PROCEEDINGS
Fortieth Annual Meeting
of the
United States Live Stock Sanitary Association

HOTEL LA SALLE, CHICAGO, ILL.
December 2-4, 1936
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December 2-4, 1936
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SANITARY ASSOCIATION
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WEDNESDAY MORNING, DECEMBER 2, 1936

The opening session of the fortieth annual meeting of the United States Live Stock Sanitary Association, held at the Hotel La Salle, Chicago, Ill., December 2-4, 1936, convened at 11:00 a.m., Dr. Walter Wisnicky, Madison, Wis., president of the Association, presiding.

President Wisnicky: The fortieth annual meeting of the United States Live Stock Sanitary Association will please come to order.

In order to proceed on a more practical basis the Chair will entertain a motion to proceed in accordance with our program instead of in accordance with the procedure outlined by our Constitution and By-laws.

Dr. L. Van Es: I move that the regular order of business be suspended and that we proceed according to the program.

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

President Wisnicky: I think it is fitting that we are opening our discussions today with the subject that you see on your program. It involves one of our most prominent members and it gives me great pleasure indeed, this morning, to introduce and present to you Dr. Irving S. Cutter, Dean, Northwestern University School of Medicine. (Applause.)

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

THEOBA LD SMITH AND HIS CONTRIBUTIONS TO SCIENCE

By IRVING S. CUTTER, Evanston, Ill.

Dean of the School of Medicine, Northwestern University

The lifetime of Theobald Smith encompassed the most interesting biological era in history. The invention of the microscope and the discovery of the "wee beasties" by Antonj Leeuwenhoek was a long step forward. But an impenetrable jungle faced the seventeenth century investigators who were equipped but feebly for its exploration. The period of the '70's and '80's of the last century, however, may be compared to a pleasant, open meadow
deep with bluestem ready for reaping. That is, it appears alluring in retrospect—it was probably far from such in prospect.

Theobald Smith was born in Albany, New York, July 31, 1859, and died December 10, 1934. His father and mother were teachers. At the age of eighteen he won by competitive examination a scholarship in Cornell University. There he came under the influence of Simon Henry Gage and a friendship was formed which endured throughout his life. He received his medical degree from the Albany Medical College, in 1883, and then returned to Cornell for advanced work in biology. It was there that D. E. Salmon found him when he applied to his old Cornell friends for someone to aid him in the study of the widespread epizootics which were threatening to curtail seriously the food supply of the nation. It is significant that Smith turned aside from mathematics, a subject in which he distinctly excelled, because of human needs.

He had been unable to join the stream of alert, American students who flocked to the German universities in the early '80's—there to drink deep from the fountains of new truths pouring from the laboratories of Robert Koch and Rudolf Virchow, in Berlin; Julius Cohnheim, in Leipzig; Edwin Klebs, in Zurich; Friedrich Loeffler, in Greifswald, and many others. But he was a discerning and understanding reader with an insatiable curiosity about living things. He entered the field when, as he put it, the germ theory of disease was but a "newspaper byword." The romantic and adventurous appealed to him—not as a seeker after emotional thrills, but as one who delved for the truth. For the most part self-trained, he early assumed a commanding position as one of the world's most distinguished biologists.

Would that I could point to the source of his inspiration at the Albany Medical College. Or perhaps, it was Gage at Cornell. At any rate he early gave evidence of such skill that he was appointed by Salmon to the Bureau of Animal Industry which had been established the previous year (1883).

His close association with Salmon was to continue for eleven years. Each had been graduated from Cornell—Salmon in veterinary science, in 1872, and Smith in liberal arts, nine years later. But Salmon had had the advantage of additional training in Paris and a fairly extensive experience in the practice of veterinary medicine in the United States. It was a happy choice when he was made chief of the Bureau of Animal Industry. It
may be remarked in passing that the spoils system, a heritage from Andrew Jackson, the hero of New Orleans, deprived the Bureau of his leadership in 1905—a black mark, illustrating the misuse of executive power. This great and good man ended his days in charge of an anti-hog cholera serum plant at Butte, Montana. He is recalled by all students of bacteriology whenever Salmonella is referred to.

It is characteristic of Theobald Smith that he began to publish the results of his investigations shortly after assuming the post at the Bureau. Within the first two years, papers appeared on culture media, on the staining of tubercle bacilli, on Koch's methods of growing bacteria, on the bacteriology of Potomac River water, and on rabbit septicemia. Salmon knew his man and with every assurance of success he assigned to his youthful director of the pathological laboratory such far-reaching problems as swine plague, Texas fever in cattle, pneumonia in cattle, abortion in mares, and a new question that was coming to the fore rapidly—is milk from tuberculous cows dangerous to health?

Bureau reports are rich in material dealing with research which was begun promptly. But Texas fever was apparently giving the country more concern than any other disease and it was soon to receive the major attention of Smith and his co-worker, F. L. Kilborne. The former approached the task with his usual caution and conservatism; both pursued it relentlessly. What a glow of satisfaction must have come to these two young scientists when the last word of their epoch-making report was written.

The story of Red Water fever reads like a romance. It was particularly well known to the cattle barons of Texas and every now and then the suggestion had been made that the disease originated with the ticks that afflicted southern herds frequently. Many an old drover would tell of observations such as: "The disease is spread only during the warm seasons" or "Northern cattle are not affected unless they graze over ground which has been traveled previously by animals from Texas."

In a preliminary report, "Observations on the Microorganism of Texas Fever," read at the Brooklyn meeting of the American Public Health Association in October, 1889, and published in the December number of the Philadelphia Medical News, Smith laid claim to no contribution to the pathology of the condition when he said:

I am fully aware that these facts . . . have been before the public since 1868.
But he proceeded to describe the intracellular bodies which he had found in fresh spleen pulp of sick animals and stated that they stained as readily as nuclei. He mentioned also a pear-shaped form and indicated that in his opinion they were parasites and that they occurred in some specimens as frequently as one in every five red blood cells. He observed that R. C. Stiles, of the New York State Board of Health, had probably seen these same bodies in 1867. A most salient feature of his paper is the concluding sentence:

Our investigation must be regarded as just begun.

Smith accorded generous credit to Kilborne. It was the latter who had charge of the North Carolina cattle in the experimental pasture near Washington. As thoroughly as possible ticks were removed from certain animals which were segregated later. Uncleaned cattle died of Texas fever, whereas the combed animals remained well.

But the entire story was not told until the appearance of that classical monograph, Bulletin No. 1 of the United States Department of Agriculture, Bureau of Animal Industry, in 1893. Here was proof indeed—complete, positive, and incontrovertible—the first instance in which experimental data supplied the information that a protozoan disease could be disseminated by an anthropod.

We can scarcely estimate the effect of this pronouncement. It made Manson's work on filariasis understandable and lighted the pathway for scores of studies that were to solve the problems of the spread of malaria, yellow fever, Rocky Mountain tick fever, typhus, and many others. So complete was the work of Smith and Kilborne that they pointed out a probable life history of the parasite which was originally identified by Thomas Say, another physician. Say did much of his work at New Harmony, Indiana, where his American Entomology with its beautifully colored plates was published. A biographical sketch of him by Weiss and Ziegler is suggested as a charming bit of reading for leisure moments.

Maurice C. Hall, writing in the Journal of Parasitology, acquires himself with credit in describing Theobald Smith's rôle as a parasitologist but one fails to understand why he felt obliged to take up the cudgels for Smith's colleagues with such vigor. In his letter transmitting Smith and Kilborne's report to the then Secretary of Agriculture, J. M. Rusk, Salmon wrote:

It had long been believed by the cattle-raisers of the West that Texas fever was caused by the ticks which were carried and scat-
tered everywhere by the southern cattle; but scientists were incredulous because they could not understand how the bite of these insects could produce such an acute disease, with destruction of the blood corpuscles and lesions of internal organs. It was not until the protozoal microorganism was discovered in the blood corpuscles (by Theobald Smith), and its destructive effects were revealed, that the action of the ticks could be explained.

In turn, Smith’s letter which accompanied the report, notes that the investigation had been begun in 1888 by Kilborne. He gives credit also to E. C. Schroeder and S. D. Maynard. In his introduction he traces the history of the disease in the United States and cites the earlier papers of Stiles, John Gamgee, John S. Billings, and Cooper Curtice. In addition he mentions the reports of Salmon and H. J. Detmers, Frank S. Billings, Paul Paquin, R. R. Dinwiddie and others working in agricultural experiment stations. He calls attention to the importance of the so-called boundary line of the permanently infected district established by Salmon and appends to his historical review a bibliography of the authors cited. At no time did Smith assert that he had originated the segregated pasture experiments but ascribes this suggestion to Kilborne. Whether Kilborne inherited this plan from Curtice is beside the point. It would be the last and most unthinkable act of so generous a soul as Smith to take unto himself merit for the tiniest fraction of a constructive idea made by one of his coworkers. In his investigation of bovine tuberculosis he acknowledges his obligation to Cooper Curtice.

Discoveries do not spring full-fledged like Minerva from the head of Jove. A hint here or an intimation there is caught by an alert ear and conveyed to a mind ready to receive, weigh, and accept or reject it. The germ of electromagnetic induction was fertilized by a dozen fathers. Scarcely a single new truth has been born in any biological or physical science without long antecedent labor pains. It usually has to wait the one all-embracing mind for complete fruition.

Had Smith’s work ended with his monograph on Texas cattle tick fever, the world might have said that here was a flash of brilliance which was accidental, but the 150 papers—more rather than less—that appeared subsequently substantiated the early promise of our greatest research worker in natural science. Other discoveries of far-reaching portent followed, each requiring analytical reasoning of like power. To use Smith’s own words it was the “painstaking care and attention to minutiae” that ever typified his work.
Those of you who possess copies of that now all too rare Bulletin No. 1, Bureau of Animal Industry, should preserve it for all time, binding the precious tome in tree calf.

Additional observations of great importance appeared in rapid succession, the products of a questioning, wondering mind. Others had postulated the existence of vitamins but no one before Smith had pointed the way to deficiency studies. Working on swine erysipelas, he noted that when guinea pigs were fed on mixed cereals—bran and oats—without fresh grass, clover, or succulent vegetables such as cabbage, a peculiar disease characterized by extravasations of blood under the skin would appear—a clear example of experimental scurvy. Again, while studying swine fever, he described with Salmon a new method of attenuating bacteria by heating cultures in suspension to 58 or 60 degrees Centigrade for a period of two hours. He found that this material would protect pigeons against living cultures which were fatal to unvaccinated birds. This inoculation with dead bacilli was the plan used later to guard the human family against typhoid, cholera, and many other infections.

If one would allow his imagination to run even a line’s breadth to the outside of the pathway of fact, he could easily assume that the discoveries of Smith and Salmon may have led von Behring to the development of the diphtheria antitoxin. At any rate, they have been accorded priority by Metchnikoff and the late J. G. Adami, of the University of Liverpool. Smith found that protection could be secured by inoculating the products of the growth of specific organisms into non-immune animals. He (and probably Kilborne) had clearly in mind the thought that the symptoms of an infectious disease were due to the diffusible products of bacterial growth, and that immunity was the ability of the animal to neutralize these poisons.

It was while Smith was director of the pathological laboratories of the Massachusetts State Board of Health, in charge of the manufacture of diphtheria antitoxin, that many papers dealing with immunity appeared. Strangely enough, in von Behring’s institute in Marburg the methods of preparing antitoxin were guarded closely and much pioneer work had to be done by Smith. He discovered that a mixture of toxin and antitoxin would provide protection which would last for years. This fact was seized upon by William H. Park and his coworkers and led later to the widespread program of immunization against diphtheria.

While injecting guinea pigs with antitoxin he noted the reaction that was afterwards termed by Paul Ehrlich “the
Theobald Smith phenomenon." It is strange that he did not publish this observation but he described it to Ehrlich in 1904 and may have permitted him to watch what today we know as anaphylaxis. The "Theobald Smith phenomenon" was reported by one of Ehrlich's colleagues and published in Berlin in 1906 and was the first recognition of allergy, serum sickness, or hypersensitivity. Ehrlich himself related that Smith gave to the scientific world the first suggestion of antigens as applied to different organisms, pointing the way for a new type of research into their reactions. He showed how pathogenic bacteria had the power of varying their forms and structures; furthermore, how their virulence could be increased through the natural selection of new hosts.

It seems rather curious that this apparently untrained investigator—he had no Ph. D. from a German university—should have pointed the way to the differentiation between the typhoid bacillus and the colon bacillus by showing that the latter organisms fermented glucose with the production of gas, whereas the Bacillus typhosus did not. Many other experiments along similar lines aided in their distinction. Herein he changed the scientific attitude toward the study of bacteria. In a notable paper entitled, "Certain Aspects in the Life History of Pathogenic Microorganisms," he stated:

It is what bacteria do rather than what they are that commands our attention since our interest centers in the host rather than in the parasite.

He visualized the shallowness of the attack upon microbes when studied from the standpoint of their morphology and taxonomy.

His interest in tuberculosis dated from his medical student days at Albany. Robert Koch had described the causative bacillus while Smith was a junior and we may infer that even before graduation he was dabbling with stains in an effort to capture the acid-fast germ. Furthermore, there was widespread public curiosity about the disease, and galloping consumption, as it was called, was as dreaded as was smallpox in the eighteenth century. His first independent paper, published in 1884, was entitled, "The Diagnostic and Prognostic Value of the Bacillus of Tuberculosis in the Sputum of Pulmonary Diseases." Within a month or two, he went to press with a second paper on the laboratory technic necessary to demonstrate the presence of the organism. In 1893, however, his contributions to the study of tuberculosis really began with his mind's eye ever fixed upon sanitary applications. It was in this year that he called attention to the possible menace of consuming milk and meat from tuberculous
cattle and urged the rigid inspection of dairy herds. In the following year he was engaged with Kilborne and Schroeder in studying the tuberculin reaction in cattle, reiterating his warning that the medical profession should investigate without delay the possibility of milk-borne infections. In his discussion of tuberculosis and public health he says:

The use of milk from infected animals is a question difficult to deal with when we consider on the one hand the clamors of public health and on the other those of the dairyman who finds it temporarily impossible to maintain his business if a large number of animals are at once withdrawn from his herd.

It was in 1896 that, along with other lines of inquiry, opportunity presented itself for attacking intensively the characteristics of the tubercle bacillus. It is probably not too much to say that bacteriologists everywhere had assumed that all was known that would ever be learned about the microbe. Nevertheless, as Smith remarked, "It is incumbent upon us to keep training and pruning the tree of knowledge without looking to the right or left." The study of the etiological factor in tuberculosis became from that time almost an obsession, yet he never permitted his enthusiasm or interest to carry him into the realm of superlatives or speculative philosophy. The Journal of Experimental Medicine and the Journal of Medical Research are rich in his contributions to our knowledge of the behavior of this bacterium. He isolated strains from cattle, the cat, the horse and the pig showing differences that could not be gainsaid. In 1897, he demonstrated that rabbits were susceptible to the bovine but not to human strains. E. B. McKinley records that but a few weeks before his death he described to his coworkers in the laboratory at Princeton some new research on tuberculosis on which he was then engaged.

Despite the fact that Maurice C. Hall states that Smith was not an orthodox parasitologist, his achievements in that field cannot be regarded other than as of singular significance. Hall complains that to his mind (Smith's) parasitology was just a sub-division of pathology, although he admits that Smith had made a "brilliant success in the field of parasitology somewhat comparable to that of the unorthodox Pasteur, a chemist, who was brilliantly successful in the field of medicine."

It would take a sizable monograph to include even a brief résumé of his studies on animal parasites. Mention, however, can be made of a few. He recognized blackhead in turkeys as a protozoan disease and described the causative agent. Later his experiments with feeding worms containing the protozoan proved the vector rôle of certain helminths. In 1889, he described
coccidia in the renal epithelium of the mouse. In 1893, he found a sporozoan in the intestinal villi of cattle which now bears his name. In 1901, he traced the transmission of *Sarcocystis muris* from mouse to mouse for a period of years and for all practical purposes worked out the life history of this parasite. In 1910, he published a study on amebiasis in swine, finding them in ulcerative and necrotic areas of the mucosa but not on normal intestinal epithelium. Even botanists may claim him as a pioneer ecologist, for as early as 1890 he was dealing in the laboratory with such questions as the variation of species under artificial conditions as well as in nature.

In 1895, the seductive voices of President Eliot, of Harvard, and Henry P. Walcott, of the Massachusetts Board of Health, lured him from the Bureau of Animal Industry. He served as director of the pathological laboratory of the Massachusetts Board from 1895 to 1915, accepting also the appointment as Fabyan Professor of Comparative Pathology at Harvard. In 1901, he declined the directorship of the Rockefeller Institute for Medical Research, stating succinctly:

Research cannot be forced very much. There is always the danger of too much foliage and too little fruit.

He was continuously sympathetic with the aims of the Institute and served on the Board of Directors from its foundation.

At the age of 55, he tackled a new and intriguing development—the organization of a branch of the Rockefeller Institute, established at Princeton for the investigation of diseases of animals. There he served until 1929, retiring at 70 to become emeritus. The Theobald Smith house at Princeton we hope will stand forever—a monument not alone to his organizing ability but to the fundamental principle for which he stood, namely, a broader and more comprehensive attack upon disease. When it shall have crumbled into dust, a greater and a finer Institute still bearing his name will rise in its place.

We may with justice consider that the whirl of the wheel of Fortune cast Theobald Smith's lot in pleasant places. One may well wonder if the training and opportunities afforded by the Bureau of Animal Industry did not have a far greater influence in molding his destiny and directing his bent than any other post that was to come to him in later life. As a professor of bacteriology in a great university he would have grown with an expanding science but the applications of his knowledge under the conditions of the day probably would not have been so great. We may refer to those years in the Bureau as the most formative of his life. Each victory stimulated him to increased effort and achievement.
It should be pointed out that Smith was a good deal of a philosopher, or perhaps, to be more exact, we may term him a biological logician. Few scientists, buried deeply in their work, possess quite so much insight into the world of affairs. He seemed to sense trends long before they came to pass, or at least were obvious to most of us. He recognized in economic tendencies a leveling influence and expressed himself on numerous occasions as convinced that we were gradually approaching a time when those who had little would have more; those who had a great deal would have less. In his essay on parasitism he says:

Parasitism is not an unknown phenomenon in the social and political life of mankind, but here we observe the curious fact that the parasites belong to the same species as those who support them,

—a sentence that is pregnant with meaning.

One of the chief attributes of Theobald Smith was his rugged scientific honesty. I never met but one other man who could adhere so strictly to a line of thought. No thrill of emotion disturbed his calm, unbiased consideration of truth. He may have been mistaken at times, but he never postulated a conclusion unless the building blocks of his foundation were of solid granite. But lest we gain the idea that he was an utterly impersonal, unfeeling, cold scientist, it should be recalled that he was one of the friendliest and most human of individuals. He loved music and was a capable performer on the organ and the piano. He found in his home with his charming wife and three children an escape from the incessant labors of the laboratory.

There is another characteristic of the man—the brightest jewel in his crown—which should be emphasized to the full. He was always conscious of the fact that he was engaged in a field of endeavor that might produce something of value to his fellow man. It would have been utterly impossible for him to have served so valiantly without this objective. Nothing could have swerved him from this straight and narrow path—no dazzling emoluments, no galaxy of perquisites; he was at peace with his conscience.

Just a word about the personality of the man. I spent a week or more in his vicinity, sometimes in his company and that of his wife, on ship board. Later, considerably more time in the British Isles. He was always the personification of gentleness and modesty. Frail, a spare eater, he looked almost as though a March zephyr would whisk him into the Great Beyond. On a chill November day, we essayed the journey from London to
Edinburgh. There was no heat in the compartment and Mrs. Smith worried much about the possibility of pneumonia, which fortunately passed him by. On the boat coming over he wrote the address which he gave before the Royal Veterinary College of Edinburgh. He had gone over it many times and the manuscript, which he later showed to me, had very few erasures indeed. A few small volumes that I had with me, dealing mostly with the history of medicine in Great Britain and in continental Europe, he read between times with great interest, particularly Knud Faber's "Nosography."

If one may judge of a man's interest from the occasional remarks that are dropped during a few weeks of supposed relaxation, I would still contend that his first and last biological love was the study of tuberculosis—the vagaries of the organism, puzzling over the reason why it did not seem possible to build up an immunity in the human species.

Yes, he was an heroic figure—one whose fame and achievements will loom larger with the passing of time. Some have called him the American Pasteur or the American Koch. He was not the American any one—he was Smith, the American.

Dr. A. T. Kinsley: In order to show our appreciation of this wonderful paper, I move we extend a rising vote of thanks to Dr. Cutter.

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

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

President Wisnicky: By precedent it is decreed that the President give an annual address.

. . . President Wisnicky read his address. . . . (Applause.)

ADDRESS OF THE PRESIDENT

By WALTER WISNICKY, Madison, Wis.
Wisconsin Department of Agriculture and Markets

It is with pleasure that I address you at the opening session of the United States Live Stock Sanitary Association. When I say that I have looked forward with eagerness and pleasure to the annual meeting of this organization, I know that I only express the feeling of all who have congregated here from widely scattered parts of this and other countries. Many of you have traveled long distances at considerable sacrifice of time and expense, which in itself voices the importance with which you regard this organization. May I take this opportunity, in behalf of the officers of this organization, to extend a most cordial greeting to all of you from all parts of our land. With equal
cordiality do we greet our friends from foreign lands, for we, in America, feel honored by virtue of your presence.

