum disease. In figures 3 and 4, the averaged mortalities of tables I and II, respectively, are presented graphically.

Similar experiments were conducted during the season of 1933. The results (tables III and IV) are similar to those of 1932. However, as the infected stock was obtained from selected reactors, the results are more pronounced than those of 1932, where the eggs of an infected flock were used. The average total mortality of the clean stock for all temperatures was 22.5 per cent as compared to 53.1 per cent in the infected stock. These figures are somewhat higher than those obtained in 1932. The percentages of autopsies from which *S. pullorum* was isolated were decidedly higher than previously, being 81.9 per cent for the clean stock and 93.5 per cent for the infected, as compared with 22 and...
79.4 per cent, respectively, for 1932. This was probably due to the fact that the incidence of pullorum disease in the infected stock was considerably higher in the selected reactors. The infected stock, when brooded alone (table IV), gave approximately the same incidence of deaths, and the percentage of mortality was approximately the same as before.

In comparing the clean and infected stock brooded separately, temperatures of brooding show a marked influence. At 72°F the clean stock suffered a mortality of 4.1 per cent. The data speak for themselves. As the temperature is increased, the mortality in the infected chicks decreased to an appreciable extent. The data for 1933 are presented graphically in figures 5, 6 and 7.

The distribution of the total mortality day by day for the 14-day period in which the chicks were brooded for 1932 and 1933 is presented in tables V and VI, respectively. It is significant that as indicated in both tables the heavy mortality in the in-
Fig. 3. The percentage mortality of clean and infected chicks brooded together in 1932.

**Table IV—The mortality of clean and reactor chicks brooded separately in 1933.**

<table>
<thead>
<tr>
<th>Temperature of Compartment °F</th>
<th>Clean Stock Chicks</th>
<th>Clean Stock Mortality</th>
<th>Clean Stock Pullorum Infection (%)</th>
<th>Reactor Stock Chicks</th>
<th>Reactor Stock Mortality</th>
<th>Reactor Stock Pullorum Infection (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Per Cent</td>
<td></td>
<td>Number</td>
<td>Per Cent</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>98</td>
<td>4</td>
<td>4 10 25 0</td>
<td>162</td>
<td>120</td>
<td>74 1 88 3</td>
</tr>
<tr>
<td>80</td>
<td>98</td>
<td>6</td>
<td>6 10 16 7</td>
<td>162</td>
<td>83</td>
<td>51 2 86 7</td>
</tr>
<tr>
<td>88</td>
<td>98</td>
<td>4</td>
<td>4 10 0 0</td>
<td>162</td>
<td>62</td>
<td>38 3 87 1</td>
</tr>
<tr>
<td>96</td>
<td>98</td>
<td>1</td>
<td>1 02 0 0</td>
<td>162</td>
<td>48</td>
<td>29 6 98 6</td>
</tr>
<tr>
<td>Total</td>
<td>392</td>
<td>15</td>
<td>3 80 13 3</td>
<td>648</td>
<td>313</td>
<td>48 3 87 9</td>
</tr>
</tbody>
</table>

Fig. 4. The percentage mortality of clean chicks brooded separately and brooded with infected chicks in 1932.
fected stock began from one to two days in advance of that in the clean chicks when they were brooded together, showing that most of the infection in the clean stock was contracted from the infected stock. The heaviest mortality in both lots ran from the fourth to the eighth day of brooding.

There are two distinct viewpoints, as to the importance of pullorum disease, held by both the poultryman and the investigator. One group minimizes the disease as a factor in the livability of chicks and attributes the cause of high mortalities to environmental agencies, while the other group stresses the causative factor, *S. pullorum*, even to the utter exclusion of all external factors, except in so far as these factors may play a mechanical rôle in the transmission of the disease from the infected bird to the susceptible chick. The first viewpoint is very clearly indicated by Beach, Strange, Holmes and Halpin, who state:

It seems certain that the presence of bacillary white diarrhea organisms of the type studied in this investigation, as indicated by the agglutination test, does not reduce egg production, impair hatch-ability or lessen the livability of chicks hatched from eggs laid by hens which react to the test.

There is ample evidence to show that occasionally a condition such as they encountered exists. Hinshaw, Scott and Payne state:

In 6 of 8 hatches bacillary white diarrhea was transmitted to normal chicks. The fact that no losses from bacillary white diarrhea occurred among the exposed chicks in two hatches may be explained by the failure of the disease to develop among supposedly infected chicks. Infection apparently was not present in these two hatches since there were no losses from the disease. Similar results in practice have puzzled hatcherymen and poultrymen for some time. It is not uncommon for poultrymen to have heavy losses from the disease in one brood and to have normal mortality in the following brood hatched in the same machine, from eggs of the same stock.

The writers have had similar experience in studies on the transmission of pullorum disease in the incubator. An explanation of this condition cannot be made at this time, but the influence of environmental factors seems a logical reason. The data presented in this paper demonstrate very convincingly that low temperature during brooding results in such a lowering of constitutional vigor that pullorum disease, when present, causes a marked increase in mortality during the first two weeks of brooding. Not only is the mortality of chicks hatched from reactor hens greater, but the spread to clean stock is considerably higher. The value of proper brooding temperature in reducing or suppressing high mortality rates is clearly indicated.
Fig. 5. The percentage mortality of clean and infected chicks brooded together in 1933.

Fig. 6. The percentage mortality of clean and infected chicks brooded separately in 1933.

Fig. 7. The percentage mortality of clean chicks brooded separately and brooded with infected chicks in 1933.
### Table V—The distribution of mortality over the 14-day period of clean and reactor chicks brooded together in 1932.

<table>
<thead>
<tr>
<th>Lot*</th>
<th>Chicks</th>
<th>Days</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>491</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>549</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

### Table VI—The distribution of mortality over the 14-day period of clean and reactor chicks brooded together in 1933.

<table>
<thead>
<tr>
<th>Lot*</th>
<th>Chicks</th>
<th>Days</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>612</td>
<td>..</td>
<td>..</td>
</tr>
<tr>
<td>B</td>
<td>320</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

*A = clean stock; B = reactor stock.*
SUMMARY

1. Chicks hatched from reactor hens and brooded at varying temperatures for the first week had a much higher mortality than chicks hatched from tested hens and brooded under similar conditions.

2. In the four brooding temperatures used, \textit{viz.}, 96, 88, 80, and 72° F., chicks hatched from the tested stock did not show such an increase in mortality as the temperature in the compartments was lowered, as did the chicks hatched from reactor stock.

3. Chicks hatched from tested hens and brooded in the same brooder compartments with chicks hatched from reactor hens showed a higher mortality than when they were brooded by themselves under similar conditions.

4. Chicks hatched from tested stock have a much better chance of living when they are subjected to hardship, such as improper temperature in shipping, or poor management after they reach the flock-owner, than have those chicks hatched from untested stock.

5. The purchase of clean stock is recommended.

REFERENCES

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\textbf{PRESIDENT FAULDOR:} If there is no other business to be brought before the meeting, we stand adjourned.

. . . The session adjourned at 11.50 a. m. . . .

\textbf{RECESS}

\textbf{FRIDAY AFTERNOON, DECEMBER 8, 1933}

The sixth and final session convened at 1:15 p. m., President Faulder presiding.

\textbf{PRESIDENT FAULDOR:} The afternoon program will be devoted to a number of important committee reports. Inasmuch as Dr. Cary wishes to leave, I am going to ask for the report of the Committee on Tick Eradication at this time. I will call upon Dr. C. A. Cary, Chairman of that Committee, for that report.

. . . Dr. Cary read the report. . . .
REPORT OF COMMITTEE ON TICK ERADICATION

Dr. C. A. Cary, Chairman, Auburn, Ala.
Dr. L. J. Allen, Oklahoma City, Dr. H. L. Darby, Fort Worth, Tex.

The tabulated report of tick eradication in the various states will be made by the Chief of the Tick Eradication Division of the U. S. Bureau of Animal Industry.

In Texas, the number of counties released and the progress of the work have been quite satisfactory to all concerned. Likewise the progressive tick eradication work accomplished and the number of counties released on December 1, 1933, indicates that in the near future Florida will be completely free of cattle fever ticks. In Louisiana, from lack of state and federal funds, and somewhat weak state tick eradication laws, the number of counties released and the advancement of the work have not been equal to what has been done in Texas and Florida, but under the conditions, Louisiana has done quite good work.

The federal authorities have recently given to Texas, Louisiana and Florida about $900,000 and this money is to be used at once in building vats in these states. We urge and expect the federal authorities to keep giving liberal donations and aid to these states so that the last cattle fever tick will soon be eradicated from the United States.

The United States Live Stock Sanitary Association most respectfully requests and urges the United States Department of Agriculture, through the regulations of the Bureau of Animal Industry, and the live stock sanitary authorities of Texas, Florida and Louisiana, and all the states bordering these three tick-infested states, to adopt and enforce regulations prohibiting and preventing the interstate movement of all cattle, horses, mules and asses from or through all inactive tick-infested areas and that no cattle, horses, mules or asses can be moved from dipping stations in inactive tick-infested areas unless the mover of said animals shall have obtained a federal inspector's certificate that said cattle are tick-free after two or more regular dippings; also the mover of said cattle shall have obtained the consent of the state veterinarian of the state into which said cattle are to be moved.

We furthermore request and urge the federal authorities, the state authorities of the infested and the bordering states, to prohibit and prevent, when and where possible, all interstate movements by truck of cattle, horses and mules from tick-infested areas without permits or legal certificates from authorized federal or state inspectors.

I move the adoption of this report.

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

I note that our program failed to make provision for the report of the Committee on Unification of Laws and Regulations, Dr. W. H. Welch, Chairman. I will now call upon Dr. Welch for the report.

Dr. Welch read the report.

REPORT OF COMMITTEE ON UNIFICATION OF LAWS AND REGULATIONS

Dr. W. H. Welch, Chairman, Lexington, Ill.
Dr. H. M. O'Rear, Washington, Dr. Thos. E. Robinson, Westerly, R. I.
Dr. D. M. Campbell, Chicago, III. Dr. A. E. Behnke, Milwaukee, Wis.

The state regulations for the interstate shipment of live stock are not uniform, they have not been uniform, and this Committee is of the opinion that universal uniformity in such regulations is probably
not desirable. However, a far greater degree of uniformity than now exists is desirable; is practical of achievement and, in some measure, necessary if the confidence of shippers of live stock in the good intent of such regulations is to be won or held. In the absence of legislation by the Congress, designed to prevent or correct evils in the promulgation of unwise, unnecessary or, for other reasons, undesirable laws and regulations hampering the inter-state shipment of live stock, it seems likely that the immediate future will witness even more chaotic conditions than now obtain.

The decision of the U. S. Supreme Court in the Wisconsin-New York case, seems to leave the matter of the laws and regulations controlling the entrance of live stock into any state entirely with the authorities of that state, in the absence of regulations governing the same field promulgated by the Secretary of the U. S. Department of Agriculture, and since there seems little reason to expect the Secretary of Agriculture to extend federal control of the interstate movement of live stock materially in the near future, we may expect to see various commercial and other interests active for the procurement of regulations ostensibly for the control of animal disease, but in reality designed for a different purpose.

Such measures adopted by any state will tend to invite retaliatory measures on the part of other states, to the end that the free interchange of live stock between the breeders and feeders of different states will be greatly impaired and the whole industry injured. Because live stock sanitary officials in the various states will be entrusted with carrying out such measures, they will be blamed by the live stock industry for the harmful effects accruing.

To remedy the present chaotic conditions and prevent even greater confusion and injustice in the future, this Committee recommends that this Association continue its efforts to induce the Congress to enact legislation granting the states authority to promulgate regulations for the importation of live stock, such regulations to be effective only after approval by the Secretary of the U. S. Department of Agriculture.

We believe that such legislation would bring about a far greater uniformity in interstate regulations than has obtained at any time within recent years, and a uniformity as great as is desirable; it being recognized that a regulation proper for control of a shipment of horses from Utah to Idaho might be unnecessary in the shipment of horses from New Jersey to Pennsylvania, and that regulations for the shipment of sheep from New Mexico to Kansas need not be the same as for the shipment of these animals from Ohio to West Virginia.

And, in the meantime, this committee urges upon all state live stock regulatory officials the desirability of revoking all obsolete and unnecessary import regulations now in existence for their particular state. As an example, it appears that the universal mallein test of horses shipped from one state to another, is no longer justified by the extent of glanders in this country, and this being a costly and an inconvenient restriction on the free interstate shipment of horses, that the requirement of mallein-testing be discontinued in the shipment of horses from the majority of states, where this disease no longer exists.

This Committee notes with concern and apprehension a disposition on the part of the regulatory authorities of some states to enforce interstate regulations for the control of live stock diseases rigorously in the case of animals shipped by rail, and to pay little or no attention to even greater shipment by truck. This is believed to be unfair to the railroads as common carriers, tending to divert much traffic from them and unfair to shippers who find it necessary or desirable to send their animals by rail, as it places them in an unfavorable position in competition with other shippers who are inclined to use trucks and thus avoid the regulations.
This Committee realizes fully the great difficulty entailed in the control of live stock shipments by truck. But, in the interest of fairness to the live stock industry, all methods of live stock transportation should be required to observe the same sanitary regulations; otherwise, our regulations may be nullified by the courts on the grounds that they are discriminating.

This Committee further desires to call attention to the fact that regulations providing for the freedom of animals from certain diseases of live stock, when coming into a state, are, in considerable measure, unjustifiable unless and until that state has taken measures to control the disease within its own border, and to control the intrastate shipments of animals so affected.