It is our hope that the various discussions and deliberations during our conference will prove both interesting and helpful to you all. Through the efforts of Dr. L. Enos Day, our efficient secretary-treasurer, and the various committee chairmen, a splendid program has been prepared for you. The nature of the subjects to be presented vary widely. Those contributing to the program are recognized as possessing special qualifications in their chosen fields. They bring to you the advance thought, newly acquired experience, and research findings of the year. The personnel of this program includes outstanding medical doctors, successful live stock producers, able representatives of the federal Bureau of Animal Industry, distinguished research workers and scientists, prominent educators, capable representatives of the commercial interests, distinguished guardians of public health and human food, and outstanding men from the state live stock sanitary official group. You will hear the reports of the various committees through their able chairmen. These reports are the result of tedious work extending over many months by the various committee members. I feel confident that this array of specialized talent will command the sustained attention of every one of you. Arrange your schedule so that you will not miss a single number on the program.

YEAR OF RECONSTRUCTION

This year may be truly termed one of reconstruction. It is the first year since the so-called “economic crash” that agriculture generally and live stock producing interests specifically have experienced a feeling of hope which comes with symptoms presaging better economic returns. In saying this, I recognize that there are certain sections of our country which again have suffered from prolonged drought. On the whole, however, the turn for the better in the various agricultural pursuits justifies the hope for continued improvement and the establishment of a more permanent agricultural economic stability.

A brief survey in the field of animal-disease control shows not only an increased activity in the various phases of the work, but also a recognizable degree of accomplishment. Numerous experiments have been advanced on various animal disease problems bringing to light many new facts from the realm of the unknown. Federal and state cooperative programs against specific animal diseases have in the aggregate progressed at an unprecedented rate. No destructive epizootics have occurred in our
county during the last year. In the field of animal disease control, this year will go down as one of accomplishment and progress. In this achievement our organization has played an important part. The influence of this organization can be recognized as a guiding hand in the advancement along the path of progress in this great conflict with the various animal plagues.

In our work, as well as in all other fields of endeavor, the turmoil of progress brings to the surface many new problems. To some of these I desire to direct your attention.

**Stockman and Veterinarian**

The first condition to which I wish to call your attention is the relationship of the live stock producer to the system of veterinary science. The live stock grower of today is a different individual than he was a quarter of a century ago. Our general educational system and the particular emphasis being placed on agricultural education bring into the ranks of live stock growers a large group of well-informed and intelligent men. They are capable of reasoning for themselves and carefully analyzing the various procedures which have a bearing on their industry. These men want basic information on every problem that has direct or indirect relationship to their business.

The advancement does not cease with the individual. It is augmented by the ever-increasing effort to improve the industry by collective action. Live stock and other agricultural organizations are making their influence felt both politically and economically. These are realities which must be fully recognized by our system of veterinary science. In the light of this our system of veterinary medicine should be vitally concerned with rendering the live stock industry the most efficient, practical and scientific veterinary service. We should not overlook the importance of the esteem with which the live stock industry regards our profession.

**Stockmen Seek Information**

The live stock grower of today does not wish to be in the dark on animal-disease problems. There is evidence at every hand of the hunger for information on animal-disease problems; information not necessarily of the "be your own veterinarian" type, but for practical and basic knowledge on disease problems that would put the live stock owner into a position to deal more intelligently with various live stock diseases. Information that would enable him to appreciate the necessity for skilled and trained veterinary service when occasion demands it. Experience of the past amply demonstrates that live stock owners have
suffered serious losses because of lack of information which would have enabled them to realize that they could have benefited by calling in trained veterinary service early. Live stock owners likewise realize that they have lost enormously as a result of not taking advantage of the sanitary management practices which would have enabled them to prevent the occurrence of diseases in their herds and flocks. It is information on disease prevention, sanitary principles, and general disease information which will enable them to use the existing veterinary service in an intelligent and practical manner which live stock owners of today desire.

With existing manifestations for that type of veterinary knowledge, the opportunity is seized upon by various interests, not primarily with the intent of giving the live stock producer veterinary information which would serve his best purpose, but with a design to use his desire for veterinary knowledge to further their own cause.

**Nostrum Vendors**

Those selling various veterinary remedies, minerals, and live stock feeds directly to the live stock owner seize upon this hunger for veterinary knowledge by offering to the live stock industry their wares on the vehicle of veterinary information. This information, some of it good and some of it not so good, on the face of it appeals to the live stock producer. He soon realizes that this veterinary information furnished by the remedy men, mineral men, and feed men is merely an entering wedge for their sales plan. After the sale of their commodity, they lose their interest in the welfare of the live stock owner as far as the disease problem is concerned.

**Breeding Schools**

Other attempts to convey veterinary information to the live stock owner come through the so-called “breeding schools.” Courses of one or two weeks are offered to herdsmen and live stock owners under the pretense of equipping them to deal effectively with various reproductive problems of the different species of domestic live stock. It is obvious that a subject of such wide scope could not be mastered by even the brightest of human beings in such a short period of time. The best that could be hoped for would be to acquire vague information pertaining to the various problems relating to genital diseases. Those who enroll in these classes for the most part are younger men, who, in the enthusiasm of youth with a prompted confidence,
emerge from this weekly or bi-weekly breeding course with a determination to try their hand at problems of animal breeding so delicate and so difficult that none but adequately trained veterinarians with specialized knowledge and experience would undertake with some degree of confidence.

POULTRY TECHNICIANS

In the poultry-disease field we have another kind of rapid-fire educational system, combined with the sale of various poultry remedies, which pretends to train hatcherymen and poultrymen as "poultry technicians" in the brief course of one or two weeks. During this short period, candidates not even possessing a high school education are, according to the advertising of the graduates, thoroughly versed in the fields of pathology, bacteriology, microbiology, pharmacology, and other sciences. This short period of time is hardly sufficient to bring about a comprehensive understanding of the meaning of the names of the various sciences which they are pretended to be taught. These men go out just like members of the above-mentioned breeding school and pretend to render a form of veterinary service to the poultry industry. About the only accomplishment which they attain is to make an effort at the sale of the various remedies which the company holding these schools has to sell to the poultry owner. Here again the objective is to sell remedies and equipment. Both the short school period and the veterinary information which goes out in the way of printed material are merely an entry to pave the way for the sale of poultry remedies. Experience in the field where these remedies have been sold confirms what could be reasonably suspected; the remedies are sold to flock owners, irrespective of whether or not the nostrums apply to the existing disease. If nothing else is wrong with the flock, the remedy vendor with his short-school experience will always find some pinworms to which he will attach sufficient importance to consummate a sale.

LONG-DISTANCE TREATMENT

Some live stock and agricultural journals also take a hand at attempting to supply, in the form of supplements or through veterinary columns, information of a technical veterinary nature. This effort, likewise, falls short of meeting the needs for information on veterinary subjects for which the live stock producer is reaching out. Too many times information on diagnosis and treatment is being dispensed at long range with inadequate facts on which to base a diagnosis. Even with a definite diagnosis there is a hazard in prescribing various treatments at long
range. A simple illustration will point to the fallacy of trying to direct live stock owners in the compounding of drugs and treatment of live stock. May I refer to an incident which occurred not long ago in our state, where an attempt was made to give flock owners written directions to prepare and administer a remedy for internal parasites of sheep. The directions prescribed specifically and accurately for the preparation and administration of the remedy. One owner, having a flock of about 60 purebred sheep, in preparing this remedy at home and following printed directions, misunderstood the measurement terms. This resulted in no small calamity, because after treatment practically his entire flock of sheep died.

COUNTY AGENTS AND FARM ADVISORS

Finally, before leaving the point, to show how generally the demand for veterinary information exists among live stock owners, I want to mention the demands being made upon the county agricultural agents and farm advisors for that information. Again it is not necessarily veterinary information of the "be your own veterinarian" type but rather for basic and practical information which would enable the live stock producer to help himself by using sanitary and preventive methods; information that would enable him to employ technical veterinary help in an intelligent and productive way. Most of you are familiar with the prolonged controversy in some states between veterinarians and the county agricultural agent system. To me it seems that in attempting remedial measures, by hammering away at some of the methods of the county agent system, was not striking at the cause of the trouble. The problem arises with the live stock owner desiring and asking for information on animal-disease problems. It is with him that we should deal in such a manner that he will get the information on animal diseases which he could use with safety and benefit, and acquaint him with the value of employing trained veterinary service in the proper way.

This expression from live stock producers for veterinary information must and perhaps will be met through the established and legitimate now-existing veterinary agencies. Present methods and policies may need modification and revision to serve best in meeting the problem of giving to live stock producers, through legitimate channels, the information on sanitary science which they can use with safety and benefit. The same channels can be used in educating them to the viewpoint of hiring trained veterinary service when it is profitable to do so.
It is probably easier to recognize the existing needs than to formulate a proper plan to take care of them. It is evident that the patent-remedy interests, the mineral and feed salesmen, the two-week graduates of non-recognized breeding and poultry-disease schools, the farm-press veterinary column and the county agricultural agent system are not adapted to meeting the problem at hand. It will become the duty of the veterinary colleges, the federal and state animal-disease-control organizations, the veterinary press, and the members of this organization to offer the major solution to the problem.

Our organization, by virtue of the purpose for which it was organized, is obliged to play a leading rôle in improving the relationship between the live stock industry and the veterinary profession, and in bringing about conditions which will enable live stock producers to utilize veterinary service on a more profitable basis. The constitutional purpose of this organization provides for the study of live stock sanitary science and the dissemination of information relating thereto; and to serve as a live stock sanitary-science clearing-house between the live stock owner, the live stock sanitarian, the milk and meat hygienist, the veterinary practitioner, the transportation and stockyard companies, the milk- and meat-producing industries and various other agencies in our organization. We have membership representation from these various agencies in our organization. As I see it, this organization is logically the one to take the leadership in pointing the way to a solution of the veterinary problem.

There are many things this organization could do relative to this cause. It would be desirable to increase the membership of live stock producers in this organization. This might be accomplished through the medium of a periodical publication entirely devoted to the dissemination of information on live stock sanitary science. Such information could be prepared in a popular and interesting style. It would serve admirably in giving the live stock owner what he needs on preventive and sanitary medicine. Through such a publication it would be relatively easy to bring about in the minds of live stock owners a proper regard for trained veterinary service. The policy of such a publication would be entirely in the hands of this organization and its Executive Committee. A far-reaching undertaking of this nature should not be arrived at in haste. At least a year of study should be made before definite action is taken.
NEED UNIFORM REGULATIONS

In a brief way, I would like to touch on another problem which is of extraordinary importance to the livestock producing industry and on which this organization can take definite action. I refer to the unification of laws, regulations, policies and methods pertaining to milk and meat hygiene and animal health requirements on livestock moving interstate.

Each year for many years, a standing committee for the unification of laws and regulations has been working on this problem. I know that the membership of this committee throughout the many years has carried out its duties in a sincere way, and has made many sound recommendations which although accepted were not supported by actual practice. The time is at hand when livestock producers, and agencies serving the livestock industry, affected by the various laws, regulations and policies, are centering their attention on them. There is no question but what there is a dire need for a more uniform system of laws and regulations pertaining to dairy and other food products, and to livestock moving interstate. To be sure, some variations are inevitable, but those not serving any good purpose should be eliminated.

SOME REGULATIONS OBSOLETE

Prior to and during the early days of the tuberculin-testing program, various cities, villages and other units of government have passed laws, rules and regulations pertaining to requirements which had to be met. Since the passage of such legislation, marked progress has been made in freeing herds and areas from bovine tuberculosis. A high majority of our states are now in the tuberculosis-free modified accredited area column. The old regulations, needed when bovine tuberculosis was prevalent, are now rendered obsolete by virtue of the progress made in the control of this disease. However, as yet no change has been made in the laws and regulations. Areas which are entirely free, or practically so, are compelled to go through the procedure of testing large numbers of cattle just to satisfy a regulation where there is no need for it whatever, from the human health standpoint. Let me cite a specific case which will exemplify the point:

A cooperative dairy plant is located in our state in a county where the infection on the last complete area tuberculin retest was so low that the county qualified to remain in the tuberculosis-free modified accredited area column for a period of six years. This concern was supplying its dairy products to a city that
had a regulation requiring a test every three years. It became necessary for this coöperative dairy organization, which was drawing products from 1,200 herds, to apply a test on these herds, involving approximately 18,000 cattle, three years after the date of the complete area test in the county. It cost this coöperative organization approximately $2,000 to test these herds in order to comply with the requirements of the city to which its dairy products were going. The test did not reveal a single animal with glandular lesions of tuberculosis. This information, of course, was available to the herd-owners and to the managers of the coöperative organization. They naturally feel that this large expense was unnecessary and unjustified from the human health or any other standpoint.

As progress is made in the control of live stock diseases and in the sanitary production of dairy and other products, it is necessary from time to time to create new requirements in order to raise the standard of excellence of these food products. If an unreasonable attitude is shown in the form of maintaining out-dated unnecessary expensive regulations and requirements, the attitude of the live stock owners and the food processor will be neither friendly nor coöperative toward the needed new regulations.

**AN EXEMPLARY CASE**

Out-dated and unnecessary regulations are also in existence in the form of requirements on cattle moving interstate. Again may I refer to an example of a state regulation which requires that cattle originate in herds which have been completely tuberculin-tested within the last three years. This regulation does not recognize the six-year modified accredited area provision. When the three years have passed, in counties which are accredited for a six-year period, the cattle do not qualify for the state in question because they cannot meet the requirement of a complete negative herd test within three years. It so happens, in these counties that are on the six-year schedule, that either no infection existed on the last area retest or only a very few reactors were disclosed. Cattle from such areas would be much safer, from the standpoint of freedom from tuberculosis, than those from an area or county that is on the three-year area retest schedule, because in the latter a higher degree of infection exists. Such a regulation is actually discriminatory against cattle in the cleaner areas, and it is discriminating against cattle that have a better health standard. Live stock raisers and shippers cannot understand the logic of such a requirement. They get the idea that these regulations are unreasonable and nonsensical.
No one can blame them, because they are right in their judgment. They lose respect for all regulations. As a result it is difficult to get sincere and whole-hearted cooperation from live stock producers and shippers when an effort is made for the observance of absolutely necessary and reasonable regulations.

CONFIDENCE OF STOCKMEN NECESSARY

This problem must be faced in a serious way. If we are to serve the live stock interests best in the way of disease control and prevention, we must enlist their confidence and respect. This in a measure can be obtained by revising requirements intended for the protection of human health, and those governing the movement of cattle interstate, in a manner that will fit the actual needs from the standpoint of human and animal health.

SHORTAGE OF VETERINARIANS

There is another problem that I would like to mention briefly, and that is pertaining to the acute shortage of graduate veterinarians. The demand for veterinary graduates in the field of animal-disease control, milk and food inspection, investigational and other fields is greatly in excess of the supply. The ranks of the veterinary practitioners, through death, disability, or retirement due to age are decreasing rapidly. There are too few trained men to take their places. I think it is reasonable to assume that the veterinary service as developed up to this point will maintain at its present level or continue to expand. We will at least need the number of veterinarians which are in demand today, or a greater number in the future. The number of graduates from the different veterinary colleges is obviously not adequate to make the essential replacements and fill the new developing fields. Those states in which veterinary colleges are located are certainly doing more than their part in contributing to the cause. I have no recommendations to make in regard to the problem. I merely wish to bring to the attention of this organization that an acute shortage of veterinarians is being felt at the present time.

I would be remiss in my appreciation of good service if before closing I did not express sincere appreciation to our Secretary-Treasurer, to the various committee chairmen and their committee members, to all members of this Association who have so actively coöperated during the year in carrying out the work of this organization, and to the contributors to this program. It has been a pleasure for me to serve with you. Thank you kindly for the opportunity.
MEMORIAL SERVICE

PRESIDENT WISNICKY: Each year, as we come back to attend these meetings, we are impressed by the absence of certain familiar faces. Some of our members have departed to the Great Beyond. This organization, each year at the opening session, pays respect to the memory of our coworkers who have passed on. Today I wish to introduce Dr. J. Leonard Axby, of Indianapolis, who will conduct the memorial services for our departed members.

... Dr. Axby read the memorial service. ...

MEMORIAL

Mr. President and Members:
The following members have gone to their final reward during the past year:

Dr. Thomas Edward Munce, Harrisburg, Pennsylvania.
Born, April 26, 1877, Washington County, Pennsylvania.
Died, March 17, 1936, Harrisburg, Pennsylvania.
Age—59 years.

Dr. Charles Stange, Ames, Iowa.
Born, May 21, 1880, Cedar County, Iowa.
Died, April 26, 1936, Ames, Iowa.
Age—56 years.

Dr. Mark Francis, College Station, Texas.
Born, March 19, 1863, Shandon, Ohio.
Died, June 28, 1936, College Station, Texas.
Age—73 years.

Dr. John Henry McNeil, Trenton, New Jersey.
Born, ———, 1870, Bowen, Illinois.
Died, September 18, 1936, Trenton, New Jersey.
Age—66 years.

Continuing our established custom. I now ask all present to refrain from business deliberation and to arise and remain standing, for one minute, and each according to the dictates of his own conscience, bow his head, and offer a silent prayer in behalf of our departed brothers.

... Silent prayer. ...

It is with deep humility and a full recognition of limitations that I conduct this service; yet the sublimity of the occasion and an appreciation of the nearness of an ever-present, omnipotent power goads me to say something kindly about these men.

Having known them, talked with them, and received inspiration from the grandeur and beauty of their idealism, it appears they always sought to be at once generous and just and to consider humanity dearer than selfish profit.

The lives they lived constitute an eloquent oration, in humbleness, brotherly love and scientific advancement, attracting to our attention, there is nowhere in the land any home so remote, so humble, that it may not contain the power of mind and heart and conscience to which communities, states, and even nations yield and history submits its processes.

Their lives prove to us that none shall guess the secrets of Nature and Providence and a free opportunity. Whatever the vigor and vitality of the stock from which they sprang, its mere vigor and soundness does not explain where these men got their great hearts that seemed to comprehend all mankind in its varied and benignant sympathy, whose visions swept many a horizon which those about them dreamed
not of, whose minds comprehended what they had never seen, and understood the language of Nature. From them we learn more of the sacred mystery of life, that its richest fruits spring out of soils which no man has prepared and in circumstances amidst which they are least expected, thus making life not only a mystery but also something of reassurance. It is not what they might have accumulated that is significant, but what they were that arrests our thoughts and takes hold of our imagination and compels us to want to emulate them. The test of every American must always be what he is. That is the very essence of our lives and of our profession, and that is the moral we abstract from their lives. So perhaps they need no eulogy today or ever. We shall regard them as a gift to our nation; their lives as an altar upon which we may forever keep alive the vestal fire of professional ethics and generous manliness as upon a shrine at which some of the deepest and most sacred hopes of mankind may from age to age be rekindled. These hopes must constantly be rekindled, and only those who live can rekindle them. Its compulsion is upon us. From this altar of fire it is for us to snatch a fire-brand and lift a great light, and hold it high for the guidance of our own feet, leaving the mystery of it all as better told by Tennyson, when he wrote:

Flower in the crannied wall,
I pluck you out of the crannies,
I hold you here, root and all, in my hand,
Little flower—but if I could understand
What you are, root and all, and all in all,
I should know what God and Man is.

Dr. Axby: Mr. President, I move a record of this service be inserted in the permanent records of the Association, and that a copy be sent to the family of each deceased member.

President Wisnicky resumed the chair.

President Wisnicky: Thank you, Dr. Axby.

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

Dr. Axby: Mr. President, I move a record of this service be inserted in the permanent records of the Association, and that a copy be sent to the family of each deceased member.

President Wisnicky resumed the chair.

Dr. Axby: Mr. President, I move a record of this service be inserted in the permanent records of the Association, and that a copy be sent to the family of each deceased member.

President Wisnicky: Thank you, Dr. Axby.

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

President Wisnicky: The next will be a report from our Secretary-Treasurer, Dr. L. Enos Day.

Dr. Day read the financial statement.

Dr. Day: At this time there are 43 state memberships, one county membership—Los Angeles County, California—the U. S. Bureau of Animal Industry and the Canadian Department of Agriculture. The State of Michigan made application for reinstatement during the year and the State of West Virginia became a new member. We have received during the year 15 new individual members.

Quite a number of members have dropped out during the last year or two. I wrote each of these a personal letter requesting them to pay up their membership, and so forth, and I did receive some back dues; not many, but enough probably to pay for the postage. I sent out about 160 letters in all.

During the year I have written each state which is not a member and two which have been members but have dropped out, to make application for membership. I think that during the next year we will be able to add two of these states to our membership list, as I have had some rather favorable reports from them.

It is my hope that each state will join this organisation. I think it is worth while and I think whoever holds this position next year should urge the states which are not members to become members. I believe they will join if we keep after them.