To cite a single example: There is little or no advantage in requiring dairy cows shipped into a state to be free from Bang's disease if Bang's disease control has not already been undertaken by that state, and there are known Bang's disease-free herds in which to put such animals. On the other hand, such a regulation preventing the importation of any but Bang's disease-free animals is a distinct disadvantage to the live stock industry of that state if such animals must be used as replacements in infected herds and, at the same time, it injures cattle-owners of other states desirous of supplying replacements for these infected herds. To put it bluntly, it is neither logical nor good business for a state or its citizens to purchase a disease-free animal until there is a safe place to put it.

This Committee views with apprehension the increasing number of weekly or monthly community sales held without any sort of official supervision and from which the animals are transported indiscriminately by truck. Many such animals are moved interstate before finally disposed of and their control after they leave the sale is exceedingly difficult. In fact, it is next to impossible to locate their destination. The only feasible way to prevent the spread of animal disease at such sales seems to lie in official control at the time of the sale.

DR. WELCH: I move the adoption of this report.

. . . The motion was regularly seconded. . .

DR. WISNICKY: I think that is a splendid report, though I should like to make a few remarks in connection with the reference that the report made on glanders in horses.

In our state we have been importing horses at the rate of about 20,000 a year. We had not had any glanders for a period of approximately 15 years. During the last two years we have detected four separate and distinct outbreaks of glanders within the State. The study as to the source of this infection in all cases traced it back to importations that came from western states, Iowa and Illinois; that is, we could not definitely determine whether those cases originated in Iowa or Illinois, because in some instances western horses are shipped to those states and then reshipped to our state after they have spent some time in either of these two states.

Fortunately, two of these outbreaks were detected shortly after the horses were shipped in; the other two were not. In one case we tested a large number of horses in a community and found approximately a dozen animals which had to be condemned for glanders. We feel that from the exposures which may have been made with these dozen animals, we as yet do not have the disease eradicated in that community. So from the experience that we have had in Wisconsin it would seem to me that recommendation in connection with glanders is not appropriate at this time.

PRESIDENT FAULDER: Is there any further discussion? Are you ready for the question?

. . . The question was called for, put to a vote and carried. . .
President Faulder: The next is the report of the Committee on Miscellaneous Transmissible Diseases. This report will be made by Dr. A. W. Miller, Assistant Chief, United States Bureau of Animal Industry, Washington, D. C.

Dr. Miller read the report.

REPORT OF COMMITTEE ON MISCELLANEOUS TRANSMISSIBLE DISEASES

Dr. A. W. Miller, Chairman, Washington, D. C.

Dr. Jacob Traum, Berkeley, Calif. Dr. J. J. Kavenek, Hartford, Conn.
Dr. L. Enos Day, Chicago, Ill. Dr. I. D. Wilson, Blacksburg, Va.
Dr. C. H. Clark, Lansing, Mich. Dr. Mark Francis, College Station, Tex.
Dr. A. J. DeFossett, Columbus, O. Dr. D. H. Udall, Ithaca, N. Y.

Your Committee on Miscellaneous Transmissible Diseases has a very brief report to submit.

Foot-and-Mouth Disease

There has been but little change in the worldwide foot-and-mouth disease situation since the 1932 meeting of this Association. During the past year, however, the Union of South Africa, which had been free for a number of years, became infected through an extension of the disease from Rhodesia and the Bechuanaland Protectorate. Prompt and drastic measures were taken by the Union authorities and progress of the disease was checked. Yugoslavia, which for a long period of time has been reporting entire freedom from that disease, became extensively infected during the year. Great Britain has continued to experience repeated outbreaks.

Although experimental work is being carried on in countries where infection has become more or less firmly established, there are no indications at this time that progress is being made in the actual elimination of the infection.

Encephalomyelitis of Equines

The report of your Committee last year dealt in some detail with encephalomyelitis of equines. During the current year, outbreaks of this disease have been reported as occurring in a large number of states. They were especially severe in Utah in the West, in Colorado, Nebraska and Kansas in the Midwest, and in Virginia, Maryland, Delaware and New Jersey in the East. The disease appeared to a slight degree in the early months of summer, gradually increased in severity, reaching a peak in September, and subsided with the coming of colder weather in October. Only sporadic cases have been reported as occurring after the first week of November.

In 1931, Meyer, Haring and Howitt, and others who studied the severe outbreaks of 1930-31 in California, reported the recovery of a filter-passing virus which was apparently the causative agent of the disease. In 1932, the federal Bureau of Animal Industry obtained a similar virus from the South Dakota outbreak of that year, and in 1933 recovered a second and similar virus from this year's outbreak. In 1933, a filter-passing virus was first demonstrated by the Bureau to be the cause of the disease as it occurs in the East. Studies which the Bureau has made have shown that the eastern virus apparently differs in some immunological respects from the western type of virus. This latter point is of especial importance in considering specific serum therapy.

Practically no definite information is available as yet as to the mode of transmission of the disease under natural conditions. Recent ex-
periments by Kelser are suggestive that mosquitoes may play a certain rôle. On the other hand, however, there is evidence to support the theory of infection by inhalation inasmuch as the disease appears to be transmitted readily in this manner.

Further experiments which have been conducted during the present year with anti-encephalomyelitis serum indicate that when the agent is administered very early and in suitable quantities it is of value and possibly some benefit is obtained when it is used as a prophylactic agent. Proper symptomatic medication has as much place in the treatment of this disease as in any other, but indiscriminate use of medicinal agents can not be condemned too severely. It is most important that the animals have careful nursing. This includes provision for adequate shelter from the sun and the elements, and the supplying of fresh water and succulent grasses. In order to avoid undue injury, adequate bedding should be provided or artificial support furnished by means of slings, and above all the animals should be kept quiet.

**California Outbreak**

On March 21, 1933, an outbreak occurred in a herd of garbage-fed swine on a ranch near San Diego, California, the exact nature of which it was not possible to determine promptly. The malady, however, which was characterized by vesicles on the snout and feet of affected animals, was of such a type as to warrant the immediate destruction of infected and exposed herds, four in number, which contained 5,488 swine. The destruction of the animals, which was completed on April 8, was immediately followed by thorough cleaning and disinfection of the premises which they had occupied. Inspection made of all domestic animals within a radius of several miles of the infected area did not disclose any further cases of the disease. A series of animal inoculations which was made in an effort positively to identify the disease was inconclusive.

**Dr. Miller:** Mr. Chairman, I move that this report be accepted and referred to the Executive Committee.

... The motion was regularly seconded. ...

**Dr. C. U. Duckworth:** When Dr. Miller got down to the last paragraph, he said "California Outbreak" and then put a period after it. He did not say outbreak of what, because he is not in position to know what it was. That is a source of satisfaction to some of us who were on the firing line out there when this thing occurred. To sit here and hear Dr. Miller read a couple of paragraphs on that condition, it would seem as though it were a very simple thing, but let me assure you that it was the most complicated thing that a veterinarian could hope to be injected into.

That is the way those things happen. You are injected into them in the middle of the night. A telephone call comes in. You have to get there as quickly as possible. You get on the job and here is a perfect picture of foot-and-mouth disease in hogs. You go about laying down a quarantine to hold the stuff in there. You go chasing down contacts, find out what it is all about. You are put to the necessity of throwing together a fighting army overnight, so to speak. You are right up against it. It is up to you to get test animals in there to prove your tentative diagnosis. All of these diagnoses are tentative.