Thank you.
# FINANCIAL STATEMENT

**L. Enos Day, Secretary-Treasurer**

## RECEIPTS

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## DISBURSEMENTS

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## CURRENT ASSETS

- U. S. Treasury Certificates $2,300.00
- U. S. Bonds $2,900.00
- Cash balance in bank $2,302.81

## LIABILITIES

Printing 1935 Proceedings $7,502.81

## STATE MEMBERSHIPS

- Alabama
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- Florida
- Idaho
- Illinois
- Indiana
- Iowa
- Kansas
- Kentucky
- Louisiana
- Maryland
- Massachusetts
- Michigan
- Minnesota
- Missouri
- Mississippi
- Montana

**State Memberships**

- Nevada
- New Hampshire
- New Mexico
- New Jersey
- New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma
- Pennsylvania
- Rhode Island
- South Carolina
- South Dakota
- Tennessee
- Texas
- Utah
- Virginia
- Vermont
- West Virginia
- Wisconsin
- Wyoming

Los Angeles County, Calif.

U. S. Bureau of Animal Industry

Canada Department of Agriculture

**November 19, 1936.**
PROGRESS IN THE FEDERAL-STATE BANG’S DISEASE PROGRAM

By A. E. WIGHT, Washington, D. C.
Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, U. S. Department of Agriculture

The Bang’s disease program being conducted cooperatively by the federal government and the state live stock sanitary authorities throughout the United States has made substantial progress during the past year. This, of course, can be readily noted from the large volume of testing conducted, and the increase in the number of herds and cattle under supervision for the elimination of the disease. In addition, the fact that a great deal of information pertaining to the elimination of the disease has been disseminated through various agencies should also be kept in mind when considering progress in this campaign.

At the end of October, 1936, there were about 536,000 herds, containing approximately 6,450,000 cattle, under supervision in the Bang’s disease control program. This is an increase of approximately 100 per cent in the herds and 70 per cent in the cattle under supervision as compared with October, 1935. During the fiscal year ended June 30, 1936, agglutination blood tests
for Bang's disease were applied to approximately 6,600,000 cattle, contained in 422,266 herds. A considerable number of these were retests. As a result of these tests, approximately 450,000 cattle (7 per cent) were found to be reactors. In October of this year, agglutination blood tests were applied to 731,656 cattle, of which 39,687 were classified as reactors. This is the largest number of tests made in any one month since the beginning of the work.

Of the special appropriation provided by the last Congress for cattle disease work, $14,214,000 was made available for the Bang's disease program. This amount is available during the fiscal year ending June 30, 1937, and is to be used for operating expenses and payment of indemnity to owners of cattle which react to the test for Bang's disease and are eliminated from herds in accordance with the federal regulations. In a few states some state funds have been made available for this work. In Maine, New Hampshire, Rhode Island and Virginia, the owners of cattle that react to the test receive some state indemnity.

PAYMENT TO OWNERS FOR ELIMINATED CATTLE

The maximum federal payment for reactors to the test for Bang's disease continues to be $25 for grade animals and $50 for purebred registered cattle. The owner receives the salvage in all states, and in the states previously mentioned he also receives a state payment in addition to the federal payment, but in no case can he receive from all sources a total payment greater than the appraised value of the animal. During the last fiscal year, the average appraisal was $70.65, the average salvage $27.43, and the average Federal payment $26.89. Approximately 11 per cent of these cattle were purebred registered animals.

PLAN OF OPERATION

The Bang's disease work, as far as the federal government is concerned, continues to be on a voluntary basis, but in certain localities in some states arrangements have been made to conduct the work in a systematic manner within a given area, such as a county, when it is found that the sentiment of the cattle-owners favors such a program, and the degree of infection among the cattle is not very high. Most of the Bang's disease work is conducted under the individual-herd plan. In about three-fourths of the states owners of herds under supervision receive a certificate when the cattle have passed a specified number of tests and other requirements are met.
Under the group testing plan, which is usually conducted on a county-wide basis, all the breeding cattle over six months of age are tested, and the infected herds are, of course, retested as many times as necessary. This feature of the work is now being conducted in several states, in some of which a considerable volume is being done. Our audience today will receive a report on the work of this nature that has been conducted in the state of Virginia.

**EXTENT OF BANG’S DISEASE**

This disease apparently exists to some degree in every locality where cattle are maintained, but the extent of the disease in certain localities is much greater than in others. On the initial test it appears that the average infection in herds thus far tested is about 14 or 15 per cent. In many localities it is much higher, while in others it is considerably lower. The state and federal officials in charge of this work are observing this feature quite closely in order to outline plans for future activities in the program.

**AGGLUTINATION BLOOD TESTS**

The testing of blood samples taken from cows being tested in connection with the Bang’s disease program is done, to a large extent, in official laboratories of the state, but in some states thoroughly trained veterinarians are permitted to make tests by the plate method. These veterinarians, from time to time, are required to submit duplicate samples to the state laboratory for comparison.

Experimental work was conducted in the field with stained antigen during the past year, with samples of whole blood being used instead of samples of blood serum, but samples of serum from the same cattle were forwarded to the state and Bureau laboratories for a comparative test. The results of these experimental tests indicate that those made with the whole-blood stained antigen compare very favorably with the tube method, but suitable special equipment and adequate training of the veterinarians making the test are necessary. It would appear that this method of testing may become useful under certain conditions.

**FURTHER STUDIES OF VACCINATION**

Experimental work in the vaccination of cattle against Bang’s disease has been conducted during the past year both in the field and at the experiment stations. In the field these experiments have been confined to calves from five to seven months of age, and in herds in which the degree of infection of Bang’s disease
is at least 15 per cent. The vaccine used is furnished by the Animal Disease Station of the Bureau of Animal Industry. This work is now being conducted in various parts of the country under supervision of Bureau veterinarians in about 220 herds, containing approximately 16,000 cattle, of which 2,400 calves have already been vaccinated. It is yet too early to appraise the results of such vaccinations conducted in the field.

**RETESTING OF SUSPECTS**

Some records have been maintained in connection with the results of retesting of cattle classified as suspects in various parts of the country, and the results reported up to September 30, 1936, are as follows:

### CUMULATIVE REPORT ON RETESTING SUSPECTS FOR BANG'S DISEASE

**Group 1—Suspects to one test**

<table>
<thead>
<tr>
<th>Number of suspects retested</th>
<th>.........................................</th>
<th>142,939</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results:</td>
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<td>Per cent</td>
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<tr>
<td>Negative to retest.</td>
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**Group 2—Suspects to two tests**

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**Group 3—Suspects to more than two tests**

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<tr>
<td>Positive to retest.</td>
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<td>19.7</td>
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**PUBLICITY**

The subject of Bang's disease in cattle and the progress made in its elimination have been given much publicity during the past year through the press and radio, which has been most helpful to the progress in many sections of the country. Maps showing the approximate percentage of cattle under supervision on January and May 1, 1936, were given wide publicity, as were the results of retesting about 2,800 infected herds in five midwestern states.

**CONCLUSION**

Preparation has been made to continue this project until June 30, 1937. It is believed that sufficient funds will be available to
conduct the work to an extent to meet the demands for testing by owners who wish to participate in the project. The amount of work to be conducted by the federal government in connection with this program after June 30, 1937, depends, of course, upon Congressional action. During the next few months, the legislatures of nearly all the states will be in session, and it is expected that some will pass laws pertaining to the elimination of Bang's disease, and provide funds for the work.

In order that those interested may have a brief summary of the status of the Bang's disease program, some statistical information on this subject has been prepared and is available for distribution at this meeting. Additional copies may be obtained from the Bureau of Animal Industry.

It has been a great pleasure to appear on this program today before an audience so keenly interested in this subject, and your kind attention is greatly appreciated.

PRESIDENT WISNICKY: Thank you Dr. Wight. I know that I speak for the entire group here when I say that your report has been very splendid and interesting. I believe we do have a few minutes to discuss these papers right after they are presented and if there is anyone who wishes to ask Dr. Wight any question, his paper is open for discussion.

DR. H. C. GIVENS: The thirty-fourth session of the Virginia legislature appropriated $30,000 to pay indemnity on cattle slaughtered on account of Bang's disease. There was a time during that biennium that federal indemnity was not available when tests were due on some herds of cattle in the state. Therefore, about $15,000 of that $30,000 was used to pay indemnity on a 24/40 basis provided by the state law during that time. The remaining $15,000 was re-appropriated by the thirty-sixth session, making available for the present biennium about $54,000, or approximately $27,000 a year.

The procedure in progress in the state of Virginia at this time is as follows: The owner of the cattle slaughtered signs a federal contract and they get the federal indemnity. No state indemnity is being paid at this time but it is all being held until the end of the fiscal year, when the money will be divided by the counties and every man paid alike not to exceed, by action of the Board of Agricultural Advisers by the State's Attorney General, $5.00 for grades and $10 for purebreds. We are going to make the money go as far as we can.

PRESIDENT WISNICKY: Our program provides for the discussion of various phases of the Bang's disease problem. The area work in Bang's disease control is being presented to us this afternoon by one who has had perhaps the most experience in that phase of work in this country. Dr. H. C. Givens, State Veterinarian of Virginia, has taken a very leading interest in this Bang's disease control problem and he is sort of outdistancing the rest of the states in the various steps which are being taken in advancement of this program. I think it was three years ago that Dr. Givens started to promote, I might say, an area test plan. We know as we go along in the control of a disease, that it customarily takes the form of working with the disease on the individual
herd plan. After that plan has advanced to a certain point, it becomes necessary for the protection of the work already done and to further the program at the proper rate, to advance to the area test plan and I think we are particularly fortunate in having Dr. Givens with us today to discuss that phase of our plan. It is a pleasure to me to introduce to you Dr. Givens of Virginia.

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

AREA WORK IN BANG'S DISEASE CONTROL

By H. C. GIVENS, State Veterinarian

and

R. E. BROOKBANK, U. S. B. A. I. Inspector-in-Charge

Richmond, Va.

It is not necessary to deal with the history of Bang's disease at this time except to state that it is not a new disease of the cattle population of this or other countries. The losses caused by the disease have been enormous and the spread of the disease within the last few years has been rapid. The devastation caused by it has grown progressively worse, because until very recently no united effort has been made to combat it.

Much of the future welfare of the cattle-breeding industry in this country and the consequent economical production of a major food supply of the nation depend upon our ability to control and finally to eradicate Bang's disease from our cattle and other live stock that may be affected by it.

At no time in the history of this Association has it been confronted by a more serious problem or a graver responsibility than the Bang's disease eradication problem. A permanent national program to eradicate Bang's disease completely from the cattle in this country is definitely under way. It is the responsibility of this Association to pilot this program, in a business-like manner, to its completion.

The material which we are submitting to this Association in regard to the eradication of Bang's disease by the area method will be confined to actual field experience of this nature in the state of Virginia. It is hoped that some definite and permanent program of eradicating Bang's disease from cattle will be adopted by all states as speedily as possible, in order that the work which has been done may be more readily protected.

No effort has been made in Virginia to establish any record. The purpose of presenting this summary is to encourage similar efforts in other states, which will naturally protect Virginia cattle from future infection.
Ten years ago, the cattle-breeders in Virginia requested that definite measures be taken to eradicate Bang's disease from their cattle. In compliance with that request, laboratories were equipped and put into operation. Veterinarians were placed in the field to work with herds of cattle and cattle-owners thoroughly to establish the fact that Bang's disease could be eradicated from herds of cattle in which it existed and could be kept out of herds of cattle in which it did not exist. Public sentiment was moulded in favor of a state-wide program of Bang's disease eradication which resulted in necessary laws, regulations and appropriations to carry out such a program. Bang's disease eradication and not cattle reduction has been the purpose of the program in Virginia from its inception. Virginia cattle-owners think in terms of eradication and talk in terms of eradication. No other method of handling Bang's disease is considered or will be considered.

INDEMNITY PROVIDED

The 1933-1934 session of the Virginia Legislature amended the state law governing tuberculosis in cattle to include Bang's disease and appropriated $30,000 to pay indemnity for cattle slaughtered on account of Bang's disease, on the basis of a maximum of $20 for grade animals and $40 for purebred registered animals. The 1934 session of the Virginia Legislature appropriated $54,000 to pay indemnity for cattle slaughtered on account of Bang's disease and this money will be prorated and paid in addition to federal indemnity.

The Virginia law declares Bang's disease to be a contagious disease of live stock; it provides for the establishment and enforcement of quarantine lines and boundaries; it provides for the compulsory testing of cattle for Bang's disease; it provides for the compulsory slaughter of cattle reacting to the agglutination test for Bang's disease; it provides for the compulsory reporting of tests for Bang's disease made on cattle in the state; it provides for the adoption and enforcement of regulations by the State Board of Agriculture; it provides for the cooperation by counties in the state to eradicate Bang's disease from the cattle in counties; and it fixes punishment and penalties for violation of the law.

Each and every essential in this law is necessary and useful though a word of warning may be sounded at this point. No contagious disease of live stock can be eradicated by law, in this country, without public sentiment and sympathy. To date no organized opposition has been met and in practically every in-
stance where it was necessary to use the law the result has been a conviction in the magistrate court, which ended the case.

The Bang's disease testing under the area plan in Virginia has been very gratifying in every respect. No disappointment has been met. We are more determined now than when we started.

Little difficulty has been experienced in having counties coöperate. This may be explained in part by the fact that none of the expense has been borne by the county or the cattle-owners. Many counties have asked for instructions for holding public hearings and adopting the necessary ordinances, in compliance with the state law, to have all cattle tested for Bang's disease, without a member of the state or federal force visiting the county, and at this time several counties are requesting that testing be started in advance of available facilities.

LOW PERCENTAGE OF INFECTION

The testing of all cattle in counties has, in every case, revealed that Bang's disease infection was less than estimates based on herd testing.

No other state, at this time, seems to be able to report as small a percentage of Bang's disease infection, according to the number of cattle tested, as does Virginia and it is believed that this situation is due to the fact that the majority of the testing in other states has been done in herds of cattle where the disease is more prevalent. The testing in Virginia has been done in areas which necessitated testing many cattle where no disease existed, or ever has existed. These excessive estimates of Bang's disease infection have tended to retard Bang's disease eradication, due to the fact that the task to some has been made to appear as impossible. This conclusion should be discarded by fair-minded persons and all who are interested in the future of the live stock industry.

The testing of all cattle in counties, followed by the slaughter of positive animals, cleaning and disinfecting premises, and re-testing of infected herds, has proven to us that Bang's disease infection can be reduced and eradicated by this method.

AGGLUTINATION TEST RELIABLE

The testing of cattle in areas, for Bang's disease, has proven that the agglutination test for Bang's disease is accurate for practical purposes. Unfortunately this method of diagnosis of Bang's disease is doubted too frequently in this country. Too many cattle-owners, as well as veterinarians, put their faith in
herd and animal history which is more frequently subject to human errors and mistakes than is the agglutination test. Individual cases have come to our attention in which it is difficult to decide the status of the animals, but these are so completely in the minority that they do not constitute a barrier to an honest effort to eradicate the disease.

In many instances the practice has been, first to pick the test to pieces and then pick the herd and animal history to pieces. Our experience indicates that the procedure should be reversed. Testing large numbers of cattle under the area plan has proven that cattle tested under varied circumstances in areas where Bang's disease infection does not exist will not react to the test, while in infected areas they will react with regularity.

We are furnishing data to show that we have tested all dairy and breeding cattle in several Virginia counties where no history or clinical evidence of Bang's disease existed. The result of the test on several thousand cattle under these circumstances was less than 0.5 per cent of reactions on the original test. The value of the test can better be judged on a basis of this kind than on a small number of animals or herds.

Cattle-owners in this country are more concerned in this program than anyone else, and for the fine spirit of cooperation they have shown they are to be congratulated. The provisions of this program have been liberal up to this point and certainly cattle-owners cannot hope to escape losses entirely and at the same time get rid of a disease as serious as Bang's disease. If they were compelled to continue with the disease they would suffer greater losses.

Additional losses that cattle-owners should be willing to accept at this time are the occasional animals that abort and fail to react. Virginia cattle-owners are sending this class of animals to the butcher and taking their loss. When this spirit prevails, Bang's disease will disappear.

Testing of all cattle in Virginia counties under the area plan has proven that this method is highly efficient in preventing the further spread of Bang's disease. In our experience no virulent outbreak of Bang's disease has occurred in areas which have been tested and all positive animals removed. In untested counties in the State, additional herds continue to become infected.

CENTERS OF INFECTION LOCATED

The testing of all cattle in areas for Bang's disease definitely locates all centers of infection in the area and makes it possible to prevent the spread of the disease, from otherwise unknown sources, into herds that are not infected.
In supplying replacement animals, for herds that have been reduced for the sake of Bang's disease eradication, the area plan of testing cannot be surpassed, since clean replacements are quickly and economically available within the area. Negative susceptible replacement animals must be protected in the process of rebuilding herds from which infected animals have recently been removed. Improper herd management in this respect will invariably result in disaster.

In no case, in our experience, in testing cattle under the area plan for Bang's disease, has the infection in animals other than cattle proven a barrier to the eradication of Bang's disease from the cattle in the area. It is our opinion that the seriousness of this source of infection is over-estimated and that upon the eradication of Bang's disease from the cattle in an area the infection, when it exists in other classes of animals, will disappear.

The testing of cattle under the area plan has proven that many more small lots of cattle, and single animals, are infected with Bang's disease than had been previously estimated. This class of animals has been found to be a serious source of infection, and the history on them is the least available, and the most inaccurate and misleading of any class of cattle.

**ASSEMBLED CATTLE UNSATISFACTORY FOR REPLACEMENTS**

Our experience indicates that assembled cattle shipped from other states into a Bang's disease-free area, on a single test in the state of origin, are not satisfactory as replacement animals. Of 1,369 cattle of this class, shipped into Virginia from other states during a period of twelve months, 42 reacted and eleven were suspicious, representing approximately a 3 per cent reaction to the test on arrival in Virginia.

These animals were handled in such a manner that made it impossible for them to contract the infection after they arrived in Virginia, and in the case of many of them the test was applied immediately upon arrival in the state. This is pointed out to prove that the present single test for Bang's disease, on assembled cattle for interstate shipment, is inadequate and that measures should be taken, in all states, to discontinue the testing of assembled cattle for interstate shipment or for herd replacements. Entire herds of cattle should be tested and in those herds showing infection all animals should be rejected. In Virginia no tests for Bang's disease have been applied to any cattle except under federal contract to include the entire herd since the inception of this program in 1934. This practice has been of inestimable value to the program in many respects.
THIRTY-DAY RETESTS NECESSARY

Experience indicates that it is necessary to retest infected herds at intervals of 30 days, or less, to control and eradicate the disease from them effectively. Unsatisfactory results which may have been experienced in this respect, in many cases, may be attributed to delayed retests. In some cases retests at less than 30-day intervals are helpful and the expense of such tests is justified.

The spread of Bang's disease is much faster than bovine tuberculosis, much faster than most of us have become accustomed to believe, and in order to combat Bang's disease effectively we must get closer to it and stay close to it to the end.

It has been found necessary to place a sufficient number of veterinarians in an area, when testing is started, to collect blood samples rapidly enough to prevent overlooking animals on account of movement that may take place within the area. We are indebted to several of the veterinary colleges for the excellent young men they have recently graduated and made available for this work. The type of work performed by these young men reflects credit not only upon themselves but upon their alma maters. The practicing veterinarians, in Virginia, have readily absorbed the Bang's disease eradication idea and have cooperated in every way.

THREE LABORATORIES CONDUCT TESTS

All agglutination tests conducted for the diagnosis of Bang's disease, in connection with the Virginia program, have been conducted in three well equipped, geographically convenient state laboratories and the system of testing has proven satisfactory and well adapted to conditions in the state. The central laboratory is operated at Richmond, and all antigen used is prepared at that point and distributed to branch laboratories. Identical technics are employed in all laboratories, each being supervised by a specially trained veterinarian, assisted by college graduates with training in laboratory procedure. The cost of testing in this manner has not been found prohibitive. The dilutions used are 1:50 and 1:100, and no reason has been found for not condemning all animals reacting positive in dilutions of 1:100 and suspecting those reacting in dilutions of 1:50. It has been found that the Bang's disease tests can be conducted rapidly in an area in this manner, since it is necessary to visit many premises only once and handle the cattle the one time.

The cattle population in Virginia is small and the herds also are small as compared with some states. It is believed, however,
that the work that is being carried on in Virginia can be carried on equally well in most states and that some similar procedure is possible in any state. As previously stated, the program to eradicate Bang's disease from the cattle in Virginia was launched ten years ago and some progress was made from the beginning. The real opportunity to make progress was welcomed in 1934, when the federal program was launched. Herd-owners in all sections of the state promptly applied for permission to participate in the program. This gave a better picture of the real problem than had been possible heretofore. This work also materially reduced Bang's disease infection in thousands of herds of cattle in the state.

BEGIN WITH LARGER HERDS

Our experience would indicate that in areas where Bang's disease infection is known to be extensive, the infection should be reduced in the larger herds before an area test is started. To reduce the cattle population of an area too rapidly will invariably lead to confusion.

In June, 1935, the first test of all the cattle in one Virginia county was undertaken. As soon as it was learned in other counties in the state that this work was in progress, we were besieged with requests to inaugurate a similar project in many other counties. This has been done as rapidly as facilities would permit.

In the beginning, individual county quarantines were depended upon to protect the tested areas. By action of the Virginia State Board of Agriculture, dated May 22, 1936, 72 Virginia counties, in which all cattle had not been tested for Bang's disease, were placed in quarantine prohibiting the movement of cattle from these counties into other counties in the state. This order gave the State Veterinarian authority to release such counties from quarantine when Bang's disease was under control in them.

In view of the fact that this Association has not adopted regulations for conducting Bang's disease eradication under the area plan, it was found necessary to operate systematically in some manner. The procedure has been to test all male and female cattle, six months of age or over, in the area (including previously negative herds) and to remove the reactors, clean and disinfect the premises, and retest all infected herds at 30- to 60-day intervals until they pass two negative tests. If the percentage of infection in the area is equal to or greater than 1 per
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<tr>
<th>COUNTY</th>
<th>INITIAL TEST</th>
<th>HERDS</th>
<th>%</th>
<th>CATTLE</th>
<th>%</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Essex</td>
<td></td>
<td>77</td>
<td>12</td>
<td>3,205</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fluvanna</td>
<td></td>
<td>61</td>
<td>12</td>
<td>1,916</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goochland</td>
<td></td>
<td>1,58</td>
<td>12</td>
<td>7,948</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hanover</td>
<td></td>
<td>57</td>
<td>12</td>
<td>7,948</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>King City</td>
<td></td>
<td>22</td>
<td>12</td>
<td>7,948</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>King George</td>
<td></td>
<td>147</td>
<td>12</td>
<td>7,948</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>King William</td>
<td></td>
<td>139</td>
<td>12</td>
<td>7,948</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>King and Queen</td>
<td></td>
<td>61</td>
<td>12</td>
<td>7,948</td>
<td>12.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table I—Range of Bang's disease infection among the cattle in 36 Virginia counties—Concluded.

<table>
<thead>
<tr>
<th>County</th>
<th>Initial Test</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Herds</td>
<td>Infected Herds</td>
<td>Cattle</td>
<td>Reactors</td>
<td>No.</td>
<td>%</td>
<td>Herds</td>
<td>Infected Herds</td>
<td>Cattle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>Lancaster</td>
<td>740</td>
<td>7</td>
<td>0.9</td>
<td>1,247</td>
<td>7</td>
<td>0.6</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Louisa</td>
<td>1,849</td>
<td>70</td>
<td>3.8</td>
<td>5,942</td>
<td>77</td>
<td>1.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Lunenburg</td>
<td>1,623</td>
<td>36</td>
<td>2.2</td>
<td>3,717</td>
<td>45</td>
<td>1.2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Madison</td>
<td>1,458</td>
<td>134</td>
<td>9.0</td>
<td>7,920</td>
<td>190</td>
<td>2.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>New Kent</td>
<td>429</td>
<td>7</td>
<td>1.6</td>
<td>1,066</td>
<td>13</td>
<td>1.2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Northumberland</td>
<td>988</td>
<td>6</td>
<td>0.6</td>
<td>2,193</td>
<td>6</td>
<td>0.25</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Nottoway</td>
<td>1,458</td>
<td>28</td>
<td>1.9</td>
<td>4,795</td>
<td>60</td>
<td>1.2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Orange</td>
<td>1,328</td>
<td>86</td>
<td>6.5</td>
<td>7,613</td>
<td>209</td>
<td>2.7</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Page</td>
<td>1,805</td>
<td>80</td>
<td>4.4</td>
<td>6,023</td>
<td>108</td>
<td>1.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Powhatan</td>
<td>751</td>
<td>30</td>
<td>4.2</td>
<td>2,954</td>
<td>65</td>
<td>2.2</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Pulaski</td>
<td>1,368</td>
<td>39</td>
<td>2.8</td>
<td>5,709</td>
<td>50</td>
<td>0.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Rappahannock</td>
<td>1,026</td>
<td>77</td>
<td>7.5</td>
<td>4,582</td>
<td>125</td>
<td>2.7</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Richmond</td>
<td>901</td>
<td>11</td>
<td>1.2</td>
<td>2,315</td>
<td>11</td>
<td>0.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Rockbridge</td>
<td>2,435</td>
<td>99</td>
<td>4.0</td>
<td>10,473</td>
<td>189</td>
<td>1.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Stafford</td>
<td>906</td>
<td>45</td>
<td>4.9</td>
<td>3,154</td>
<td>87</td>
<td>2.7</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Westmoreland</td>
<td>1,072</td>
<td>10</td>
<td>0.9</td>
<td>2,950</td>
<td>12</td>
<td>0.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>York</td>
<td>368</td>
<td>24</td>
<td>6.5</td>
<td>908</td>
<td>38</td>
<td>4.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>46,865</td>
<td>2,171</td>
<td>—</td>
<td>167,221</td>
<td>3,861</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Average</td>
<td>—</td>
<td>—</td>
<td>4.6</td>
<td>—</td>
<td>—</td>
<td>2.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: The data represents the number and percentage of infected herds and reactors in initial and six-month retests across 36 Virginia counties.
cent, all cattle in the area are retested, beginning six months from the date the original test of the area was started, after which all infected herds are again followed out.

By this method the disease has been reduced in a satisfactory manner. Available information indicated that Bang's disease infection in the cattle in Virginia was most prevalent in the northern part of the state and gradually diminished toward the southwestern part of the state. It was decided, therefore, to start eradication through the central part of the state and gradually work into the more heavily infected areas. To date, 56 Virginia counties have voted, through their county boards, to have all their cattle tested for Bang's disease and of these all cattle have been tested once in 36 counties, and all cattle have been tested twice in 13 counties, with the first test in progress in the remaining 20 counties.

Bang's disease infection varied on the original county-wide test of all dairy and breeding cattle in 36 Virginia counties from a maximum of 5.1 per cent infection to a minimum of .25 per cent, with an average of 2.3 per cent.

In 13 of these counties, after customary retesting of infected herds was carried out, a retest was conducted on all cattle which showed the average infection in the cattle in these counties to be approximately 0.5 per cent.

Table II demonstrates the result of two tests approximately one year apart on all dairy and breeding cattle in a county comprising 1,122 herds and 2,541 cattle. On the original test of the cattle in this county, 34 positive animals were found. Of these, 19 were one-cow lots, leaving only 15 herds of cattle in the county with infection. A retest of these 15 herds containing 45 cattle showed three positive animals.

**Table II—Progress in eliminating Bang's disease from 1,122 herds of cattle in King and Queen County, Virginia.**

<table>
<thead>
<tr>
<th>Test</th>
<th>Date</th>
<th>Total Herds</th>
<th>Infected Herds</th>
<th>Cattle</th>
<th>Reactors</th>
<th>Suspects</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>First area test</td>
<td>9-10-35</td>
<td>1,122</td>
<td>34</td>
<td>2,541</td>
<td>36</td>
<td>84</td>
<td>1.4</td>
</tr>
<tr>
<td>Retest of infected herds</td>
<td>1-16-36</td>
<td>15*</td>
<td>2</td>
<td>45</td>
<td>3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Second area test</td>
<td>10-1-36</td>
<td>1,103</td>
<td>4</td>
<td>2,571</td>
<td>4</td>
<td>10</td>
<td>0.15</td>
</tr>
</tbody>
</table>

*Nineteen herds eliminated first test.
For the purpose of obtaining information as to what would happen in a year in a county of this kind, the retesting of all cattle in the county was postponed for one year. The retests on all dairy and breeding cattle in this county showed four infected herds, four positive animals and ten suspects, reducing the original infection of 1.4 per cent to 0.15 per cent. Two of the reactors on this test were found in previously infected herds; one an animal which had previously been negative, the other an animal on which no history of previous test could be obtained, and evidently a "skipped" animal or an imported one.

Table III demonstrates the result of three county-wide tests for Bang's disease in a county in which the original county-wide test revealed an infection of 5.4 per cent. The extent of the infection in this area was originally greater than this test indicates. Many herds in this area were tested and the infection reduced in them the year before this work was started. Information of interest obtained as the result of testing done in this county is as follows:

**Table III—Effect of three tests on number of Bang's disease reactors and suspects in Botetourt County, Virginia.**

<table>
<thead>
<tr>
<th>Test</th>
<th>Date</th>
<th>Total Herds</th>
<th>Infected Herds</th>
<th>Cattle Reactors</th>
<th>Suspects</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>First area test</td>
<td>6-17-35</td>
<td>1,916</td>
<td>346</td>
<td>8,342</td>
<td>446</td>
<td>394</td>
</tr>
<tr>
<td>First retest infected herds</td>
<td>8-10-35</td>
<td>246</td>
<td>203*</td>
<td>2,026</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Second retest infected herds</td>
<td>10-22-35</td>
<td>—</td>
<td>381†</td>
<td>3,136</td>
<td>34</td>
<td>75</td>
</tr>
<tr>
<td>Second area test</td>
<td>11-30-35</td>
<td>1,868</td>
<td>23</td>
<td>7,948</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Additional retest infected herds</td>
<td>—</td>
<td>167‡</td>
<td></td>
<td>1,883</td>
<td>49</td>
<td>23</td>
</tr>
<tr>
<td>Third area test</td>
<td>9-1-36</td>
<td>1,830</td>
<td>23</td>
<td>8,221</td>
<td>35</td>
<td>7</td>
</tr>
</tbody>
</table>

*Forty-three herds eliminated first test.
†Includes all tests of infected herds before second area test.
‡Includes retests of all herds found infected.

In the first county-wide test 43 single animals reacted, in all parts of the area. It is probable that these animals would not have been intercepted by any other procedure. On the retests of infected herds following the county-wide test a total of 84 additional animals reacted, a number of which were suspects in the county-wide test.

In the second county-wide or area test, conducted approximately five months after the first test, 26 animals reacted that had been negative to previous tests. Twelve of these animals
were single animals that were negative to the first test in the county.

Additional retests as indicated in table III, after the second county-wide test, are misleading. There were not 167 infected herds containing 1,883 cattle. These were retests of the same infected herds and cattle in the infected herds found in the second county-wide test.

The third area or county-wide test, conducted nine months after the last test, disclosed 35 positive animals and seven suspects. The histories of these 35 positive animals have been thoroughly investigated. Six of them were animals imported into the county since the previous county-wide test. Ten of them came from herds that were originally negative but had some history of exposure. The remaining 19 animals came from previously infected herds.

Table IV indicates the continued progress that has been made in eradicating Bang's disease from the cattle in Virginia since the inception of the program in 1934. Almost constantly the number of cattle tested, each month, has increased while the percentage of infection has decreased. The figures on this table include all tests made on cattle in the state—the area testing and the herd testing in sections where area testing has not been inaugurated.

**Table IV—Percentage of Bang's disease reactors in Virginia from August, 1934, through October, 1936.**

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>CATTLE</th>
<th>REACTORS</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third quarter 1934*</td>
<td>19,418</td>
<td>1,880</td>
<td>9.7</td>
</tr>
<tr>
<td>Fourth quarter 1934</td>
<td>36,003</td>
<td>3,282</td>
<td>9.1</td>
</tr>
<tr>
<td>First quarter 1935</td>
<td>46,166</td>
<td>4,054</td>
<td>6.6</td>
</tr>
<tr>
<td>Second quarter 1935</td>
<td>53,216</td>
<td>2,306</td>
<td>4.3</td>
</tr>
<tr>
<td>Third quarter 1935</td>
<td>71,350</td>
<td>3,256</td>
<td>4.5</td>
</tr>
<tr>
<td>Fourth quarter 1935</td>
<td>79,980</td>
<td>1,838</td>
<td>2.3</td>
</tr>
<tr>
<td>First quarter 1936</td>
<td>89,058</td>
<td>2,104</td>
<td>2.4</td>
</tr>
<tr>
<td>Second quarter 1936</td>
<td>117,645</td>
<td>3,389</td>
<td>2.9</td>
</tr>
<tr>
<td>Third quarter 1936</td>
<td>126,509</td>
<td>2,780</td>
<td>2.2</td>
</tr>
<tr>
<td>Fourth quarter 1936†</td>
<td>38,277</td>
<td>591</td>
<td>1.5</td>
</tr>
</tbody>
</table>

*August and September, 1934, only.
†October, 1936, only.

This summary of progress in eradicating Bang's disease from cattle, by the area plan, in the state of Virginia, has been presented for your information. We, in Virginia, feel that this method is the solution of the Bang's disease problem. We know of no reason why the program should not be continued.
President Wisnicky: I think Dr. Givens has presented to this group a picture that is a revelation in this advanced step in Bang's disease control work. Dr. Givens has had some very able support in this work. His coworker, Dr. R. E. Brookbank, is listed on the program for a discussion and it is a pleasure for me to call upon Dr. Brookbank.

Dr. Brookbank: I believe Dr. Givens has told you the whole story and I really have nothing to add to it. It seems to me that the work has been wonderfully successful for the reason that the people want it and also because Virginia has a progressive and aggressive State Veterinarian and a Board of Agriculture second to none.

Dr. A. J. DeFosset: In table III that Dr. Givens presented it indicated that in the first area test 446 reactors and 394 suspects were found. There is quite an emphasis on suspects. Where was your dividing line between reactors and suspects?

Dr. Givens: The suspects 1:50 and the reactors 1:100.

Dr. DeFosset: Do you have any figures to show what happened to those suspects?

Dr. Givens: I could not give you figures. I have the results of a few herds with me here. They are the results of testing infected herds in which eight or more tests have been made. The results of these tests indicate that probably 65 per cent of the suspects will later react, that is, in the infected herds. However, I cannot say just how these 394 came out.

Dr. A. E. Wight: Do you assemble these cattle or do you go from farm to farm?

Dr. Givens: We go from farm to farm.

Dr. R. A. Hendershott: What cleaning and disinfecting requirements do you have?

Dr. Givens: In regard to the cleaning and disinfection question, there seems to have arisen the recognition that cleaning and disinfecting is going to have to be done where necessary with some judgment. However, under open range conditions, where one cow is the herd or something like that, there is no place for disinfection. Some cleaning might be done but not to amount to anything. Does that answer your question?

Dr. Hendershott: Does your state law provide for enforced branding of reactors?

Dr. Givens: Yes.

Dr. Hendershott: How do you classify your reactors?

Dr. Givens: Complete agglutination at 1:100; 1:50 is a suspect.

Dr. D. H. Clark: What method of testing do you use?

Dr. Givens: Tube method.

President Wisnicky: Are there any further questions on this subject? Anyone who has ventured on to untrodden soil should be willing to answer all kinds of questions and there are, no doubt, some questions in the minds of some of you on the subject. The matter is now open for discussion. I want to say also that any live stock producers or others who are here who have questions may feel free to ask them.

Dr. W. H. Hendricks: I should like to commend Dr. Givens on this work. I should like to make an observation also. It would seem to me that the percentage of infection when you first start to work was extremely low in your whole state. It also would seem to me that your herd units were small. I am wondering if that does not have a bearing on the effectiveness of this work. I am also wondering, if this same plan were attempted in some of our sections where we carry
a much heavier percentage of infection, whether we might expect the
same degree of success.

Dr. Givens: I mentioned that it would be necessary, where the in-
fection is heavy, to reduce it before an area test was started. I would
sincerely advise this in every case. In the case of Botetourt County,
which I discussed, the percentage of infection a year before was much
in excess of 5.5. We did an intensive lot of herd testing in that county
prior to the work done later. Certainly, our herds are very small.
I think our average herd on the county-wide basis will average four
or five cattle and there are many one-cow lots. Such lots are quite
easy to free from infection because when you get the cow you have
the herd. Certainly when the eradication of Bang's disease is under-
taken in the large herds of the West, the stockmen there will have
problems with which to deal that we do not have, although I believe
that you will solve the problem if you go at it with enough vigor. You
will have to get your cattle men interested.

Dr. W. A. McDonald: We are much interested in Dr. Givens' paper
and the discussion of this area work. Recently we adopted a plan of
area work in Louisiana and have met there some of the same condi-
tions which are outlined in this paper with regard to the percentage
of infection.

Before we started area work in that state, we were fighting an
average of about 12 per cent infection in the herds throughout the
state. In the last 60 days, taking advantage of the fact that we were
bunching all the cattle in the state for dipping purposes in connection
with tick eradication, we have tested all the cattle in six parishes
and found the percentage of infection to run from 1.5 to 4 per cent,
whereas in the individual herd work, before we started the area work,
we were finding an average of 12 per cent. I am wondering if this
is not because of the fact that in the herd testing plan we get the
herds of those who are more active in the cattle business and there is
more exchange of cattle from herd to herd and a consequent greater
spread than over the state as a whole. I am just hoping that proves
true throughout the whole territory. We want to subscribe 100 per cent
to the area plan. We think it is the only way we will ever get anywhere
in the Bang's disease eradication work.

Dr. A. W. Rice: I shall have to follow my friend from Louisiana.
We are doing some area work in Arkansas very satisfactorily. We
are also testing about 70 herds of cattle in Pulaski County that fur-
nish milk to Little Rock. They are large herds. The sanitary condi-
tions with these herds was not satisfactory. We knew something was
wrong, so now we are paying more attention to the sanitary situation
and I think we will make better progress from now on.

President Wisnicky: If there are no further questions, we shall
close this discussion and on behalf of this group I wish to thank you,
Dr. Givens and Dr. Brookbank, for the splendid report that you have
made and congratulate you upon the progress that you have made.
(Applause)

A problem as large as the Bang's disease problem naturally has
many parts to it and we felt, in order to get a complete discussion of
the Bang's disease problem, we would have to look at it from the
viewpoint of not only the research man, the control man, but also
from the viewpoint of the herd-owner who is actually going through
the experience of this Bang's disease clean-up work. We are mighty
fortunate today to have on our program a man who, I think, is with-
out question the outstanding figure in American agriculture. We have
a man who is also the busiest man in the world, yet he carries on
his farming operations with splendid success. It is peculiar that these
busy men will find time to do so many things, even to come to a
meeting of this kind and carry on the discussion on this problem from
THE ATTITUDE OF THE BREEDER AND THE MILK PRODUCER TOWARD THE CONTROL OF BANG’S DISEASE

By W. S. Moscrip, Lake Elmo, Minn.

Mr. Chairman and gentlemen of the Sanitary Association: It was suggested to me at lunch that I might consider briefly a part of this subject with which perhaps many of you are not familiar. I refer to the federal plan as a cattle-reduction program.

Your chairman has referred to the fact that I happen to be a member of the Executive Board of the National Cooperative Milk Producers Federation. Of course, we were tremendously interested in the production control plans and the discussion that was put forward by the AAA; and sooner or later we knew that there would be discussion as to dairy control production. We knew, also, some of the things that were being suggested as cattle-reduction programs. I attended one meeting where probably 25 representative men seriously discussed a program of removing from the herds of the dairymen of this country the two- and three-year-old heifers that were within six weeks of calving. That hardly seems possible and yet that was seriously discussed. We did not think that we should proceed in that way. We felt that if we were to reduce the cattle population of this country we should first decide what the condition was as to disease in those herds and remove from the herds the diseased animals before we removed the two- and three-year-old cattle. We were told that we probably could not sell that proposition to the AAA.

We had been carrying on blood testing for Bang’s disease for many years in Minnesota and we felt that we had certain definite results that we could present and did offer to present to AAA officials as to what could be done. The Federation authorized a committee and arranged for its appearance. And I wish to give credit here to the men who prepared the material which
that committee carried to Washington, Dr. Cotton, of our State Live Stock Sanitary Board, and Dr. Fitch, of our University. They supplied the buckshot that we used that put the two- and three-year-old plan out and directed attention along the proper lines. I also wish to express our appreciation of the Federation for the cooperation we had from Dr. Mohler in putting over the idea that was finally adopted and put into operation as a federal program. So much more has been done through education, bringing to the farmers, dairymen and live stock breeders of the country the facts that they needed to know, that it seems the problem was really beneficial because cattle reduction had to be faced in some form and it would have been many, many years that we would have been talking about area testing even in Virginia where "one cow gets the herd" if it had not been for this program.

So much for the inauguration of the program. In that connection, perhaps I should say this. I have always felt that agriculture has a very definite responsibility to the consumer—to the purchasers of our products to produce as efficiently as is humanly possible. No other industry can long succeed or even stay in business that does not conduct its affairs on the highest possible efficiency and certainly agriculture cannot expect the public to pay prices for products that are produced inefficiently. That should be a fundamental principle, it seems to me, in all production, and starting with that fundamental, I think that no live stock breeder can produce live stock or dairy products efficiently in a herd that is—shall I use the word "rotten"?—with disease. It is a physical impossibility and in addressing you this afternoon, I am speaking very largely from my own personal experience. I am sure that my veterinary associates in Minnesota will agree that I am probably the original doubting Thomas. I see one of them nodding his head. However, I did become sold on the program a good many years ago and as we went along in our herd blood-testing, disposing of animals which were infected, controlling the disease, we, of course, faced first the problem which is the most important result of Bang's disease in purebred cattle breeding—sterility. And while, of course, no one for a moment would say that you eliminate sterility from a herd when you eliminate Bang's disease, you do, very largely, as far as my experience goes, to all practical purposes, eliminate sterility and shy breeders. That, in my opinion, is one of the most important factors in herd management or in milk production that a breeder faces, situated as we are, producing milk for a fluid milk market where you are supposed to
maintain a steady flow throughout the year. Therefore, if your breeding program is interfered with, as Bang's disease interferes with it, you simply cannot produce milk efficiently, the same amount month after month and week after week. Shy breeders are one of the main factors in that part of our program. Of course, from the purebred standpoint, we like to see a calf every twelve to thirteen months, because there is where, in ordinary good times, we make our profit. If you carry a cow 15, 18, 20, or 24 months or over to get a calf, you are lessening your chances for profit very greatly.

I had planned to discuss some things with you but as I got up and studied my audience and after having met some of you at noon, I think I would be rather presumptuous so I am going to pass over them briefly. If you care to have me discuss them later, all right.