Then the diagnosis is seen. It is a snap. There is nothing to it provided your hogs break and your cows break and your guinea pigs break and the horse doesn't. But when the hogs all break and the guinea pigs won't do anything, and the cows do less, then the horse gives you a little lesion, you are up a tree. You can't call it vesicular stomatitis. We gave the cows enough virus to knock down every cow, and they licked their chops and liked it. Every hog that we gave
virus to broke with beautiful lesions. You never saw a prettier lesion of foot-and-mouth disease in your life than was in those hogs.

We were up against a tough problem. We had had foot-and-mouth disease in California a couple of times before. Some folks think we might have had it three times, but some of us think it was only twice. Some of us think that 1932 was the same as 1933. When you consider that New Zealand had just removed the quarantine from California, and here we break again with foot-and-mouth disease a year following, it would seem that the rest of the world would soon be in position to regard the United States as permanently infected.

The diagnosis of foot-and-mouth disease was by no means justifiable. We were in an isolated place at the end of a state approximately 1,000 miles long. There weren't many hogs. If hogs were all that could be infected with this condition, it did not seem justifiable to diagnose it as foot-and-mouth when it was questionable, and get ourselves quarantined, hold in the products of the soil that were being shipped out, when actually we did not know what was going on. We did as much as we could.

We treated the thing as though it were foot-and-mouth disease. We held it in there. We chased down all contacts and found that fat stuff had gone to the packing-house. We went and got it. We did not take any chances. We took care of the situation as though it were foot-and-mouth disease. But we got up a tree on our diagnosis.

We sent the material to Dr. Mohler at Washington. He arrived at the same conclusion we did. He sent the material to Germany, and Professor Waldmann got the same results that we did, and, further, he demonstrated that the virus, whatever it was, was immunologically different from the three strains of foot-and-mouth that he knows in Germany.

When Dr. Miller said "California Outbreak" and put a period behind it, I guess a period is all you could put behind it because nobody knows what it was.

I want to say that we can expect this condition to come again. I have gone through the campaigns that we have had in California, from the field angle and from the administrative angle. I have seen it handled two ways. I have seen it handled separately by the two divisions, and it does not work so well. When we get together and say that we are a little proud of our political subdivision and we want to retain our identity, we get busy and appoint a committee. "Well, I will put a state man, a federal man and a county man on that committee." That does not work so well.

We got together in San Diego as though we had no political subdivisions to consider at all. We borrowed men from Los Angeles County, because they had men there who were trained in the fighting of this condition. The federal boys, the state boys and the county men from San Diego County and from Los Angeles County were working there as one unit, with no consideration of our political subdivisions. It worked remarkably well.

If any of you are ever cursed with such a thing as that, call in Uncle Sam and tell him, "We are going to work under one head," and you will save yourselves money in fighting that way. (Applause.)

PRESIDENT FAULDER: Is there any further discussion? Are you ready for the question?

. . . The question was called for, put to a vote and carried. . . .

PRESIDENT FAULDER: The report of the Committee on Parasitic Diseases will be made by Dr. E. A. Benbrook, Department of Veterinary Pathology, Iowa State College, Ames, Iowa.

. . . Dr. Benbrook read the report. . . .
REPORT OF COMMITTEE ON PARASITIC DISEASES

DR. E. A. BENBROOK, Chairman, Ames, Iowa

Dr. B. A. Beach, Madison, Wis.
Dr. V. C. Fretz, Omaha, Neb.
Dr. J. E. Shillinger, Washington, D. C.
Dr. Ward Giltner, East Lansing, Mich.
Dr. C. F. Schlotthauer, Rochester, Minn.
Dr. M. C. Hall, Washington, D. C.
Dr. W. H. Hendricks, Salt Lake City, Utah

Last year the Committee on Parasitic Diseases presented a survey of parasites of horses, cattle, sheep, swine and poultry in the United States, as gathered by the seven members of the Committee who were assigned to definite areas of the country. The report also contained a recommendation that an effort be made to obtain one or more reporters on parasites from each state so that a more comprehensive survey might be made. At the present time, 56 persons in 45 states have signified their intention to assist the Committee in this plan and it is believed that one or more persons can quickly be secured to act from the states still remaining.

For a nationwide survey to succeed, it is essential to start work very soon after the annual meeting of the Association. This year, for various reasons, this Committee was not fully notified of appointment until April, 1933. This delay did not allow the chairman enough time aside from his regular duties to complete the survey as planned. Therefore, the report this year will consist of a résumé of the principal advances made in our knowledge of parasites and parasitic diseases of food animals and their control, during approximately the past twelve months as reported in available literature. This résumé is by no means exhaustive but is intended to bring to the attention of members of this Association certain items of interest.

PARASITES OF HORSES

Considerable impetus has been given to the attack upon bots in horses by Wehr (Washington, D. C.), who states that bot larvae appear to embed in the tongue for about 28 days before reaching the stomach. This information is of value to veterinarians as an aid in determining the right time to treat horses for bots. The date of treatment should be set at one month after the disappearance of the adult flies in the fall. Flies are killed by one day of freezing temperature. Immediately after the adult bot flies have died, bot eggs should be removed from the hair, preferably by using a 2 per cent solution of cresol applied with a mop or rag. This method of treating horses will allow them to go into the winter in better condition than was the case when treatment was delayed until the bot larvae became more fully developed in the stomach and duodenum.

Graham, Slatter and Park have reported remarkably good results in the campaign waged against internal parasites of horses in Illinois. During 1932, approximately one-sixth, or about 150,000, of the horses of Illinois were treated for bots, strongyles and ascarids. Work was carried on in 66 counties by 204 veterinarians in a cooperative manner. Most of the horse-owners have reported that the treated horses worked better, were more easily handled and were better able to withstand the heat in the summer.

The U. S. Department of Agriculture has issued a two-reel motion-picture film on the control of bots in horses. This should be widely used by those interested in promoting bot-control campaigns.

Underwood (Washington, D. C.) obtained promising results in treating colts for the elimination of ascarids. He used normal butyldene
chlorid in a dose of 0.3 cc per 2.2 pounds of weight after a 36-hour fast. This treatment was followed in four hours by purgation with raw linseed oil. The growth rate of colts so treated was not inhibited, as has been reported following the administration of other anthelmintics.

Kelser (Washington, D. C.)* has found that the mosquito Aedes aegypti is capable of transmitting equine encephalomyelitis. Probably other mosquitoes also may be offenders.

PARASITES OF CATTLE

Rees, and also Dikmans,† of the Zoological Division of the federal Bureau of Animal Industry, have published a most valuable series of observations on anaplasmosis in this country; including the identity of carriers of the parasite, its nature and its morphology. Those interested in this disease should consult the extensive articles published in the JOURNAL of the American Veterinary Medical Association, in the North American Veterinarian and in Parasitology. As the disease, Texas fever, approaches control under the efficient functioning of federal forces, anaplasmosis becomes of greater importance and the knowledge gained in eradicating the former disease provides a valuable basis of information for the control of the latter.

Wilson and Morley (Virginia)$ have added new links in the chain of evidence needed in working toward the control of bovine coccidiosis. The characteristics of the species of coccidia have been studied further; also their resistance to external influences and certain factors in immunity have been investigated. Wilson believes that bovine coccidiosis is one of the common diseases of cattle that are being diagnosed as hemorrhagic septicemia, forage poisoning, plant poisoning, etc. Microscopic examination of feces either in the field or by a diagnostic laboratory may be helpful in making a differential diagnosis.

Eno (New York) and Kastner (Kansas) have published the results of the use of azamine in treating cases of bovine coccidiosis in the field. Apparently good results were secured, although control animals were not used to check the treatment.

Following the first report of trichomoniasis of cattle in the United States by Emmerson (Pennsylvania),§ the disease has been studied by McNutt, Walsh and Murray (Iowa). They described a pathologic process of the bovine uterus and vagina associated with abortion in which trichomonads were the only apparent etiological agent found. Later Cameron, Fincher and Gilman (New York) reported the presence of trichomonads in two dairy herds. They believe that the bull is an important factor in the spread of the disease. They also described methods which they found successful in freeing the uterus and the vagina from these protozoa.

Dikmans (Washington, D. C.) has brought out some new facts concerning the small stomach worm of cattle, Ostertagia ostertagi. It has been generally reported that these nematodes are found in nodules in the wall of the fourth stomach. Postmortem examinations on a large number of cattle in Louisiana showed no nodule formation, the

worms being found in a layer of mucus close to the lining of the pyloric end of the fourth stomach.

Hadwen (Canada) has recorded an observation on the treatment of cattle infested with warbles, to the effect that saturated sodium chlorid solution brushed on the clipped backs of cattle kills the young grubs. Other workers have reported unfavorably on this procedure.

**Parasites of Sheep**

Stoll and Stumberg (New Jersey) are carrying on studies relating to nematode infections, using *Haemonchus contortus*, the common sheep stomach worm. These experiments are designed to throw additional light on the mechanism of nematode infections.

Jay (California) has reported in considerable detail the procedure used and the results obtained in the California campaign against the liver fluke, *Fasciola hepatica*. Flukes have been controlled successfully in California sheep by means of sound practical measures participated in by stock-owners and their organizations, federal officers and state officials. California has led the way in showing other states what may be done in fluke control.

Shaw (Oregon)* appears to be the first to have studied liver function in sheep infested with liver flukes. This test consists of injecting the dye, rose bengal, intravenously and then estimating its rate of elimination by the liver from the blood-stream. He found that the function of fluke-invaded livers was but slightly altered as regards their ability to excrete the dye. He also determined that carbon tetrachlorid in doses greater than necessary to kill immature and mature flukes did not produce sufficient damage to the liver to be detected by this test.

Krull (Washington, D. C.) has found a new snail host capable of harboring the sheep liver fluke during its development. He has also reported finding sheep liver fluke adults in cotton-tail rabbits.

Mitchell and Cobbett† have studied the life cycle of the head grub, *Oestrus ovis*, in the sheep of Texas and New Mexico. They state that the grubs developed to maturity in the heads of spring lambs in from 2½ to 3 months. At room temperatures the larvae pupated in from 12 to 72 hours, emerging from the pupal cases 17 to 37 days later. The adult flies lived from 4 to 32 days in captivity. The entire life cycle was from 3½ to 4½ months. Approximately 90 per cent of the sheep were infested, there being from one to 40 larvae in each head. The frontal sinuses were commonly infested, and the maxillary sinuses were rarely infested. No evidence was found to show that the infestations were a lethal factor as a cause of death in large numbers. However, infestation was a factor in causing excessive nasal discharge with accompanying detrimental effects. These investigators believe that death or destruction of grubs in the frontal sinuses is dangerous, hence preventive measures offer a better means of control than surgical or medical treatment. They further found that commercial pine tar applied to the sheep's noses at intervals of twice a week has very little repellent effect on the adult flies. A new type of salt-trough repellent applicator was tried that showed some promise of usefulness.

Baker (New York) reports the finding of *Trichostrongylus axei*, the small stomach worm, in horses as well as in the abomasum of sheep and cattle in the state of New York. This tiny nematode was distinctly pathogenic for the animal infected. Tetrachorethylene in 5-cc dosage for lambs appeared to be effective.

Augustine (Massachusetts) has made use of the quick-freezing methods now available in industry to kill trichinae in fresh pork. Infected pork loin roasts were exposed to -34.6° C. (-3° F.), which was obtained after six hours of freezing. All larvae appeared to be destroyed and no infection resulted from feeding the meat to susceptible animals.

Bachman, Rodriguez and Molina (Puerto Rico) attempted to immunize swine against trichina infection by means of intramuscular injections of trichina extract, but thus far without success.

Schwartz and Alicata (Washington, D. C.) have investigated the etiology of the mottled appearance of swine livers so commonly associated with ascarid infestations. These areas of interlobular connective tissue-increase and cyst-like swellings were in many instances found to contain larval Ascaris suum, in various stages of disintegration.

Nighbert and Connelly have obtained notable success in applying a modified McLean County system of swine sanitation in the southern United States. This method has done much toward the control of ascarids, kidney worms, nodule worms, thorn-headed worms, lung worms and whip worms. They recommend that sows farrow on pastures rather than in permanent farrowing-houses. In sections where the soil is sandy and well drained, sows need not be washed. Only 5.5 per cent of 5,006 pigs were lost from disease as opposed to 18 per cent where the system was not used; and more rapid daily gains were made by the pigs.

Alicata (Washington, D. C.) has reported the presence of the swine kidney worm, Stephanurus dentatus, not only in the South but also in swine raised in California, Illinois, Missouri and New Jersey. Spindler (Georgia) has found that kidney worm larvae in soil and feces cultures can penetrate the intact skin of swine.

Spindler also has studied swine nodule worms. He found the larvae living in moist soil in pastures and in houses and under shelters as well as in masses of feces. Burning over fields did not destroy all larvae. Growing a crop will apparently free an area of soil from larvae. The proper feeding of growing pigs aids considerably in controlling nodule worms by decreasing the tendency of "rooting."

Lucker (Washington, D. C.) has found, on the basis of infection experiments and morphology, that the gullet worms of ruminants and swine are identical, and that the name Gongylonema pulchrum should be applied to these parasites. This completes and confirms work reported by others.

Biester and Murray (Iowa)* upon continuing their observations of swine enteritis, have demonstrated that colloidal iodin in large repeated administrations did not influence the course of controlled coccidial infections.

Doyle (Indiana)† has described a rickettsia-like or anaplasmosis-like disease of swine, and Kinsley (Missouri) has published a clinical report on a swine disease in which "amoebae" appeared in large numbers in mucosal scrapings of the intestine.