We found in controlling the disease in our herds that care at calving time was one of the main factors in the whole problem. We found that if proper precautions were observed, proper isolation at calving time, and proper sanitation maintained, that we could keep positive animals, in our case, on the same premises with no spread of the disease. In that connection I want to say, as far as my personal experience and observation goes, one can maintain valuable, purebred, positive animals successfully if he takes the precautions that are necessary and still not spread the disease. However, in my opinion, you cannot do that with tuberculosis. With this observation I shall skip that particular point that I had intended to discuss just a bit more thoroughly and pass on to some things that I have observed that happen.

Following the directions of the men I mentioned some moments ago, we have eliminated the disease and have our third accredited certificate. We have been troubled with a lot of things. Veterinary practitioners have had quite a little work in attempting to reduce losses in some of the herds, and in some very valuable animals we have had, but since we have succeeded in removing Bang's disease from the herd, we have not had a big need for veterinary services. I do not know whether that means anything scientifically or not but I have found that other men have had exactly the same experience. My own observation is, and I have checked with several and Professor Peters of our University bears me out in both of these statements, that a great deal of our calf trouble disappeared with Bang's disease and I do not know whether that can be sustained scientifically or not. It is my observation.
Then you come to the question that every buyer of purebred live stock and of replacement live stock should consider. That is the source from which he gets his purchases and his replacements. I wish to say that I do not believe today that any replacement buyers who feel their obligation to their clients or any purchaser of purebred live stock who knows at all what he is about will buy from any herd if he does not know the condition of the entire herd. I think the day is past where the purebred breeder can sell at anything like the prices that he should get if he does not have his herd under supervision and cannot say with authority that he has a clean herd or give the exact condition of his herd and how he is conducting it. I know in our breed, that has been the case for a considerable length of time. I say again, I do not believe in the future it is going to be possible, with this great educational campaign, for a purebred breeder to continue as such with any degree of success until he does fall in line with this Bang's disease program.

As far as the milk producer goes—you see, we Holstein people, Mr. Chairman, not only produce cattle but produce some milk. I see some friends of the opposite side in the audience so I could not resist boasting that we do produce milk—he has the same responsibility of efficient production and of putting his house in order as far as Bang's disease control goes as the producer of cattle because in a herd that has Bang's disease you cannot efficiently produce milk on account of the things that I have already mentioned—shy breeders, sterility and all that sort of thing. It just cannot be done and there again is the obligation to the milk consumers, to the trade, to produce as efficiently as he can before he can ask advanced prices.

We have there a problem which I do not believe is a serious one but there it is and that is the human health element. The producer of milk, in my opinion, has not the right to ask the public to buy from a disease-infected herd. I think, therefore, another of his obligations to his public is for him to get in line.

Then there comes, I think, the nub of the whole program, and that is the education of the breeder, the live stock man, as to just what the program is and what it means because, unless we owners coöperate in these disease-control programs, we just do not get anywhere. If facts could be ascertained, where the program is not working out satisfactorily and where results are not good, we would find that there is not 100 per cent coöperation or 100 per cent understanding and appreciation of what the problem is. That, in my mind, is the first thing to be done in
carrying forward this program of disease control, to bring this appreciation and understanding to the breeders of this country.

As I said in the beginning, this cattle-reduction program follows the disease-control program. The AAA has made progress that we could not have made in years and years under the old plan that we had in Minnesota but just the same there remains a tremendous amount of educational work to be done. Breed organizations and organizations such as yours, I think, have a very decided responsibility in getting to the breeders and farmers of this country the necessary information by which they can avail themselves of the program and through which they can rid their herds of this disease. The farmers in my own territory are back of this program. Those who have taken part in some of the earlier survey tests that we made in Minnesota are anxious to go on but they feel that certain very definite things should be done. Some who have had bad breaks have come to me.

Some years ago our State Live Stock Sanitary Board made a survey of four counties in the state. My own county happened to be one. I am thinking now of those who in that initial survey had an absolutely clean herd and even on a subsequent test had a clean herd but this summer had a bad break and who lays it to the fact that a neighbor has a herd that is very badly infected. This man feels the time has come when some definite plan of compulsory area testing has got to be had. A lot of breeders feel that same way.

I was particularly interested in the discussion of the area work in Virginia because possibly we have not gone far enough in many of our states. Most states have not gone far enough. In Minnesota, when we go far enough and we are really doing the job as it should be done, we are going to be testing, in my opinion, on the area plan.

I want to say just one final word. That is, that in any state, and this is the obligation of the veterinarians as well as of the state officials, that when a positive animal is disclosed, that animal should be identified beyond any chance of the identification being lost or changed and should be quarantined. That has not been done in every state but I think it is one of the first things that should be done wherever this work is initiated.

Therefore, with a better understanding by the breeders of his problem and by closer cooperation with the veterinarian, I think it will be possible eventually to come to a plan that will control Bang's disease in the herds of this country. (Applause.)

DR. C. F. RIORDAN: Do you not believe, as I do, that all animals which react should be tagged, branded and removed for immediate
slaughter? Should not any animal that reacts go? And do you believe in vaccination?

Mr. Moscrip: When I said I thought all animals should be tagged, branded and quarantined, I meant that they should be quarantined under the supervision of the live stock sanitary officials and removed only under their authority. I feel, absolutely, that no animal which has reacted should be lost sight of and allowed to be passed on to an innocent purchaser.

What do I think about vaccination? I do not know. I do not believe that there are a dozen men in the audience who could give an answer to that question. It is largely in the experimental stage as yet.

President Wisnicky: Are there any further questions? If not, I wish to thank Mr. Moscrip for coming here and presenting this fine address.

We now reach out to the state of California to get the report of their success and it gives me great pleasure to introduce Dr. Kenneth G. McKay, of the University of California, Berkeley, California, who will talk to you on “Experiences in the Control of Bang’s Disease in California.”

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

EXPERIENCES IN THE CONTROL OF BANG’S DISEASE IN CALIFORNIA

By Kenneth G. McKay, Berkeley, Calif.

Agricultural Extension Service, University of California

This paper may be divided into two phases:

A. The control of Bang’s disease in Del Norte County, California.

B. The control of Bang’s disease in University of California demonstration herds.

Bang’s Disease Control in Del Norte County

The county seat of Del Norte County is 85 miles from the nearest railroad. Until recent years, travel in the county was chiefly intracounty, and the intercounty travel was mostly by sea. At the time Del Norte was selected as a demonstration county, California’s constitution did not permit indemnity in disease-control projects.

In the summer of 1929, due to a court injunction prohibiting veterinarians from branding cattle reacting to the tuberculin test, a period of six weeks elapsed, before the present bovine tuberculosis law became effective. No veterinarian was practicing in the county, and in order to obtain a test of their herds before the injunction lapsed, the Del Norte Dairymen’s Association employed a veterinarian from Humboldt County to test several hundred head of cattle. Fifty per cent of the mature cat-
tle tested reacted to the tuberculin test; the percentage was not so high in the younger cattle, but appalling at best. In addition, many dairymen in the county were experiencing enormous calf losses.

Representatives of the University of California, the State Department of Agriculture, and the California Dairy Council, on November 12, 1929, were of the opinion that Del Norte County offered an opportunity to study tuberculosis and Bang's disease control, on a voluntary county area basis, that no other California county could duplicate because:

1. The dairymen of the county desired to eradicate disease from their herds.
2. The dairymen were experiencing enormous annual calf losses.
3. These men had a very active and cohesive dairymen's association.
4. Of the limited number of cattle in the county—approximately 5,000 being in production.
5. The county itself is isolated from other dairy sections in California, and is divided into districts isolated by natural barriers or rivers and hills. The county is without a railroad, thus all travel is confined to automobiles, trucks, and shipping vessels, which facilitate the controlled movements of infected cattle.

The plan of procedure among cooperative agencies in the Del Norte program is briefly outlined as follows:

1. The Division of Veterinary Science of the University of California, at Berkeley, conducted the agglutination tests for the determination of the presence of Bang's disease.
2. The Agricultural Extension Service of the University of California offered recommendations for the most efficient procedures to be followed in the control of Bang's disease, having in mind the economic welfare and desire of the owners, such as:
   A. The immediate disposal of reactors.
   B. The segregation of the reactors on the premises.
   C. The segregation of the offspring.

The veterinarian of the Agricultural Extension Service went to the county and drew the blood samples in the cooperating herds three times a year, and forwarded the samples to Berkeley for test. Upon receipt of laboratory reports, methods to be followed were outlined by this veterinarian, and the owners were given individual-herd-test sheets indicating the positive, negative and suspicious animals in their herds.
3. The Division of Animal Industry of the State Department of Agriculture agreed to be responsible for the tuberculosis control program and, in 1933, further agreed to award State Bang's Disease-Free certificates to cattle-owners whose herds were without evidence of infection for a minimum period of one calendar year.

Beginning in the year 1930, three county-wide blood-test surveys were made annually; generally in February and March, in July and August, and in October and November. The program was concluded in August, 1935. On January 18, 1930, the first bleeding operations for the determination of the extent and prevalence of Bang's disease began. Of the 3,760 head of cattle tested on the first survey, 16.2 per cent were positive, and 13 per cent suspicious. At the end of the first year, 146 cattle-owners were engaged in some definite program, working toward the elimination of Bang's disease reactors. Only twelve cattle-owners within the county were not identified with the program. It was interesting to observe that those not in the program were renters who were confronted with expiring leases, or foreigners who had the attitude that they were being forced to submit their herds to unnecessary tests. A few herds were found to be so badly diseased that the owners were not in a position to carry on any kind of a disease-eradication program at that time, except to raise calves free from disease.

Each farm presented its own problem, as to the program to be followed. Determining factors were the desire of the owner, percentage of infection, farm acreage, farm pasturage, water supply, drainage, and size of milking barn. In herds with approximately 50 per cent or more infection, the program resolved itself into one of abandoning the old herds and raising the calves and heifers free from infection. In herds having approximately 30 per cent infection, segregating of the infected and non-infected cattle was instituted. In herds of slight infection it was suggested that the positive cattle should be sold.

A farm survey of the coöperators revealed the following: Three-fourths of the dairymen owned their own properties and one-fourth were tenants and related tenants. About one-fifth of the coöperators were of foreign extraction, consisting mostly of Swiss, Italian and Portuguese, and about one-tenth of the coöperators were Indians.

A comparison of the butterfat in milk received at the Smith River plant of the Del Norte Milk Products Company, for the first ten months of 1930, exceeded the corresponding months of 1929 by 5,504.7 pounds butterfat. This was unusual because of
the fact that the herds supplying this plant were in the badly
diseased section of the county. No new territory had been
tapped by this plant during the previous year. Therefore, it
would appear that the segregated heifers that came into pro-
duction and gave birth to full-time calves were increasing the
production more than enough to offset those animals that were
eliminated from this section of the county during the previous
year, because of disease.

The blood samples were handled in the following manner:
Through the courtesy of the Del Norte Dairy Products Associa-
tion, the blood samples were cooled, packed and mailed for sero-
logical test, to the Division of Veterinary Science, University of
California, at Berkeley. The samples were carried by stage from
Crescent City, California, to Grants Pass, Oregon—a distance
of 85 miles; thence by rail to Berkeley—a distance of 474 miles.
Thus they traveled a total of 559 miles, much of the distance
being through the warm valleys of northern California. Not-
withstanding this long trip, only a small percentage of blood
samples hemolyzed in transit, even during the summer months.
Later, arrangements were made to transport the blood sample by
stage to Eureka, California, a distance of 85 miles, thence by
rail to Berkeley, a distance of 284 miles, saving approximately
190 miles of travel to the laboratory.

In 1934, the University announced that on July 1, 1935, they
would withdraw the University Bang’s disease free service. This
was done in order that the dairymen might prepare themselves
to continue the project on their own initiative. It is interesting
to note that in the summer survey after this announcement, the
total number of animals tested was only 854, an all-time-low
figure. This was due to the fact that most dairymen lost interest
when informed that they would no longer get the free public
service on Bang’s disease control. In fact, several dairymen
turned their infected and clean herds together, following the
University announcement.

In the spring of 1935, a most exacting survey, the 16th in
number, was made to contact all cattle-owners, including non-
coöperating dairymen, family cow-owners, campground owners,
and town cow-owners. This accounts for the large number of
cows tested and the consequent high percentage of positive re-
actors. In the summer of 1935, the last survey represents only
19 herds tested, of which twelve herds proved to be clean and
qualified for a State Bang’s Disease-Free certificate. The other
seven herds were tested only as a special accommodation to the
owners.
The Bang's Disease program in Del Norte County proved not as successful as had been anticipated at its initiation in 1930. However, Del Norte experiences an annual rainfall of 72 inches per year, and many years in excess of that amount. With poor farm sanitation and segregation, it is not surprising that some dairymen were unable to control Bang's disease. Therefore, it is remarkable that 81 dairymen qualified for a State Bang's Disease-Free certificate the last year of the program.

In 1933, 50 cattle-owners received State Bang's Disease-Free certificates, representing 861 head of clean cattle, and in 1934, 66 cattle-owners received certificates, representing 992 head of clean cattle. Of these latter, 37 herds, representing 617 cattle, received a renewal state certificate; and 29 herds, representing 375 cattle, received their first state certificate. In 1935, 81 cattle-owners received certificates, representing 1,304 head of clean cattle, of which 60 herds, representing 984 cattle, received a renewal state certificate, and 21 herds, representing 320 cattle, received their first state certificate.

Concurrently with the voluntary Bang's disease control program, the Del Norte dairymen were confronted with a colossal tuberculosis problem. On August 15, 1931, Del Norte County was declared a tuberculosis control area. The United States Department of Agriculture, on August 2, 1934, designated Del Norte County a modified accredited tuberculosis-free area, as the extent of the infection had been reduced to less than 0.5 of one per cent. A total of 1,417 reactors had been removed from the county under the control area plan, aside from 881 head of cows positive to the agglutination test. On the other hand, 1,098 cattle, mostly clean Oregon heifers, had been purchased to supplement the cattle removed on account of disease. The clean replacement heifers that were introduced on badly abortion-infected premises, reacted on subsequent Bang's disease tests in high percentage.

Contrasting the tuberculosis and Bang's disease programs, one observes that the tuberculosis program handled under regulation and indemnity was much more successful than the long-time voluntary Bang's disease control program.

The decline of prices of butterfat and other agricultural commodities made it much harder for the dairymen to follow the voluntary program as compared to the existing conditions of 1930 when the program was initiated. Because of economic conditions, 86 of 93 reporting dairymen handled their Bang's disease program without a cash expenditure. Seven dairymen reported having spent only $1,185.00 on barn improvements or
fences in an attempt better to control the spread of Bang's disease. This amounts to less than $170.00 per reporting dairyman.

At this point it is interesting to note that:

88 dairymen reported the average age of their barns to be over 24 years old.
20 dairymen reported the age of their barns to be between 30-40 years.
5 dairymen reported the age of their barns to be between 40-50 years.
7 dairymen reported the age of their barns to be over 50 years.

More dairymen might have succeeded in controlling Bang's disease if they had been in a position to improve their barn facilities for the segregation and the sanitation of their cattle.

A summary of the herds that received one or more State Bang's Disease-Free certificates follows:

1. Ninety-seven cattle-owners in Del Norte County received one or more State Bang's Disease-Free certificates.
2. Twenty-nine of the cattle-owners who received State Bang's Disease-Free certificates had less than five cows.
3. Thirty-seven herd-owners had a clean test on the initial test in 1930.
4. Twenty-seven of the 37 herd-owners who had a clean test in 1930 remained clean continuously through the program which ended in August, 1935.
5. Seven herds, clean in 1930, became infected with Bang's disease and at a later date qualified for a state certificate and remained clean.
6. Fourteen infected herds in 1930 finally qualified for a state certificate and remained clean.
7. Three clean herds in 1930 that were awarded state certificates later became infected and remained so.
8. Three infected herds in 1930 finally qualified for state certificates, but later became infected and remained infected.
9. Eleven herds entering the program after 1930 qualified and were awarded State Bang's Disease-Free certificates.

A few other dairymen had clean herds at the time of the last survey, but could not qualify for a State Bang's Disease-Free certificate because they had ceased to test frequently enough, or because suspicious animals were found in their herds. A high rainfall of 72 inches per year and poor sanitation made it impossible for some dairymen to control Bang's disease.
In conclusion, to carry on a voluntary county-wide Bang's disease clean-up program and make it effective, it should have the following features:

(1) An educational program preceding and coexistent with the control program.

(2) A preliminary test survey should be made before attempting a county-wide clean-up program. This gives every stock-owner a fuller opportunity to appreciate his individual problem and responsibility before subscribing to a voluntary program.

(3) A future date when compulsory testing becomes mandatory on all stock-owners is highly advantageous.

(4) Control recommendations should have the economic welfare and desire of the owner kept in mind.

It is gratifying to report that the number of Bang's disease-infected cattle in the county program had decreased from 3,112 in 1930, to 1,683, in 1935, and that in the last year of the program, 81 cattle-owners were awarded a State Bang's Disease-Free certificate.

It appears the program of segregating the infected cattle from the clean cattle, and raising calves and heifers free from disease is a logical and economical procedure in the control of Bang's disease. In badly infected herds, the program might well be augmented by vaccinating calves.

The Control of Bang's Disease in University of California Demonstration Herds

Demonstration herds were selected without regard to percentage of infection or regard to available equipment. They varied from most modest to elaborate enterprises and provided a variety of observations from those experiencing storms of abortion and its sequelae to those experiencing quiescent stages of the disease. The educational value that would accrue to a given dairy district was the foremost thought in the selection of the Bang's disease demonstration herds.

The Division of Veterinary Science of the University of California has published several technical as well as practical bulletins and circulars on Bang's disease control, which are available for free distribution, as well as certain publications of other state experiment stations and the United States Bureau of Animal Industry. In the main, the problem was one of selecting subject matter and applying it under existing field conditions in an economic way.

The preponderance of evidence available points to the segregation method supplemented by calf-raising as the most economical
procedure in controlling and eventually eradicating Bang's disease. If eradicating the disease is impractical, then the recently improved methods of vaccination may have a place.

Literature is replete with evidence that vaccines in the past caused many animals to abort. Recently, recognized experiment stations have reported a considerable measure of success from the use of certain specialized vaccines. Extensive field trials will be necessary before being able to form a definite conclusion concerning them. The United States Bureau of Animal Industry now furnishes licensed biological firms with a culture which has been found to possess few of the undesirable features of the old vaccines.

The agricultural extension program for the University demonstration herds and in Del Norte County has been conducted on the segregation method supplemented by calf-raising, with the end in view of not only controlling the disease but also of eradicating it from the premises.

The extension specialist in veterinary science

(1) Supervises the Bang's disease program in the selected herds and offers recommendations for the most efficient procedure, having in mind the economic welfare and desire of the owner.

(2) Draws blood samples at appropriate periods from the selected herds and forwards these to the Division of Veterinary Science, at Berkeley, for serological test.

(3) Identifies each animal in the herd.

(4) Tabulates and summarizes the resulting data which then become available to the proper University and state officials.

Results of tests and interpretations are made available also to the farm advisors' offices in the counties in which the farms are located. The farm advisors in turn inform the owners on the University interpretation of the tests.

A demonstration herd project is considered completed after the herd had received a certificate from the Division of Animal Industry, State Department of Agriculture, and a result demonstration meeting has been held on the farm. Such a meeting gives a detailed account of herd status at the time of initiating the program and the experiences on the farm until the completion of the project. The herds then pass over to a local practitioner of veterinary medicine and he in turn sends the blood samples to the State Department of Agriculture for laboratory test.

The herds selected for demonstration purposes must meet the approval of the extension specialist in dairying, the Chief of the
Division of Veterinary Science, and the extension specialist in veterinary science. In no instance has an owner been urged to sell his positive group until he himself felt it uneconomical to keep them longer. Nor has an owner been urged to build new barns to handle the negative cattle. The projects have been carried on without extra expense excepting personal inconvenience of handling two herds with the available equipment at hand. However, in a few instances the owners, on their own initiative, have hastened their programs by selling reactors found on the first test.

The owners of demonstration herds have been almost unanimous in their enthusiasm for the benefits received in controlling and eradicating Bang's disease. The negative groups uniformly give more milk, have more vigorous calf crops, have less breeding trouble, less mastitis, and fewer retained placenta, than do the positive groups.

It appears that Bang's disease is more readily controlled on the demonstration herds scattered throughout the state than on the farms of Del Norte County. Most of the demonstration herds are located in the hot valleys of California where better dairy practices are in vogue. Consequently the possibility of contamination is not so great on the demonstration herds as on the farms of Del Norte County. The demonstration herds were chosen because of their location with respect to dairy districts and their reputation for being good cooperators with the Agricultural Extension Service; thus a very select group of dairymen are controlling Bang's disease in the demonstration herds.

Sixty-seven University demonstration herds have received state certificates of freedom from Bang's disease since 1932. Herds qualifying for a state certificate must be free from the evidence of Bang's disease for a period of one calendar year. Ten demonstration herds qualified for a state certificate of freedom from Bang's disease in the year 1933, 18 in 1934, 27 in 1935, and twelve have qualified thus far in 1936.