Encouraging results have been obtained by Johnson (Oregon), who immunized chickens against coccidiosis by feeding sporulated oöcysts in wet mash.

Delaplane and Stuart (Rhode Island) studied the possibilities of house flies as transmitters of coccidiosis. They concluded that the coccidial oocysts were destroyed or eliminated in the process of the development of fly larvae to the adult stage and thus the common house fly is only a potential mechanical carrier of coccidia.

Patterson, working in New York, found that direct sunlight, drying, putrefaction and decomposition appreciably lowered the viability of the cecal coccidium, *Eimeria tenella*. On the other hand, moisture, shade and cold favored their viability. Patterson was unable to infect turkeys, ducks, pheasants and quail with *E. tenella*. He was also unable to infect quail with *E. acervulina*, *E. maxima* and *E. mitis* of chicken origin. Likewise *E. phasiani* and *E. dispersa*, coccidia of pheasants and quail, were not infective for chickens.

Warner (Connecticut) has shown that coccidia in material from poultry ranges and houses remain infective for at least 49 days, and that heavily seeded soil from poultry plots contain infective oocysts for at least 197 days. He also concluded that coccidiosis is not transmitted through the egg during incubation.

Andrews (Maryland) reports that “toxite,” a commercial preparation of unknown composition, when sprayed on poultry litter once per week, controlled coccidiosis of fowls under conditions of poor sanitation. He recommends this procedure, supplemented by cleaning of the house and removal of litter at least every three weeks.

Beach and Ackert (Kansas) have indicated that yeast in the ration does not alter the degree of infestation of chicken ascarids. Ackert, Porter and Beach have observed that as young chickens advance in age (up to 100 days) their resistance to the growth of the common round worm, *Ascaridia lineata*, is increased. Porter and Ackert noted lowered resistance to ascarids in chickens subjected to repeated blood loss.

Alicata and Jones (Washington, D. C.) have discovered that a dung beetle acts as intermediate host for the chicken tapeworm, *Hymenolepis cantaniona*; one beetle was found to contain 2,217 larvae. Cuvillier and Jones have found two new beetle hosts for *Hymenolepis carioca*, a tapeworm of chickens.

Cuvillier and Jones have also made a study of the intensity of intestinal worm infestation of chickens under varying conditions of confinement. They found that infestation in free-ranging or partially confined birds is much higher than in birds that had been confined to unscreened cement runs, and later as adults to the second floor of an unscreened wooden house. In the latter group 75 per cent remained entirely free from worm parasites; while in the former group only 2 to 5 per cent were free.

Poultry vermifuges have received considerable attention during the past year or so. Hawn (North Dakota) states that doses of 0.25 to 5 grains of kamala were neither safe as a tmicide for turkeys weighing from 2½ to 28 ounces, nor efficient for turkeys weighing from 2½ to 80 ounces.

Bleecker and Smith (Arkansas)* noted considerable difference in the efficiency of commercial worm remedies for poultry. They recommend Black Leaf 40 and Lloyd's alkaloidal reagent in combination with kamala as being superior to the other vermifuges studied. For all but cecal worms, this treatment was administered with a reported 100 per cent efficiency and at a lower cost than “iodine vermicide,” which showed an efficiency of 75 per cent in their experiments.

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Thomas (Florida)* states that hens given one worm treatment and placed back on the same ground are handicapped, as they suffer a decreased egg production due to the treatment. He recommends sanitation as the best means of control. When infestation does occur he advises that the flock be culled vigorously and that worm treatment be omitted until some efficient flock treatment becomes available.

Schlotthauer and Essex (Minnesota)† studied histomoniasis of turkeys, using a healthy and diseased flock. There was no evidence of transmission of the blackhead parasite in the turkey egg. However, eggs from infected turkey hens showed almost three times the amount of infertility and over twice the number of dead embryos that eggs from healthy turkeys showed. They also tried cecal occlusion as a means of preventing the disease; although the results were favorable, the practical value of this surgical treatment still remains to be demonstrated.

Delaplane and Stuart (Rhode Island)‡ used cecal ablation as a preventive measure against histomoniasis of turkeys. Their mortality was about 14 per cent, which is lower than that previously reported elsewhere.

Tyzzer (Massachusetts) has developed a strain of *Histomonas melleagris*, originally pathogenic for chickens and turkeys but which lost its virulence under long cultivation. Infection with this strain of the parasite furnished a high degree of protection against virulent infection.

Cuvillier (Washington, D. C.) has produced artificial infection of an English sparrow with *Syngamus trachea*, the gape worm of chickens.

Newsom and Stout (Colorado) report a new fluke disease of the proventriculus of chickens, the parasite being *Psilostomum ondatrae*.

Beaudette, Black and Hudson report the occurrence of the proventriculus nematode, *Tetrameres americana*, in New Jersey chickens. In 1930, 0.9 per cent of the 4,429 birds examined were infected, and in 1931, of 3,915 birds examined, the occurrence was 1.17 per cent.

Wilson (Louisiana) made the interesting observation that *Menopon stramineum*, the body louse of chickens, can pierce the bases of the quills of young feathers and thus ingest blood.

Skidmore (Nebraska) has described the blood cell infection of turkeys caused by the protozoan, *Leucocytozoon smithi*, and its transmission by the black fly, *Simulium occidentale*. Martin, and also O'Roke, have described the occurrence of a similar fatal disease of ducks in Michigan caused by *Leucocytozoon anatis*, transmitted by *Simulium vetustum*. O'Roke suggests methods for raising ducks so as to reduce exposure to attacks of the black fly vectors of the disease.

**MISCELLANEOUS**

Wright, Bozicevich, Underwood and Schaffer (Washington, D. C.) have published additional results of critical tests with normal butylidene chlorid as an anthelmintic. Toxicity tests, carried out on two horses, indicated that this chemical has a safety factor for the horse of at least 14 times the therapeutic dose rate of 0.2 cc per kilogram of body weight. It appeared that n-butylidene chlorid might prove

‡Delaplane, J. B., and Stuart, H. O.: Cecal ablation of turkeys by the use of clamps in preventing enterohepatitis (blackhead) infection. *Jour. A. V. M. A.*, lxxxiii (1933), n. s. 36 (2), pp. 238-246.
an efficient treatment for the removal of gastro-intestinal parasites of cattle if a satisfactory method of administration could be found. This drug, when administered to adult chickens in doses of 1 cc to 6 cc, gave an efficacy of 98.4 per cent for the removal of the common round worm, *Ascaridia lineata*, and 4.7 per cent efficiency against the cecal worm, *Heterakis gallinæae*.

Chandler (Michigan)* reports success in rapidly killing coccidial oocysts in *vitro* by the use of freshly acidulated hypochlorite solutions. He concluded that this method would probably be effective in poultry-houses, cow-barns, etc., if freshly acidulated hypochlorite solution containing 0.2 per cent or more of available chlorin was vigorously applied, with a broom, at a rate of about three gallons per 100 square feet.