Only 15 University Bang's disease demonstration herds have been dropped since the beginning of the program in 1929. They are as follows:

8 herds through dispersal.
4 herds have been transferred to the U.S.B.A.I. vaccination program.
2 herds through non-compliance.
1 herd was transferred to a project in the Experiment Station of the University of California.
Field trials have also been initiated in eleven additional herds by vaccinating groups with U.S.B.A.I. culture 19 in cooperation with the Division of Veterinary Science of the University of California.

In conclusion, the control of Bang's disease in the demonstration herds has been very successful. This may be attributed to the fact that the coöperators are carefully selected, understand the program to which they are subscribing, and have an economic interest in controlling Bang's disease. The extension veterinarian also offers recommendations for the most effective procedures, having in mind the economic welfare of the owner and coöperator. The attitude of the coöperator is more significant to a successful program than the equipment at hand. This extension program includes all types of herds from most modest to those of elaborate equipment. Herds where the disease is quiescent naturally will have encouraging experiences as compared to those herds experiencing storms of abortion. A program that is based on the segregation of the infected animals from the non-infected, and supplemented by raising heifers and calves to maturity free from disease, has the advantage of keeping blood lines of high production and excellent type in the herds.

**President Wisnicky:** I wish to thank Dr. McKay for coming here to discuss the Bang's disease problem in southern California. Now we approach that part of the program that we might term the advance guard. You know before a program such as the Bang's disease program or any other animal disease program can be advanced, it is necessary to clear the road for the work. I think the Committee on Bang's Disease has been clearing the road for years so that this Bang's disease program might be advanced. For a number of years, Dr. C. P. Fitch, of the University of Minnesota, has been serving as chairman of that committee and I wish to take this opportunity to commend him for the splendid work he has been doing. You know, some people are so willing to work and when we find them, we put the responsibility on them and let them go ahead. I think Dr. Fitch has worked hard this year and has a very fine report to present. It is a pleasure for me to introduce Dr. C. P. Fitch, who will give you that report.

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

**REPORT OF COMMITTEE ON BANG'S DISEASE**

Dr. C. P. Fitch, Chairman, Saint Paul, Minn.
Dr. Cecil Elder, Columbia, Mo. Dr. H. C. Givens, Richmond, Va.
Dr. S. B. Foster, Portland, Ore. Dr. A. E. Wight, Washington, D. C.

1. Your Committee desires to recommend the continuance of the present federal-state Bang's disease program. The progress of this program has already been presented to you. The activities of the past year show that, in general, the work has continued satisfactorily.
There are, of course, in the progress of this work, several things which should be carefully considered. We desire at this time to call particular attention to some of the more important phases of this work.

2. Laboratory facilities for carrying out these activities vary widely in the different states. Laboratories have been established in some of the states where previously facilities were very meager. In other states, additional technicians and labor have materially added to the facilities of laboratories already in existence. These changes have in due course brought about additional variations in procedure in some cases, and in others the procedures have been made no more uniform.

We would recommend that all antigens used be carefully retested under federal supervision in order that uniform sensitivity may be secured. This should apply not only to the antigens used in the federal-state project but also to those employed in state and private tests. Laboratories and field veterinarians should strive to make their procedures uniform.

3. Provision was made in the first federal contract for restrictions on additions to herds treated under the program. Time has shown that these provisions were necessary, in fact, essential to the success of this work. Replacements are difficult to obtain in certain localities. There is a great temptation, on the part of the owner who is replacing reacting animals, to be insufficiently careful concerning their origin. Before additions are made, previous infection should be removed by careful cleaning and disinfection following the disposal of the reactors. Carefully selected negative replacements are usually more susceptible than the animals in the herd and must be properly safeguarded. Purchasers should be warned of the danger of relying on the results of a single test. This phase of Bang's disease is in a similar position to replacements in connection with bovine tuberculosis 20 years ago. We should bear in mind the same general safeguards that have become so well established in connection with tuberculosis control. These safeguards are all the more important because of the greater prevalence of Bang's disease. Among these safeguards are: (a) due consideration of herd history, (b) origin from clean herds or clean areas, (c) installation of proper sanitation facilities and (d) parturition stalls.

4. In the early part of the federal-state Bang's disease program, retests were not conducted sufficiently often, and in many localities this is true at the present time. We believe that more frequent retests will increase the efficiency of the work. It is very important that frequent retests be made in herds showing a rising infection or one recently infected. A single negative herd test should be warned of its limitations, especially pertaining to negative tests of pregnant cows.

5. There is always a tendency, in the application of biological tests in the control of infectious diseases, to ignore the necessity of hygiene and sanitation. All sources of infection are not removed from a herd when the reactors to the agglutination test for Bang's disease are slaughtered. It is true that Brucella abortus is not so hardy an organism outside the animal body as is the tubercle bacillus. This increases the efficiency of careful cleaning and disinfecting. The fact does not diminish the necessity and need of these processes. It seems to your committee that it is very important to clean a barn or shed properly as well as to disinfect it. We desire to emphasize to all veterinarians carrying on Bang's disease control, that proper hygiene and sanitation are imperative. Special attention is directed to the use of utensils such as pitchforks and shovels. Manure forks and shovels should be identified by notches or red handle tops, so that their intended exclusive use is plainly indicated. The proper management of the pregnant animal, especially just prior to and following parturition, is
particularly important and cannot be ignored if satisfactory results are to be obtained. Reactors not removed immediately for slaughter should be carefully segregated from the negative animals and held in complete isolation.

6. We are still afflicted with the sequelae acquired from the former terminology of Bang's disease. To overcome a well-rooted nomenclature requires years of strenuous effort. Contagious abortion and infectious abortion are still used to designate Bang's disease. Many live stock owners still believe that an animal infected with Bang's disease should abort, and the corollary, that all animals abort which are infected with Bang's disease. Authoritative statements have been made that this is not true, but the impression still clings and causes a great deal of misunderstanding which is difficult to explain satisfactorily. We realize the difficulty which a field veterinarian encounters when asked to explain to an owner why a recent aborter in his herd is negative to the test. This condition is not surprising. This is a natural sequence of the terminology which for years has clung to this disease. We must meet this situation unitedly. We cannot expect cattle-owners to believe a half-heartedly given explanation which may not be entirely clear to the individual making it. Studies indicate that an appreciable number of abortions are due to causes other than Brucella abortus, and further, animals may be infected with the Brucella organism and never abort. These facts are gradually becoming disseminated. We must do all we can to aid in their fuller comprehension.

7. Studies on vaccination have been continued during the past year by some experiment stations and especially by the federal Bureau of Animal Industry. Encouraging results of the efficiency of calfhood vaccination with a culture of Brucella abortus of reduced virulence make it evident that this method should be tried out under field conditions. Already approximately 220 herds containing about 16,000 animals have had 2,400 calves vaccinated under the supervision of the Bureau veterinarians. The average infection of Bang's disease in these herds is about 27 per cent. The result of this experiment will be watched with a great deal of interest.

Your Committee regrets exceedingly that certain agencies have seen fit to capitalize on these and other experiments by recommending the general use of vaccines for the control of Bang's disease. Vaccination for Brucella abortus infection is still in the experimental stage. The results so far obtained with calfhood vaccination are encouraging. General vaccination at present cannot be recommended. We should be patient and await the results of the carefully planned field experiments which are now in progress. It takes many years, during which more than two pregnancies have passed, before results can be obtained which will give us the true picture of the value of vaccination.

8. Many states do not have adequate laws or regulations governing Bang-positive animals. Your Committee knows that proper safeguards are not taken in many states to designate and quarantine such dangerous animals satisfactorily. Your Committee recommends that each state study its Bang's disease control measures and take the proper steps to protect its Bang's disease-free herds properly.

**Regulations Providing for Bang's Disease-Accredited Areas**

The extent of the area shall be determined by state and federal agencies cooperating. When testing is started, the area shall be placed under quarantine and the following rules shall be enforced:
1. All cattle which may be used for dairy or breeding purposes, except those for immediate slaughter, when imported, brought in or allowed to enter the quarantined area, shall conform to the following rules:

(a) Cattle from Bang's disease-accredited areas or herds officially Bang's disease-free-accredited according to the U. S. D. A. standard, may enter the area without being retested. All such cattle shall be identified and shall be accompanied by approved certificates.

(b) All other male or female cattle shall be blood-tested and found free of Bang's disease by an officially recognized agglutination method within 30 days prior to the date of entry, and shall be maintained in quarantine separate from other cattle and shall be retested in not less than 30 nor more than 60 days after the date of entry. If found free, they shall be released from quarantine.

2. All cattle in the area, including calves six months of age or over, which may be used for dairy or breeding purposes, shall be tested. All animals reacting to the agglutination blood test for Bang's disease in dilutions of 1:100 or more shall be slaughtered within 30 days of date of test, and all premises where such reacting animals were found shall be cleaned and disinfected.

(a) If, as the result of one test of all male and female cattle in the area, the infection does not exceed 1 per cent, all infected herds shall be placed in quarantine and retested at 30- to 90-day intervals until they pass two consecutive negative tests and pass a further negative test not less than six months from the date of the second negative test, when the area shall be declared a Bang's disease accredited area for a period of one year by state and federal agencies cooperating.

(b) If, as a result of a complete retest of all male and female cattle in the area, made at the end of the period, less than 0.5 per cent of infection is found, the area may be declared a Bang's disease accredited area for a period of three years, provided infected herds are treated according to paragraph (a).

(c) If, as the result of an original complete test of all male and female cattle in an area, the percentage of infection is found to be not greater than 0.5 per cent, the area may be declared a Bang's disease accredited area for a period of one year, providing that all infected herds in the area are treated at 30- to 90-day intervals until they pass two consecutive negative tests and pass a further negative test not less than six months from the date of the second negative test.

(d) An area may be re-accredited for an additional three-year period from the last date of accreditation, when not less than 10 per cent of all herds of cattle, including calves six months of age or over, which may be used for dairy or breeding purposes, and all previously infected herds in the area are retested and as a result of such test not more than 0.5 per cent of infection is found.

Dr. Fitch: Mr. President, I believe the procedure of this organization is to refer this report to the Executive Committee. I so move.

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

President Wisnicky: This report is now open for discussion. Do you have any questions to ask regarding it?

Mr. A. J. Glover: If I understand the Doctor's suggestions right, his plan is directed toward area testing. I think I missed one suggestion. What percentage of reactors in a county should there be before he would move for compulsion?

Dr. Fitch: That question was not touched on at all. That depends upon the state and federal agencies cooperating in the respective states. It would vary within wide limits, in my opinion, and would depend
TRANSMISSIBLE DISEASES OF SWINE

upon the state in which it was carried on. Your Committee made no recommendation whatever, in that regard.

Mr. Glover: I think all of us who have herds which have been tested and from which reactors have been removed, are interested in getting rid of all reactors in our neighborhood. I am wondering if we could not arrive at a time, and there are only a few stubbornly holding out, when education has been carried on sufficiently to demonstrate the value of accredited areas, when compulsion could be asked. I wonder if it would not be an opportune time to state somewhere near the percentage when compulsion would be required. To start compulsion in an area where the educational program has not been carried on would not be wise, but there are counties in our state where we are nearly ready and it seems to me that a few people do not have the right to prevent the many from having protection from this infection.

Dr. Fitch: That is the belief of the Committee, Mr. Glover, but I think the exact percentage is a matter for local determination, allowing local agencies and contributing causes to determine that.

President Wisnicky: Is there any further discussion on this report? If not, I wish to thank you, Dr. Fitch, and your Committee for your diligent work and the splendid report which you have presented.

Dr. R. A. Hendershott: I move that the meeting adjourn until tomorrow morning at 9 o'clock.

The motion was seconded, put to a vote and carried, and the meeting adjourned at 4:10 p.m.

ADJOURNMENT

THURSDAY MORNING, DECEMBER 3, 1936

The third session convened at 9:00 a.m., President Wisnicky presiding.

President Wisnicky: The meeting will now please come to order.

In performing the various functions of this organization we have one duty and that is the election of officers. This comes on the last day of the meeting. It has been customary to appoint a nominating committee. What is your pleasure in respect to this?

Dr. H. D. Proctor: I move that the President appoint a nominating committee.

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

President Wisnicky: In accordance with those instructions, I will appoint the following to serve on that committee:

Dr. E. T. Faulder, New York, Chairman.
Dr. Edward Records, Nevada.
Dr. Herman C. Hinehart, Illinois.

This committee will form a slate, nominating members for the various offices of this organization and have a report ready when the election of officers comes in the regular order of business.

Now today, we are going to spend the forenoon on that most interesting subject, "Transmissible Diseases of Swine." If you will look at your printed program, you will find that the report of the Committee on Transmissible Diseases of Swine comes last, but it has been thought advisable to make a change. Therefore, we shall ask for the report of the Committee on Transmissible Diseases of Swine, by its able
chairman, Dr. A. T. Kinsley. Dr. Kinsley has been giving serious consideration to this problem and there is a brief report to make, but this year the main emphasis was placed on the program. The Committee is anticipating that many interesting things which will be of much value to you will come out in the various papers and discussions. I now take great pleasure in presenting Dr. A. T. Kinsley to give us the report of his Committee.

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

REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF SWINE

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

Your Committee again this year has deemed it advisable to devote the major portion of the time allotted to the swine section to papers and discussions on certain specific swine diseases and new developments in the prevention and control of hog cholera. The Committee's report, therefore, will be brief and confined to a few general statements.

Hog cholera, enteritis and swine erysipelas, in the opinion of the Committee, continue to be the most important transmissible diseases of swine, ranking in importance in the order named. There was a marked decrease in the prevalence of these and other transmissible diseases of swine during the late summer and fall months. However, because of the large reduction in the number of hogs on farms in the Corn Belt states, as a result of the shortage of feed due to the severe drouth which visited these states the past summer.

The extensive drouth has not only served to reduce the hog population but it appears to have been responsible for lowering the quality of the feed produced in the hog-raising districts of the drouth areas, so that they are deficient in certain of the important elements which have to do with maintaining the normal resistance of swine and other animals to infectious diseases. Reports received by the Committee indicate that in recent weeks there has been an increase in the losses following vaccination against hog cholera which apparently can be attributed to no other cause than a lowered resistance due to some deficiency in the diet. It is the belief of the Committee that these conditions will increase during the coming winter and spring months and may include infectious diseases affecting the breeding animals. The Committee feels justified, therefore, in suggesting that the kind and quality of feed available should be considered in connection with the prevention and treatment of transmissible diseases of all swine in the drouth areas.

DR. KINSLEY: Mr. President, I move that the report be adopted by this body. It has already been received by the Executive Committee.

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

PRESIDENT WINSICKY: As Dr. Kinsley has said, they have a really heavy program for you on this subject and I think the first paper that is to be presented here is of great interest to you because it comes from the field of research. I take great pleasure in introducing to you Dr. T. W. Munce, of Sioux City, Iowa, who will discuss "Experiments with Crystal-Violet Hog Cholera Vaccine."

... Dr. Munce read his paper. ... (Applause)
EXPERIMENTS WITH CRYSTAL-VIOLET HOG CHOLERA VACCINE

By T. W. Munce, Sioux City, Iowa

The brilliant scientific achievements of Dorset, McBryde and Niles have annually endowed the swine-raising industry of the world with monetary benefits of such magnitude that they cannot be computed. Through their discoveries of hog cholera virus, anti-hog cholera serum and the simultaneous use of these products for immunization, these workers became not only benefactors of the agricultural world, but they also became outstanding promoters of medical science. To the latter they made available the two products which research workers in general regard as having the greatest immunizing efficiency of any agents yet known to science.

Notwithstanding the almost perfect efficiency of serum and virus for the prevention of hog cholera, Dorset and McBryde continued their studies of immunizing agents against that disease. Such is the spirit of true scientists—always striving for perfection. One of the final accomplishments of Dorset's life was the discovery of a crystal-violet vaccine, which in early experiments promised to rival the serum and virus treatment in immunizing value. Subsequent to Dorset's death, study of this vaccine has been continued by his illustrious coworker, McBryde, and other members of the scientific staff of the United States Bureau of Animal Industry. To date, a detailed report of their experimental work has not been published. However, a report by McBryde at the 1936 meeting of the American Veterinary Medical Association indicated that their results up to that time had been very satisfactory.

Early this year the Bureau of Animal Industry very graciously supplied information concerning the manufacture of this crystal-violet vaccine to commercial producers of anti-hog cholera serum and to other interested institutions. The purpose of that action, doubtless, was to promote a more general experimental study of the vaccine and to determine, if possible, its value as an immunizing agent when produced by different workers and when used under a variety of conditions. As a result, we have been privileged to make certain studies of the vaccine. The following is a report of our observations to date. It is realized that the scope of our work thus far has been insufficient to justify definite conclusions, in fact, additional work may alter some of our present views. At any rate, it is hoped that this preliminary report may prove of some assistance to other
workers and thereby contribute to a successful study of this important subject.

In some respects our results have not been so satisfactory as those reported by McBryde and his coworkers. It should be distinctly understood that this report is in no sense an effort to discount or to challenge their results. In the preliminary stages of any research development, different results are frequently obtained by different workers, especially when working under different conditions.

THE VACCINE

The results herein reported were obtained from the use of ten experimental lots of crystal-violet hog cholera vaccine. Each lot of vaccine was prepared substantially in accordance with information obtained from the Bureau of Animal Industry. With each 90 parts of virulent defibrinated blood were mixed, first, 10 parts of an aqueous 1 per cent solution of phenol and, second, 5 parts of an aqueous 1 per cent solution of extra pure crystal violet. This vaccine mixture was then held for 14 days at a temperature of 37.5° C.; thereafter it was stored under refrigeration. Each lot of vaccine contained equal, or nearly equal, amounts of defibrinated blood from at least two and, in most instances, from three virus-producing pigs; these pigs were bled on the seventh day following inoculation, and after having exhibited, for at least two days, grave symptoms of acute hog cholera.

Our experience in the production of this vaccine would lead us to endorse the practice of bleeding pigs in a manner which will prevent contamination of the blood during that operation; of holding each virus pig’s defibrinated blood separately; of culturing each pig’s blood and rejecting non-sterile bleedings; of incubating each pig’s defibrinated blood separately, and of culturing again at the end of incubation, before mixing. Crystal violet is bactericidal only for Gram-positive organisms; defibrinated blood is an excellent culture medium and when incubated for two weeks it will enable even a slight contamination by crystal violet-resistant organisms to ruin the product. At the present time, we are inclined to believe that the rejection of product, because of gross contamination at the end of incubation, will constitute a material item in the cost of producing the vaccine on a commercial scale.

Some improvements in the physical and chemical nature of the vaccine will doubtless result from further study. In its present stage of development, the viscosity is sufficiently high to render the vaccine somewhat difficult to handle in syringe
equipment. It also exhibits a pronounced tendency to foam when agitated, as in rapid handling. This undesirable tendency should be eliminated, if possible, in order to prevent excessive waste of the product and to prevent gross inaccuracies in the doses actually administered. A criticism of less importance will probably be registered by practitioners, because of the extent to which the crystal violet may stain their equipment and clothing.

**ATTENUATION TESTS**

After the vaccine mixtures had been held at a temperature of 37.5° C. for 14 days, a portion of each lot was injected into cholera-susceptible pigs, for the purpose of determining that proper attenuation had been obtained. Doses of 5 cc and 10 cc were employed. These tests proved that the ten experimental lots of vaccine covered by this report were properly attenuated. It might be permissible to report the fact that several lots of experimental vaccine, not included in this report, demonstrated some degree of virulence after having been attenuated as stated above. Further studies, therefore, may or may not indicate the necessity for some modification of the attenuation temperature or period.

It would appear permissible to consider that the degree of attenuation may be a factor of some importance in the degree of immunity stimulated by the vaccine. At the present time we do not have definite proof that the virus in the attenuated product has been killed, rather than merely modified in nature. If the virus does remain alive in the vaccine, our tests would indicate that it is modified to a degree which renders it incapable of causing hog cholera, if eliminated from the bodies of vaccine-treated pigs. This is indicated by the fact that cholera-susceptible pigs were in contact with our vaccine-treated pigs throughout these experiments. These susceptible pigs remained well during the experiments and later proved susceptible when inoculated with hog cholera virus.

While none of the vaccine pigs developed hog cholera in our attenuation tests, all of them did not remain well. On the 14th day after one group of 58 pigs received vaccine, a condition resembling swine influenza made its appearance among them. A total of eight pigs sickened, but all recovered within a few days. Two other pigs developed pneumonia and died during our attenuation tests. Several facts cause us to believe that none of these were cases of hog cholera resulting from improperly attenuated virus in the vaccine. These facts are:
1. The symptomatology and pathology were not those of hog cholera.

2. Some of the pigs which sickened and recovered, later proved to be susceptible to hog cholera.

3. Untreated control pigs in contact with the sick pigs remained well, and later proved susceptible to hog cholera.

While these reactions following the administration of the vaccine were not hog cholera and could not therefore be directly charged to the vaccine, they naturally aroused thought as to whether or not the vaccine might lower resistance and thereby predispose vaccinated animals to other infections, subsequent to its administration. It is a generally accepted view that the administration of unattenuated hog cholera virus, either alone or with serum, is followed by a decline in resistance to secondary infections. All of the immunological and physiological factors involved in this decline of resistance are not known. However, one demonstrable feature thereof is a pronounced leukopenia. An effort was made, therefore, to determine whether or not a leukopenia follows the administration of the crystal-violet vaccine. Cell counts were made of the blood of a number of vaccine-treated pigs and a leukopenia was noted in at least some of the animals. Our experimental data on this point to date are too limited to warrant a statement concerning the degree or duration of this leukopenia. Further studies and observations will be required to determine whether or not it is sufficiently severe to induce post-vaccination infections.

**Immunity Tests of Vaccine-Treated Pigs**

The vaccine-treated pigs were tested for immunity after the expiration of periods which varied from 21 days to 201 days following the administration of the vaccine. Their immunity was determined either by the administration of fresh hog cholera virus of proven virulence, or by pen contact for 48 hours with cholera-sick pigs. In this report we show the results of the immunity tests in two tables for a purpose which will be explained later.

In table I are shown the results of immunity tests of 73 pigs, each of which received 5 cc or 10 cc of one of the nine experimental lots of crystal-violet vaccine indicated.

The totals show that of the 73 pigs tested for immunity, 14 died, 13 showed severe reactions, three showed mild reactions and 43 remained well. Reactions were classified as "mild" when the animals were noticeably dull, depressed and slow, but still
showed some desire to eat. Reactions were classified as "severe" when the animals became definitely sick and refused feed.

Table II shows the results of immunity tests of pigs treated with crystal-violet vaccine, lot 006.

The data in table II shows that of 47 pigs exposed as indicated, nine died, four showed severe reactions, two showed mild reactions and 32 remained well.

Table I—Immunity tests of pigs previously treated with nine lots of crystal-violet vaccines.

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>PIGS</th>
<th>AGE OF VACCINE WHEN INJECTED*</th>
<th>DAYS ELAPSING BEFORE EXPOSURE TO VIRUS</th>
<th>VIRUS EXPOSURE (cc)</th>
<th>PIGS DIED</th>
<th>REACTION</th>
<th>PIGS WELL</th>
</tr>
</thead>
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<tr>
<td>A-1</td>
<td>2</td>
<td>1 93</td>
<td>21</td>
<td>2 0</td>
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<td>SEvere</td>
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<td></td>
<td>1</td>
<td></td>
<td>21</td>
<td>2 0</td>
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<td></td>
<td>1</td>
</tr>
<tr>
<td>A-22</td>
<td>1</td>
<td>1 82</td>
<td>21</td>
<td>2 0</td>
<td>1</td>
<td></td>
<td>1</td>
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<td>22</td>
<td>2 0</td>
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<td>1 55</td>
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<td>41</td>
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<td>Totals</td>
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<td>14</td>
<td>13</td>
<td>3</td>
<td>43</td>
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</table>

*Stated in days and computed from completion of attenuation.

Combining the results shown in tables I and II, we find that of a total of 120 vaccine-treated pigs tested for immunity as indicated, a total of 23 died, 17 showed severe reactions, five showed mild reactions, and 75 remained well. In any attempt to interpret these results as an index to the immunizing efficiency of the vaccines, it might be considered unfair to charge against the vaccines the deaths of the two animals which were "hypered," in other words, received 5 cc of virus per pound body weight. It would be fair to include the other animals which received excessive doses of virus because they remained well.
Excluding the two animals which were "hypered," we find that of the remaining 118 vaccine-treated pigs which were tested for immunity:

21 pigs (17.7 per cent) died.
17 pigs (14.4 per cent) showed severe reactions.
5 pigs (4.2 per cent) showed mild reactions.
75 pigs (63.5 per cent) remained well.

**Table II—Immunity test of pigs previously treated with one lot of crystal-violet vaccine.**

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Pigs</th>
<th>Age of Vaccine When Injected*</th>
<th>Days Elapsing Before Exposure to Virus</th>
<th>Virus Exposure (cc)</th>
<th>Pigs Died</th>
<th>Reaction</th>
<th>Pigs Well</th>
</tr>
</thead>
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<td></td>
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<td></td>
<td></td>
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<td>Severe</td>
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<td>1</td>
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<tr>
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<td>5</td>
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<td>22</td>
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<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>106</td>
<td>10.0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>121</td>
<td>50.0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>139</td>
<td>Hyp'r'd</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>168</td>
<td>50.0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>201</td>
<td>50.0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

*Stated in days and computed from completion of attenuation.

It is our opinion that the foregoing figures are still somewhat unfair, if they are to be regarded as an index to the immunizing efficiency of the vaccines. With the facilities available for this work, it was not possible to conduct blood-filtration and pig-inoculation tests to determine that the cause of death in each instance was or was not hog cholera. The possibility therefore exists that some disease or factor other than hog cholera may have been responsible for one or for several of the deaths or reactions; in fact, two or three of the pigs which died revealed lesions which caused us to suspect the existence of some other disease, at least as a complicating factor. On the other hand, when pigs which have remained well while held under close observation for a period of three or four weeks, develop severe illness within four to eleven days following their inoculation with hog cholera virus of proven virulence, and when certain phases of their illness suggest hog cholera, a logical conclusion naturally attaches some responsibility for that illness to the virus with
which they were inoculated. That line of reasoning has for years been followed in the interpretation of potency tests of anti-hog cholera serum. Therefore, it would appear satisfactory in the interpretation of vaccine immunity tests.

Perhaps the most unfavorable feature of our results as shown in tables I and II is the irregularity in the degree of immunity developed by the vaccine-treated pigs. Additional experimental work will be required to determine whether the fundamental fault rests in the vaccine or in our technic of its preparation and administration. The possibility also exists that we are not following the proper procedure in our tests for immunity. Could it not be possible that a protective degree of immunity is developed by some animals later than three weeks following the administration of the vaccine.

The results in tables I and II show that most of the deaths and severe reactions occurred in pigs which had been treated less than 42 days. Furthermore, they also apparently indicate that the degree of immunity was much greater at 91 to 201 days than at 21 to 42 days following vaccine treatment. That is especially true if the test doses of virus, ranging from 2 cc to 50 cc, can be regarded as an index. To us, this relatively higher degree of immunity after 90 days is one of the most surprising features of these experiments.

If this apparent finding is confirmed by further work, it will suggest for consideration the possibility that the virus in the vaccine is alive; that, perhaps in a modified nature, it is capable of living, multiplying and stimulating immunity for a considerable period after injection. We are unable to explain this apparently continued increase in immunity from the standpoint of any factor outside of the vaccine. We at least believe that it was not due to exposure of the experiment animals to hog cholera virus after the vaccine was administered. The vaccine-treated pigs were held in non-infectious quarters, every precaution was taken to avoid carrying virus to them and cholera-susceptible pigs were in contact with them throughout the experiments.

A degree of immunity sufficient to protect pigs against 50 cc of hog cholera virus is quite complimentary to the vaccine. However, practical considerations prompt the hope that maximum immunity will be found available much earlier than 90 days after the pigs have been treated. In that connection it should be noted that these experiments included only one immunity test involving four pigs, between the 42nd and 91st days following vaccine treatment. Therefore, this relatively high degree of immunity may have developed earlier than the 91st day.
INFLUENCE OF AGE OF VACCINE UPON ITS IMMUNIZING EFFICIENCY

The ages of the various lots of vaccine were computed from the date on which their attenuation was completed.

The results of the experiments reported herein do not reveal a consistent relation between the age of the vaccine and its immunizing efficiency. Perhaps it should be noted that vaccine 006, at the age of 166 days, satisfactorily immunized 11 (91.7 per cent) of a group of 12 pigs. However, at the age of 116 days, this same lot failed to immunize satisfactorily any of a group of three pigs and at the age of three days, it satisfactorily immunized 21 (65.6 per cent) of a group of 32 pigs. The immunizing efficiency of vaccine 006 might therefore be considered as 65.6 per cent at the age of three days, 0.0 per cent at the age of 116 days and 91.7 per cent at the age of 166 days. That the immunizing efficiency of the vaccine should increase with age is inconceivable. We therefore consider that these results were due to some factor other than the age of the vaccine at the time it was used, and we conclude that no information of value on the point in question was supplied by our experiments.

THE USE OF ANTI-HOG CHOLERA SERUM WITH THE VACCINE

The possibility of a slowly developing immunity, and other practical considerations, indicated the advisability of determining whether or not the administration of anti-hog cholera serum in conjunction with the vaccine would influence the resulting degree of active immunity. Twenty-two pigs were selected for this experiment. Two pigs received 60 cc of serum each; ten pigs received 5 cc or 10 cc of vaccine each, and ten pigs received 60 cc of serum in conjunction with 5 cc or 10 cc of vaccine each. Anti-hog cholera serum, serial 5122, and crystal-violet vaccine, lot 006, were used. Large doses of anti-hog cholera serum were employed for the purpose of intensifying any restraining influence which the serum might exercise in the development of immunity. In order to permit the expiration of the passive immunity conferred by the serum, immunity tests were not started until 106 days after treatment. In conducting the immunity tests an effort was made to inoculate the pigs in groups of four, so that each group consisted of one pig which had received 10 cc of vaccine plus 60 cc of serum, one which had received 5 cc of vaccine plus 60 cc of serum, one which had received 10 cc of vaccine alone and one which had received 5 cc of vaccine alone. The test doses of fresh, virulent hog cholera virus employed and the results of the tests are shown in table III.
CRYSTAL-VIOLET HOG CHOLERA VACCINE

Only one of the two serum-alone treated pigs was inoculated with virus, because that pig and the serum-vaccine treated pigs, proved that the passive immunity conferred by the serum had expired at the time these tests were started.

The results in table III show that eight of ten pigs tested from 106 to 201 days after receiving vaccine plus anti-hog cholera serum, developed hog cholera when inoculated with 2 cc of virulent virus. On the other hand, eight of ten pigs which had received similar doses of vaccine alone, and had been held under

<table>
<thead>
<tr>
<th>DAYS AFTER ORIGINAL TREATMENT</th>
<th>ORIGINAL TREATMENT</th>
<th>PIGS EXPOSED</th>
<th>VIRUS EXPOSURE (cc)</th>
<th>PIGS DIED</th>
<th>REMAINED WELL</th>
<th>SICK 2 DAYS RECOVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>106</td>
<td>Serum</td>
<td>1</td>
<td>2.0</td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Vaccine</td>
<td>2</td>
<td>10.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serum-vaccine</td>
<td>2</td>
<td>2.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>121</td>
<td>Vaccine</td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serum-vaccine</td>
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<td>2.0</td>
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</tr>
<tr>
<td>139</td>
<td>Vaccine</td>
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<td>Hypered 200</td>
<td>2</td>
<td></td>
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<tr>
<td></td>
<td>Serum-vaccine</td>
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<td>2.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>168</td>
<td>Vaccine</td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serum-vaccine</td>
<td>2</td>
<td>2.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>201</td>
<td>Vaccine</td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Serum-vaccine</td>
<td>2</td>
<td>2.0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vaccine</td>
<td>10</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serum-vaccine</td>
<td>10</td>
<td></td>
<td>2</td>
<td>7</td>
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</tr>
</tbody>
</table>

the same experimental conditions, survived inoculations of 10 cc to 50 cc of virulent hog cholera virus. These results indicate that the simultaneous administration of anti-hog cholera serum in conjunction with crystal-violet vaccine results in a very unfavorable influence on the degree of active immunity stimulated by the vaccine. This finding is in accord with results reported by McBryde.1

INFLUENCE OF METHOD OF ADMINISTRATION ON IMMUNITY

During the course of these experiments the question arose, as to whether or not the subcutaneous administration of the vaccine might result in a stronger and earlier immunity than if the vaccine were administered intramuscularly. In order to obtain
some information on this point, 32 pigs were selected for an experiment. Sixteen pigs received either 5 cc or 10 cc of vaccine intramuscularly and 16 pigs received similar doses of the same serial of vaccine subcutaneously.

After the expiration of 21 days, five pigs of the intramuscular group and six pigs of the subcutaneous group were tested for immunity by the inoculation of 1-cc doses of virulent virus. Two of the pigs in the subcutaneous group died and four remained well. One of the pigs in the intramuscular group showed a very severe reaction, one developed a mild reaction and three remained well.

After the expiration of 41 days following their treatment with vaccine, the balance of the pigs in both groups each received 1 cc of virulent virus. Of the remaining eleven pigs in the intramuscular group, three showed severe reactions and the others remained well. Of the remaining ten pigs in the subcutaneous group, one showed a severe reaction, one exhibited a mild reaction and the others remained well. The combined results of the immunity tests of the animals in both groups are shown in table IV.

**Table IV—Results of immunity tests, intramuscular and subcutaneous methods.**

<table>
<thead>
<tr>
<th></th>
<th>VACCINE ADMINISTERED</th>
<th>VACCINE ADMINISTERED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INTRAMUSCULARY</td>
<td>SUBCUTANEOUSLY</td>
</tr>
<tr>
<td>Pigs</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Severe reactions</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Mild reactions</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pigs remaining well</td>
<td>11 (68.7%)</td>
<td>12 (75.0%)</td>
</tr>
</tbody>
</table>

The number of pigs in this experiment was insufficient to justify a definite conclusion as to which method should be employed in the administration of the vaccine. The results apparently indicate, however, that practically the same degree of immunity was obtained following the intramuscular injection of the vaccine as was obtained following its administration subcutaneously.

During these experiments we made an observation which perhaps should discourage the intramuscular injection of the vaccine. Examination of the sites of the injections, in pigs which died, revealed the fact that the dye (crystal violet) had not been completely absorbed after four weeks or slightly longer. In
some instances a small encysted lesion was found in the hams, which might or might not have been capable of causing improper curing. This would seem to recommend the subcutaneous injection of the vaccine at a site and in a manner which will not result in damage to the dressed carcass.

**DOSAGE OF VACCINE**

Throughout this report we have not distinguished between pigs which received 10 cc of vaccine and those which received 5 cc. In practically all instances we have placed both classes of pigs in one group and referred to them as "vaccine-treated pigs." There were two reasons for this procedure. The number of pigs concerned in these experiments is too limited to justify conclusions regarding such an important point as proper dosage of the vaccine. Furthermore, the results of these experiments did not clearly indicate superior immunizing value on the part of the 10-cc doses as compared with that of the 5-cc doses. In support of that statement we cite the results of the immunity tests shown in tables I and II. The pigs which received 10 cc of vaccine were in most instances paired throughout these tests with pigs which received 5 cc of vaccine, and were held under the same experimental conditions. The total of 120 vaccine-treated pigs consisted of 50 pigs which had received a 5-cc dose of vaccine and 70 pigs to which 10-cc doses had been administered. The distribution of the deaths and reactions between these two dosage groups is shown in table V.

**Table V—Results of immunity tests, 5-cc and 10-cc doses of vaccine.**

<table>
<thead>
<tr>
<th></th>
<th>5-cc Dose Vaccine</th>
<th>10-cc Dose Vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>Deaths</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Severe reactions</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Mild reactions</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Pigs remaining well</td>
<td>27 (54.0%)</td>
<td>48 (68.5%)</td>
</tr>
</tbody>
</table>

The results shown in table V may indicate a slightly greater immunizing efficiency for 10-cc doses of vaccine, but the total number of pigs involved is insufficient to justify serious consideration of that possibility.

**SUMMARY**

It is realized that the scope of the preliminary experimental work reported herein is not sufficiently comprehensive to justify
definite conclusions regarding any phase of the subject yet investigated.

Certain improvements in the physical and chemical nature of the vaccine are desirable.

Improvement of production procedures is desirable in order to prevent excessive growth of contaminating organisms during attenuation of the vaccine.

The attenuation of the vaccine by holding at a temperature of 37.5° C. for 14 days may or may not require some modification.

The administration of the vaccine was followed by a leukopenia. This leukopenia may or may not be of sufficient degree and duration to invite post-vaccination infections.

Immunity tests of 118 vaccine-treated pigs, 21 to 201 days following the administration of the vaccine, resulted in 21 deaths, 17 severe reactions, and five mild reactions; 75 pigs, or 63.5 per cent of those tested, remained well.

Irregularity in the degree of immunity developed by vaccine-treated pigs was perhaps the most unfavorable feature of our experimental results.

There was some experimental evidence suggesting the existence of a stronger immunity 91 to 201 days following vaccine treatment, than existed after a post-injection period of 21 to 42 days. If confirmed, this observation suggests the possibility of a slowly developing immunity and raises a question as to whether the virus in crystal-violet vaccine is alive or dead.

These experiments furnished no dependable information concerning the probable influence of the age of the vaccine upon its immunizing efficiency.

Large doses of anti-hog cholera serum apparently interfered with the immunizing efficiency of crystal-violet vaccine, when both products were administered simultaneously.

The degree of immunity stimulated by subcutaneous and by intramuscular injections of vaccine was approximately equal. Other considerations seem to advise against its use intramuscularly.

The results of these experiments did not clearly indicate superior immunizing efficiency on the part of 10-cc doses of the vaccine as compared with that of 5-cc doses. Conclusions regarding dosage should not be considered until a large number of experimental results are available for study.

ACKNOWLEDGMENT

The author wishes to express his appreciation to Dr. S. H. Regenos, Dr. L. E. Willey, Dr. F. W. Larson and Mr. Paul Pur-
win, of the scientific staff of Allied Laboratories, Inc., for their suggestions and assistance in this work.

**REFERENCE**


Dr. A. EICHHORN: I do not have very much to add to the conclusions reached by Dr. Munce. However, I should like to make a few remarks pertaining to this procedure of changing from the simultaneous method, or the orthodox method of control, to the modified vaccine.

We know very well that efforts have been made to modify viruses in every conceivable way in order that they might be utilized from immunization purposes. Thus far, the efforts in general have been rather unsatisfactory. So what Dr. Dorset said and his coworkers published on the procedure of preparing the crystal-violet vaccine has created considerable interest here as well as all over the world. Efforts have been made to check these findings and the report you have heard represents the results obtained from one institution. I am sorry to say that practically all the work, up to the present time, on a large scale, has been conducted by commercial laboratories. Of course, we fully appreciate industry in the production of serum and virus and industry is very much concerned if any changes are to be made in the procedure of developing immunizing products. Manufacturers should know in time whether to proceed along another line than the one they have been practicing up to date.

Now, we ourselves, have followed the description of the method of preparing the vaccine as has been published by the Bureau of Animal Industry, but our experiments were rather limited and confined to about 15 lots of pigs, each representing about five to eight pigs. The experiments were started in January and we finished the work the latter part of August.

In the first efforts to produce the vaccine, we found considerable difficulty and, as also pointed out by Dr. Munce, that it is very essential to obtain a virus free from contamination. We know well that these contaminations may come either directly from the circulating blood, or the virus may become extraneously contaminated. But in either case, organisms should not be present at the time when an effort is made to produce a vaccine, because the crystal violet is not sufficiently bactericidal to prevent the growth of many of the organisms, especially the gas-producing type. Therefore, we developed a method of bleeding hogs under sterile conditions and although we have had some difficulty, it was not greatly important, because it is purely a matter of technic and that can be developed so it will work in practice. However, we must guard against one thing and that is that frequently hogs selected for virus production may harbor in their circulatory system organisms of the septicemic type. So it is very essential that the blood of each hog selected for vaccine production should be found free of such contaminating organisms.

I am not going to take much of your time but I would like to summarize the results of the 16 lots of virus taken and used for vaccine production. We found that in seven lots, the pigs were protected with the vaccine and subsequently withstood the immunity test with 2 to 5 cc of virus. In one lot we practically failed and in the other lots the vaccine was responsible for the sickening of the hogs which ultimately recovered. In all these different lots we had a break from the immunity test. Thus, in all, we might say, sixty-five per cent of the vaccinated hogs showed positive evidence of a solid immunity and
in the other cases, we had either failure or partial failure. These tests were conducted on a very limited scale and even on the scale reported by Dr. Munce, it is not safe to draw conclusions. I believe that if the Bureau of Animal Industry would undertake the vaccination of hogs in the field under all conditions there would be some good results. We heard from the report that many times hogs are vaccinated when they are suffering from a deficiency disease of some kind and these are conditions which we might not meet in all cases.

So, in all conditions the vaccine should be tested on 100 or 200 hogs which would enable us to draw definite conclusions. You remember well, when the suckling pig vaccination was advocated, the Bureau undertook to test this procedure on many thousands of pigs and after a certain number of failures they decided against it. So, I believe a matter of this kind would be well worth while and the results would give us a basis to show definitely that the vaccination is either worth while or not.

For the present, at least, it certainly has opened a field and while crystal violet vaccine might work with hog cholera and might not with other viruses, this can be explained by the fact that possibly in hog cholera we have factors which are not present in other virus diseases. In hog cholera, the blood of the animal, during a certain stage, has a virus in a greater concentration than in other virus diseases and this fact probably makes it possible to develop a vaccine which will be useful in the general immunization of hogs against cholera. (Applause.)

DR. J. D. RAY: Just a few personal observations following the use of three lots of crystal-violet hog cholera vaccine prepared similar to that described by Dr. Munce. The experimental outline furnished by the B. A. I. was followed as nearly as practicable in these tests, which were made at the plant of the Corn States Serum Company, Omaha, Nebraska.

All pigs used were purchased from farms that were supposed to be free from disease, and they were kept in isolated quarters for the first three weeks after receiving the crystal-violet vaccine. Daily temperatures were taken. Check pigs proved the lots to be susceptible to hog cholera.

Thirty-three pigs have been vaccinated with crystal-violet vaccine, using doses of 3, 5 and 10 cc. Two pigs that received 5 cc and three that received 10 cc developed secondary infections and died within three weeks after receiving the crystal-violet vaccine. Another 10-cc dose pig became sick, but recovered. This pig was disposed of without further testing.