Bishop, of the Bureau of Entomology, has reported vicious attacks on live stock in Florida by the mosquito, *Psorophora columbiae*. These insects attacked in swarms, causing death, from blood loss and toxemia, of 80 cattle, 76 swine, 3 horses, 1 mule, 20 chickens and 2 dogs. The milk supply from one district in Florida was reduced about 1,000 gallons per day for four days. Men were reported sick for several days as the result of attacks.

In view of the considerable number of papers being published on the treatment of animals for various parasitisms, it might be well to recall the admonition of Dr. M. C. Hall, who stated in 1929:

"We must realize that either in the clinical observations of the veterinarian or the field of veterinary research, a failure to keep checks usually invalidates the work as far as any definite conclusions applicable elsewhere are concerned. If all the animals of a herd are treated in one way, little can be concluded if good results do follow. There is always the possibility, and often the likelihood, that if half the animals were left untreated the same results would have been obtained in both groups."

Those who report unchecked experiments should be reminded of the frankness of Ambroise Paré, surgeon of the 16th century, who, regarding his work on one of his patients, said: "I dressed his wounds and God healed him."

This year the American Veterinary Medical Association honored two pioneers of parasitic research in this country by presenting medals to Dr. Cooper Curtice and Dr. Fred L. Kilborne. These are well-deserved honors and will doubtless be approved by every member of the U.S. Live Stock Sanitary Association.

Staff members of the Laboratory of Animal Pathology and Hygiene of the University of Illinois have published a highly useful clinical bulletin on "Microscopic Diagnosis of Parasitisms in Domestic Animals," with 167 illustrations.

The chairman of this Committee has received a copy of the report of the Committee on Parasitic Diseases of the Intermountain Live Stock Sanitary Association, by Drs. L. E. Swanson, Chairman, W. B. Earl and W. T. Huffman. This report is in the nature of a survey of parasitism in the eleven western states composing the Association. The Committee deserves commendation for its work.

Through the generosity of Dr. Maurice C. Hall, chief of the Zoological Division, Bureau of Animal Industry, Washington, D.C., this Association has been offered the use of a list of parasites of domestic animals in the United States. The Zoological Division has accumulated

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these data in the form of a card index over a period of many years. Dr. Hall is willing to have a list typed from the cards and arranged by states, provided the U. S. Live Stock Sanitary Association will finance the printing of it. With such a list as a guide, the work of making a parasite survey, as planned by this Committee, would be much easier. A person conducting a survey in a given state would know what parasites had previously been reported and could thus confirm and add to the data from year to year.

In closing this portion of the report, the chairman asks anyone interested to request specific references on the items mentioned in the résumé. The chairman also wishes to thank the members of this Committee for their suggestions and assistance.

**Recommendations**

This Committee recommends that its work be continued on the same basis as approved at the 1932 meeting.

We urge the appointment to this Committee of persons who are definitely interested in parasites from a control, research or teaching standpoint.

As an appendix to this report, we recommend that this Association print the list of parasites of domestic animals of the United States as furnished by the Zoological Division of the Bureau of Animal Industry, Washington, D. C.

We particularly ask that the committee for 1934 be appointed within a month after the close of the present meeting, so that the proposed parasite survey of the United States may begin without further delay.

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**DR. BENBROOK:** Mr. Chairman, I move that the report be accepted and referred to the Executive Committee.

. . . The motion was regularly seconded. . . .

**DR. A. W. MILLER:** Mr. Chairman, I should like to make an inquiry as to what will be the status of this recommendation in regard to printing the information that Dr. Hall will furnish. Is there anyone who will be able to pass on that? I think we should know what it will cost to print that before we take any action on it.

**PRESIDENT FAULDER:** I would suggest that Dr. Benbrook give us a little idea as to about how many pages it would cover.

**DR. BENBROOK:** This offer was made to the Association within the past month by Dr. Hall. For many years, Dr. Hall's staff has been collecting a list of what they believe to be the parasites of the United States. This list is in the form of a rather voluminous card index, containing records of parasites of all sorts of animals. Dr. Hall has offered to make up a list of those parasites that have been found in our food-producing animals, and send that to the Committee.

I presume the thing to do would be to ask Dr. Hall to submit that list and, if the Executive Committee feels that it can publish it, to do so. Neither Dr. Hall nor myself at this time knows how many pages it would run. It would be published in the proceedings of this Association as an appendix to the report of the Committee on Parasitic Diseases.

**DR. MILLER:** Before we go any further, I am rather interested in finding out what it will cost. I have belonged to this Association for a great many years. I can remember when we were in the hole, and had to adopt some rather devious methods of financing it. Now we are in excellent financial condition, and I want nothing done that will
I am, of course, familiar with Dr. Hall's division. I know that he is short of funds.

I think there should be some check put on this. If it is left to the Executive Committee to decide, that would seem to be all right. This reference, though, I do not understand has anything of that kind attached to it.

DR. BENBROOK: I recommended that this report be referred to the Executive Committee. That is perfectly plain, isn't it?

DR. MILLER: I am not sure that it is.

DR. BENBROOK: There is no intent whatever of forcing this on the Association. The members of this Committee feel that it would be a remarkably good piece of work by this Association; it would be very helpful in making a parasite survey of the United States. If this Association wishes that done, well and good; if not, then they should take such action as will stop that, and the Committee can use its energies in other directions, possibly.

PRESIDENT FAULDEN: Dr. Miller, would it be satisfactory to you if Dr. Hall makes up this list of parasites? You will then have an idea of how many pages it will cover. Then let Dr. Dyson decide whether or not this Association can stand the added expense of printing it. Would that be satisfactory to the members?

DR. MILLER: If it could be left to Dr. Dyson, it would certainly be agreeable to me, because I don't know a tighter man on earth.

(Laughter)

PRESIDENT FAULDEN: Dr. Benbrook, would that be satisfactory to you?

DR. BENBROOK: Whatever the Association or its Executive Committee decides to do will have to be all right.

PRESIDENT FAULDEN: Is there any further discussion? Are you ready for the question? Those in favor of accepting this report will signify by saying "Aye"; opposed, "No." The report is accepted.

The next report is that of the Special Committee on Legislation. Dr. William Moore, chairman of the Committee, is not here. I am going to ask Dr. C. E. Cotton to make a statement in regard to this report.

REPORT OF SPECIAL COMMITTEE ON LEGISLATION

DR. COTTON: Dr. Moore was unable to attend this meeting, and a report was not prepared. However, the correspondence relative to Dr. Moore's work (he was the only man of the Committee who did any actual work during the year) was presented to the Executive Committee.

It was decided to ask the incoming President to appoint a Committee, in the hope that when the proper time came they could undertake to get the necessary Congressional legislation.

I might state that Dr. Moore made one trip to Washington with the idea of undertaking to get this legislation initiated, but you can all realize that the last Congress was very much interested in efforts that were being made to take care of the present depressed condition. He was advised that it would be very foolish to undertake to do anything under those conditions.

In the meantime, the Supreme Court decision in the celebrated New York case was rendered, and under that circumstance some of the members of the Committee were of the opinion that it was not necessary to undertake to obtain legislation.

However, since that time the majority of the members of the Committee are of the opinion that we do need legislation. That was quite thoroughly discussed in the Executive Committee and, as I stated
before, resulted in the Executive Committee recommending to the incoming President that another Committee be appointed to attempt to get this legislation, and the necessary funds were appropriated to take care of it.

LETTER FROM DR. KILBORN

Dr. H. Preston Hoskins: I was under the impression that you were going to follow the program as printed and that the report of the Committee on Tick Eradication would follow the report of the Committee on Parasitic Diseases.

I have a letter here that I thought would fit in very nicely between these two reports. It is a letter that I received this morning from Dr. Kilborne, who was mentioned in the report presented by Dr. Benbrook, on behalf of the Committee on Parasitic Diseases.

Most of you know, as the report stated, gold medals were awarded to Drs. Cooper Curtice and Fred L. Kilborne at the meeting of the A. V. M. A. in this city the past summer. Dr. Kilborne was not able to be here in person to accept his medal, so it was transmitted to him through Dean Hagan of the New York State Veterinary College at Cornell.

This letter which I received this morning is an acknowledgment of the receipt of the medal. I think it is very interesting.

"I can assure you that I appreciate the honor, although coming to me forty years after the work was done. I feel that I ought to be thankful that I am still living to be able to receive it in person. Too often honors come to men after they have passed on."

"It may be of interest to you to learn how Texas fever work was started. I well remember being in Dr. Salmon's office in the Bureau of Animal Industry in the spring of 1889, and Dr. Salmon saying to me, 'Kilborne, I wish you and Smith would conduct some experiments on Texas fever and see if you can discover the cause of the disease.'"

"I asked him what line of experiment he would suggest. His reply was, 'I don't know. I will leave that to you and Smith.' A few days later, after conferring with Dr. Smith, I called at Dr. Salmon's office and suggested to him that if we were to conduct experiments in Texas fever I ought to go to North Carolina and get some material, meaning cattle and ticks. He said, 'That will be fine. Go ahead. Get anything you think you will need.'"

"The result of our experiment is history. See Texas Fever Bulletin No. 1, Bureau of Animal Industry, published in 1893."

"Much of the credit for our investigation of Texas fever as well as other diseases investigated by the Bureau of Animal Industry by Drs. Smith, Curtice and myself should also be extended to members of the Cornell University faculty, especially Dr. James Law, Dr. B. G. Wilder, Professor S. F. Gage, Professor J. H. Comstock and J. C. Caldwell who fitted us for our scientific investigation.

"I wish to extend to you, and through you to the American Veterinary Medical Association, my thanks for the handsome medal and more especially for the sentiment accompanying it."

PRESIDENT FAULDER: Thank you, Dr. Hoskins for bringing that letter to our attention. It will find a place in the annual report.

The next report is that of the Committee on Legislation, by Dr. D. E. Westmorland. State Veterinarian, Frankfort, Ky.

. . . Dr. Westmorland read the report. . . .
REPORT OF COMMITTEE ON LEGISLATION

Dr. D. E. Westmorland, Chairman, Frankfort, Ky.

Dr. Joseph J. King, Sacramento, Mr. E. M. Harmon, Des Moines, Calif.
Mr. H. R. Smith, Chicago, Ill. Mr. A. J. Glover, Fort Atkinson, Iowa.
Mr. C. L. Johnson, Hartford, Conn. Wis.
Dr. C. G. Lamb, Denver, Colo.

The report of the activities of your Legislative Committee for the past year will be brief, as conditions throughout the country have been such that most of the time and efforts of legislative bodies have been devoted to relief measures and legislation other than that affecting live stock disease control.

However, our services have at all times been available to assist the Special Legislative Committee in its efforts to obtain relief by resolution or amendment of federal laws to permit states to promulgate and enforce quarantines.

We will suggest that it is the opinion of your Committee:

1. That the necessary legislation should be promoted in states where area tuberculosis work is near completion to provide for compulsory tuberculin-testing. This will materially assist in completing these programs.

2. Regulations should be adopted by the various tuberculosis-free modified accredited states for the movement of cattle from one area to another where the same status is maintained.

3. When a definite policy is adopted by this Association for the control and eradication of Bang's disease, the regulations in the various states should be uniform. Some definite policy should be adopted by the federal government regulating the interstate movement of animals infected with Bang's disease.

4. Efforts should be made to bring about more uniform regulations for interstate movement of live stock. We realize that conditions vary in the different states and localities which require special regulations for the orderly movement of live stock. However, these slight variations would not materially interfere with uniform regulations.

DR. WESTMORLAND: I move that the report be accepted.

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

ELECTION OF OFFICERS

President Faulder: The next order of business is the election of officers, a President and three Vice-Presidents. Following the procedure of the past few years, I have, at the direction of the Executive Committee, named a Nominating Committee of three. I will call upon the Chairman of that Committee for a report.

Dr. H. D. Port: Your Nominating Committee wishes to place in nomination the following:

President: Dr. Thomas E. Robinson, Rhode Island.
First Vice-President: Dr. C. C. Hisel, Oklahoma.
Second Vice-President: Dr. E. A. Watson, Quebec, Canada.
Third Vice-President: Dr. W. A. Sullivan, Wyoming.

Dr. E. A. Crosseman: I move that the nominations be closed, that the By-laws be suspended and the Secretary be authorized to cast one ballot for the officers named.

The motion was regularly seconded and carried.
At this time I am going to request Dr. Harrie W. Peirce and Dr. E. A. Crossman to escort the next President, Dr. T. E. Robinson, to the platform.

Mr. President and Members of the Association: Believe it or not, I experienced an awful shock when I heard the report of your Nominating Committee, and I have been wondering if they and you fully realize what you have just done. You have elected a small man from the smallest state in the Union to preside over and guide the destinies of this nationwide Association for the ensuing year.

Mr. President and gentlemen, I consider this a very great honor, not only to myself but to the little state of Rhode Island which I represent, and I promise you here and now that I will exert my utmost endeavors to promote the welfare and further the interests of the United States Live Stock Sanitary Association during my tenure of office. (Applause.)

Mr. President and Friends: I appreciate the honor of having recognition from this body. I consider that I am quite young in this organization to receive recognition to the extent of being elected one of its officers. I promise you to give the best that I have. (Applause.)

In turning the gavel over to the new President, I would be unappreciative if I did not extend my most hearty thanks to you my fellow members for the support given to me during the past year.

I especially want to thank those who have delivered addresses and prepared papers, the chairmen and members of the various committees, and our genial and hard-working Secretary, Dr. Dyson.

Dr. Robinson, I have the utmost confidence that the future of this Association will be in strong hands during your tenure of office, and I have reason to believe that in the coming year this Association, under your guidance, will extend the vast knowledge regarding medicine and control of the various animal diseases to a further degree than ever before.

The Association is to be congratulated for its wise selection, and I congratulate you, Dr. Robinson, on the attainment of that great honor. Gentlemen of the convention, your new President, Dr. Robinson.

(The meeting adjourned at 2:40 p.m.)