The 27 pigs remaining were given 2 cc of virulent hog cholera virus three weeks after the crystal-violet vaccine. Three of these had received a 3-cc dose of vaccine. All sickened and two died. Thirteen received a 5-cc dose of vaccine. Five sickened but recovered. Seventeen received a 10-cc dose of vaccine. Two sickened and recovered.

Five of these have been hyperimmunized with hog cholera virus, 150 to 195 days after receiving the crystal-violet vaccine. One died from shock at the time of hypering. The four others showed a solid immunity and were bled in the usual manner. Fourteen others have been tested for immunity by injecting 7 to 10 cc of virulent hog cholera virus, 110 to 230 days after receiving the crystal-violet vaccine. They remained well. The other animals are being held for later exposure.

An experiment was started to determine the value of the simultaneous use of crystal-violet vaccine with anti-hog cholera serum. Ten pigs weighing 35 to 40 pounds were selected. Three pigs received 2 cc of vaccine and 15 cc of serum. Four pigs received 5 cc of vaccine and 15 cc of serum and three pigs were given 10 cc of vaccine and 15 cc of serum. Seventy-five days later, two pigs from each lot receiving
vaccine and serum were given 7 cc of virulent hog cholera virus. The pigs that received 2 cc and 5 cc of vaccine with serum developed hog cholera. One pig that received 10 cc of vaccine and serum sickened and the other was slow, but both recovered.

Our experience with these few animals would indicate that animals carrying a latent infection are prone to develop secondary complications after vaccination with crystal-violet hog cholera vaccine. The size of dose seems to be an important factor. (Applause.)

President Wisnicky: We have another paper, prepared by Dr. W. H. Boynton, Gladys M. Woods and Dr. F. W. Wood. I am pleased to introduce Dr. Boynton, who will continue this discussion.

... Dr. Boynton read his paper. ...

PROGRESS IN HOG CHOLERA CONTROL WITH TISSUE VACCINE

By William H. Boynton and Gladys M. Woods

Division of Veterinary Science, University of California
Berkeley, Calif.

and F. W. Wood, Berkeley, Calif.

INTRODUCTION

At the risk of being adjudged guilty of tiresome repetition, the writers wish to reiterate the statement that, among the factors responsible for the spread of hog cholera, the presence of unmodified virus in the field is a definite hazard. The simultaneous method of immunization is, in itself, probably the most adequate one for establishing resistance to the disease but the human element concerned in the handling of the unmodified virus required by this method is much less reliable. Lack of strict regulations governing the use of a dangerous product has lifted the administration of virus out of the province of competent veterinarians, where it properly belongs, and permitted its indiscriminate use to become directly responsible for many so-called "breaks." Then, too, the ever-present menace of the contagiousness of unmodified virus must be considered. That small proportion of pigs which apparently cannot be rendered immune will remain a source of infection to the premises.

In spite of years of application of the simultaneous method of immunization, as pointed out by Kinsley and Records, unrestricted use of active virus, together with insufficiently controlled transportation and many other factors, makes hog cholera accountable still for frightful losses among swine.

Indeed, the history of virus infections has shown not a single instance of eradication of the disease by means of a serum-virus method; on the other hand, tissue vaccines, already proved
satisfactorily in rinderpest, are more successful measures for combating this type of infection.

It has become of gravely increasing importance, therefore, that an efficient but less dangerous procedure should be substituted for the serum-virus method, and tissue vaccines claiming to fulfill these requirements have been described. The United States Bureau of Animal Industry report presented by McBryde, at the meeting of the A. V. M. A. this year, indicates that good results have been obtained with their crystal-violet blood-vaccine method. The tissue vaccine, on which Boynton reported first in 1933, has shown very favorable results also.

METHOD OF PRODUCTION

Since Boynton's previous reports on the subject of hog cholera tissue vaccine, slight modifications have been and are constantly being made to improve the quality as well as to increase the efficiency of the vaccine. The method of production for field application, briefly reviewed, is as follows: Finely ground tissues of spleen, lymph-glands, kidney, testicle, spinal cord, red marrow of bone, and blood are mixed with an equal volume of diluting fluid, which is composed of 3 parts of physiological saline and 1 part of glycerin, and is buffered at pH 7.4. One per cent of eucalyptol is added to this mixture, which is now ground several times through a colloid mill. This insures, in a few minutes, a much smoother-textured liquid product than the formerly used ball mill, which was allowed to turn for an average of 72 hours. The finely divided particles, so obtained, should afford a more even distribution of virus and chemical modifying agent, and, consequently, a more thorough contact between the two. After the milling is completed, the vaccine is passed through a 40-mesh sieve without mechanical aid, and is then bottled and stored in the refrigerator.

The period of attenuation of the vaccine was varied for different lots, but an average of about eight weeks elapsed before the vaccine was tested. It is hoped, but not yet proved, that the colloid mill process will shorten the period required for sufficient attenuation.

To test the efficiency of each lot of vaccine, two doses of 5 cc each are injected intramuscularly into the neck or axillary space of an average of six pigs at intervals of two weeks. At the expiration of two weeks following the last injection, the vaccinated pigs and two controls, which were placed in the same pen with the others at the time of the first injection, are each given 1 cc of virus. Most of the vaccine pigs should survive the in-
jection of virus, while the untreated control pigs should develop hog cholera within seven days. The number of survivals among the vaccinated group determines the relative potency of the lot of vaccine tested. In addition, since two susceptible control pigs are with the vaccinated group throughout the immunization period, the test shows that there is no spread of hog cholera infection from the vaccine-treated pigs to susceptible control animals.

Observations in connection with the preparation of a potent vaccine seem to suggest that only virus-inoculated pigs should be used for vaccine production. With regard to the potency test, it has been noted that recently weaned pigs or pigs of low weight do not readily adapt themselves to change of feed and laboratory conditions and, consequently, become unthrifty; hence, pigs weighing less than 40 pounds do not represent a fair test.

EXPERIMENTAL PROCEDURES

Among several experimental procedures tried recently, one was directed toward ascertaining the keeping quality of tissue vaccine under adverse conditions. In this experiment, a 250-cc bottle of potent vaccine was exposed in a clear glass bottle to daylight and room temperature for 38 days. Immediately following this period, six pigs were injected with 5 cc of this exposed vaccine and all six proved resistant to subsequent virus inoculation.

To investigate somewhat the possibilities of shortening the period required for attenuation, one lot of vaccine was placed in the incubator at 37.5° C. for one week and then stored in the refrigerator. Two days after its removal from the incubator, six pigs were injected with the vaccine. Of these six, four survived virus inoculation later. The evidence of this experiment and of immunization experiments now in progress indicates a reduced attenuation period may well be hoped for, but no more definite statement can be made at this time.

FIELD TRIALS

On March 30 of this year, field immunization was undertaken, and to date two herds of grain-fed pigs totaling approximately 2,600 pigs have been vaccinated.

The herds chosen for these field trials were ones in which the owners had sustained great losses as a result of serum-virus immunization, and, consequently, were extremely dissatisfied with this method. The owner of the smaller herd declared that most of his losses resulted from misuse of virus on his premises. In
the larger herd, mortality due to secondary infections, principally necrotic enteritis, varied from 25 to 60 per cent in former years. From October, 1934, to April, 1936, an attempt was made, on some 4,000 pigs, to control necrotic enteritis in this herd by means of *Salmonella supestifer* bacterins. These bacterins were saline suspensions of agar cultures and, later, mixtures of saline suspensions and whole cultures. For the first few trials pigs three weeks of age were selected, but these failed to show good results. From then on, pigs ranging from one day to one week old were treated. Results were encouraging but occasional flare-ups continued to occur, and the possibility of controlling the infection through the use of bacterins was abandoned for the present, particularly as the owner was desirous of trying some other method of immunization against hog cholera in the hope that such a method might aid in stemming fatalities from inter-current infections. The history of these herds and, especially in the larger herd, the conditions existent on the premises recommended these pigs for field experiments in which the relative efficacy of the tissue vaccine and serum-virus methods could be compared.

Vaccination of these herds was accomplished in two injections of 5 cc each, and was adapted more or less to the weaning method used by the owners. Since the owners customarily weaned their pigs at eight weeks of age, the first injection of vaccine was made when the pigs were six weeks old and the second at the end of eight weeks; in other words, at weaning time. This was the procedure applied to most of the pigs, but in the smaller herd, which numbered just 184 pigs, all but 20 were already weaned at the time of vaccination.

Eight to twelve weeks after the second injection, a few of the vaccinated pigs were selected from the group and brought to the laboratory where they were each given 1 cc of virus to test their susceptibility to hog cholera.

Among the 34 field-immunized pigs brought to the laboratory for the immunity test, three deaths occurred, making a loss of 9 per cent. It should be stated at this time that nine lots of vaccine have been used in the field so far and of these nine, six, judged by the number of pigs surviving the potency test, had an efficiency of 100 per cent. The pigs given the immunity test, to date, have included groups vaccinated with but two of these 100 per cent lots, one 83 per cent lot and the remainder of the virus-inoculated groups were vaccinated with two lots ranging in potency from 50 to 75 per cent. It was among these two groups that the above-mentioned 9 per cent loss occurred. This would
tend to suggest that a vaccine with an efficiency of not less than 80 per cent should be required for field practice.

Field losses in the previously mentioned small herd of 184 pigs, some of which were coughing at the time of vaccination, numbered two after the first immunizing dose. No deaths occurred, however, following the second injection of vaccine. No accurate estimate of losses following vaccination of the larger herd could be obtained but not a single case of hog cholera has been observed and, according to the owner's report, substitution of the tissue vaccine method for the simultaneous method caused a marked reduction in losses from secondary conditions. In addition, among the cases of enteritis which did occur, a much higher percentage of recoveries was noted than when the simultaneous method was practiced. A further advantage is that, while growth of pigs appears to be retarded for a period following serum-virus immunization, pigs treated with tissue vaccine showed no reaction and reached marketing weight at least a full month earlier when the latter method of immunization was used.

From these results, it is obvious that the tissue vaccine method produces an adequate immunity, markedly reduces the possibility of losses from pneumonia or enteritis and, therefore, can be satisfactorily substituted for the simultaneous method. The progress obtained with this method, which does not introduce active virus into the field, suggests the brightest outlook for hog cholera control thus far.

REFERENCES


Dr. H. J. Shore: I am very much interested in this work and I am sure everyone in the audience is. Dr. Munce and Dr. Ray referred to hyperimmunization of some of these vaccinated pigs and I should like to ask if they have tested the potency of the serum from these hypers.

Dr. J. D. Ray: We have not tested the potency of this serum yet because we have not had it long enough.

President WISNICKY: We come to the subject "Swine Pox," and Dr. Charles Murray, Dean, Division of Veterinary Medicine, Iowa State College, Ames, Iowa, will open the discussion. Dr. Murray.

. . . Dr. Murray read his paper. . . . (Applause.)
Swine pox is a disease of comparatively rare occurrence. In European literature it has been reported and described by Spinola, Laquerriere, Szanto and others. Poenaru succeeded in infecting healthy pigs with the blood and with lymph from the lesions of pigs suffering with pox. He submitted evidence that the disease is due to a virus, filtrable through coarse filters. Velu, in Morocco, observed outbreaks generally benign but in some instances serious. Up to the time of his studies, it had been considered that the disease in swine was always associated with pox in other domestic animals and in man, but Velu found no evidence to substantiate this belief. He observed that in spite of the conditions that prevailed in Morocco favorable to the transmission from swine to humans, such never occurred.

Glasser states that swine pox occurs most commonly in young pigs and that, except in warm countries, it is not usually a serious infection; that general disturbance with fever is rare, and that the virus is closely related to that of vaccinia and smallpox and is transmissible to calves and sheep. Rivers, in his classification of filtrable viruses, records swine pox as more closely related to pox of horses, sheep and goats in that they are all distantly related to smallpox and cow pox. In Iowa, McNutt, Murray and Purwin for several years, in the course of routine examinations of swine, observed peculiar skin eruptions which they tentatively diagnosed as swine variola. In 1928-29, the condition occurred more commonly in swine submitted for diagnosis, while field reports of peculiar skin lesions were more numerous.

In order to remove doubt as to the authenticity of the diagnosis of swine pox, a few pigs from a herd showing a high incidence of the infection were obtained and careful study of these cases was instituted. According to the observations of these investigators, the disease occurred in young swine from suckling age up to 200 pounds weight but not in aged hogs. It was observed in all seasons of the year. All pigs in a herd were not affected, though in some herds up to 80 per cent showed lesions. When generalized disturbances occurred the animals were usually found suffering from other diseases at the same time and to the latter such symptoms were generally referred. The eruptive processes were commonest along the belly and on the inner surfaces of the legs. In pigs with extensive lesions the spread was
over the sides and sometimes, though rarely, along the back and on the face and ears. No lesions were ever observed on the nose, lips, tail, or anus, or much below the hock-joint or knee.

The earliest observed change in the skin was the appearance of a slightly elevated, reddish, congested area, 0.5 to 1 cm in diameter. The surface soon changed to a lighter color of semi-transparent appearance, due to the formation of tiny vesicles. No large vesicles or pustules were ever observed. The central area of the elevated spot changed from its vesicular appearance to a gray area that became dark brown, shrunken, and scab-like. The affected epidermis about this central area retained its normal position, such that the lesion assumed an umbilicated, pox-like appearance. The central portion continued to dry, became harder, and with the subsidence of inflammation, stood out above the general level of the skin and fell off as a scab.

To determine whether the disease could be transmitted, a pig and two rabbits were inoculated. The latter were shaved over the thigh and the skin was scarified with a blunt needle previously scratched through fresh lesions of naturally affected pigs. In five days, a few pimples appeared along the needle scratch but they healed promptly. A 50-pound pig was inoculated on the side by scarification. Fifteen days later, well developed pox lesions were present over the belly, inner surfaces of the legs and, to some extent, on the sides, with but few appearing in the region of inoculation. The case was mild with the subject eating well and remaining active for 30 days. Sections made from the lesions of this experimentally induced case were identical with those examined from field cases.

In a pen in the same barn, 40 feet from the inoculated pig, were a number of 60-pound shotes being used in an experiment with hog cholera virus. Eighteen days after the first lesions were detected on the inoculated pig, 10 per cent of those in this remote pen showed well defined pox lesions. The infection was believed to have been carried by mice, of which there were large numbers in the barn. Apparently the simultaneous exposure of this group to hog cholera virus had no influence upon their susceptibility to pox virus nor did the latter in any manner affect the course of cholera.

Sections for microscopic study were made from field cases, from experiment pigs accidentally infected, and from one purposely induced case. Comparative studies showed them to be identical. Microscopically the first change apparent was a dilation and filling of the more superficial capillaries of the corium at certain localized points, together with a slight swelling of the
prickle cells and vacuolization in a few of the prickle cells in these areas. At this stage, there was little or no leukocytic infiltration in the corium and no foreign cells in the epidermis. The cells of the affected portions of the epidermis, particularly the prickle cells, swelled to several times their normal size; their cytoplasm stained faintly. Swelling of the cells increased the thickness of the epidermis and gave the impression of hyperplasia but it was impossible to observe any marked increase in the number of cells. The increase in thickness of the epidermis, which was four to eight times that of adjacent normal tissue, was due rather to swelling of the cells.

Areas of vacuolation in the cell usually began near or around the nucleus. Seldom was there present in the same cell more than one vacuole, which increased in size and finally occupied nearly the entire cell area. The nucleus after its initial enlargement shrank in size, became shriveled, took odd forms until finally its site was marked only by small particles of chromatin which also disappeared, leaving only the borders of the cell which inclosed the vacuole and some small particles of degenerated cytoplasm. Vacuolar degeneration may be applied to the form of degeneration taking place in these cells. No multinucleated, degenerating cells were found.

A reticulum was formed by the remaining borders of the degenerated cells. The reticular material did not often rupture, so that there was not much evidence of communication between the different vacuoles. A breaking down of the reticulum took place in what might be termed the pustular stage. Evidence of fluid exudate coming from under the epidermis was not marked in the set of slides examined. Vacuolar degeneration depends to some extent on fluid exudate. The more superficial layers of the corneum were nearly always lost and often there was evidence that they had been pushed off by a collection of fluid under them. No collection of fluid between the degenerated cells was observed. The remaining opposing borders of the cells were in apposition.

Up to this time there had been no cellular infiltration of the epidermis but during the later stages there was a collection of leukocytes in the superficial portion of the corium. Degeneration and necrosis of the prickle cells first became complete just under the stratum corneum in the center of the lesion. Into this area infiltration with leukocytes took place. Evidently leukocytes were attracted by necrosis rather than by any virus present. In smallpox, Councilman noted the late cellular infiltration of pox vesicles and offered the above explanation. Cellular infiltration
continued from this point to the sides and depths of the degenerated and necrotic area. The reticulum also was destroyed, although not until the leukocytes had become necrotic or degenerated.

Involvement of the malpighian layer was not uncommon but usually only small areas were affected. Desiccation and condensation began early and evidently in the center of the lesion. The entire infiltrated areas shrank into a granular, amorphic mass. Healing took place with growth of epithelium from the margin of the lesion when the malpighian layer was destroyed, also from the entire malpighian layer under the lesion when not destroyed. Cornification of the surface of the new epithelium took place, so that the dried mass of purulent material and cellular detritus was covered on the outside by the old, changed, cornified epithelium and under it was the newly formed stratum corneum. At or before this time, the scab-like mass was rubbed off or lost. Umbilication seemed to be due to drying of the central part of the well-advanced lesion and to a more active inflammation about its circumference.

Secondary bacterial infection did not have a part in any of the limited number of slides examined. Bacteria were found in the later stages but then only on the very surface in any numbers. In the stage of vacuolar degeneration many cellular inclusions were noted, both in the prickle cells and in the columnar cells of the malpighian layer. Bodies were present in the cytoplasm and in the nucleus. Some of the bodies were evidently products of degeneration, others were not identified and no particular study was made of them. Eosinophiles were very numerous in the corium in the late stages, but were not noted in the epidermis.

Evidence that the disease is swine pox is afforded by the gross general character of the lesions, the development and healing of the lesions, and that it is a highly infectious, contagious affection of young pigs. Further, microscopic study shows that the initial lesion with its degeneration of the epithelial cells, the late infiltration with leukocytes, and the healing process are all quite typical of pox in other animals. Our findings are in accord with those of Velu in that rabbits were refractory to inoculation. The course of the disease, the absence of serious losses and serious symptoms, and the healing and recovery as observed here are much like the disease known as swine pox in Germany and described by Glasser. Absence of serious losses is explained by Glasser when he says that swine pox is most apt to be benign in temperate climates. The only objection that might be raised
to the term pox is that vesicles of any size were not found and that pustules such as those present in smallpox and cow pox were not observed. It is possible that large vesicles and true pustules can develop in what is known as swine pox, but detailed descriptions of such are not available. Again, it should be remembered that swine pox is rather distantly related to smallpox and cow pox. Absence of true pustules cannot be explained on the ground that the cases observed were abortive. They were mild but not abortive. However, there are often different forms of pox in the same species of animals.

On the basis of the above it is proposed that the disease be known as swine pox or swine variola.

DR. F. M. WILSON: Swine pox is very interesting to me at this time. I practice in eastern Iowa and I think that at the present time swine pox is quite prevalent in my territory. It was also quite prevalent in the fall of 1935.

My experience in the field has led me to believe that the condition, at times, can be really serious to the swine-grower. Whether that is due to the devitalizing effect of the pox allowing the ravages of secondary invaders or primarily to a very severe case of pox, I am not prepared to say. However, I selected this specimen from a group in which there were some 35 fall pigs weighing about 50 pounds each. When I took this specimen, there was already a loss of two pigs and this pig would, undoubtedly, have succumbed to enteritis. In this pig, the ventral surface of the body was absolutely covered with pox scabs as well as the back, the ears, the face and well down on the legs as far as the hocks. I find that quite commonly in these severe cases. Also, in this particular pig I found a condition which I had been told of but had never seen before. I found quite distinct pox marks in the mucous lining of the stomach. That is the only time I had ever seen that condition.

A few observations that I have made in my experiments in the field are that, as Dr. Murray stated, it is a disease of comparatively young hogs and most all of the severe cases are found in pigs weighing from 25 to 50 pounds and occasionally in a hog six months old. In my experience, it was quite a hazard in the simultaneous serum-virus treatment against hog cholera. You can get rather disastrous results. In this connection I should like to say, too, that the postmortem findings in many cases, whether they are due to secondary invaders or to the pox itself, can very closely resemble the picture of hog cholera in a number of ways—congested lymph-glands throughout the body—so the postmortem picture could very easily confuse one.

In my experience it has been a condition that occurs in the fall and winter months. It has largely been, wherever I have found a severe outbreak, that the hogs have been very lousy. As a closing statement, I would say that in my experience in the field, the control or eradication of the hog louse is the major factor in controlling and alleviating swine pox in the field.

DR. J. R. RAY: Mr. Chairman, I should like to ask Dr. Murray or someone else what the dangers are with reference to pox virus being spread through hog cholera virus when it is used as a simultaneous immunizing agent.
DR. MURRAY: I am afraid I cannot answer that. I should not think it would be considered as a hazard.

DR. WILSON: From my observation in the field, I do not believe I have ever gotten any serum or virus that was infected with pox virus. I have never been called back on post-vaccination trouble where pox did not exist before. As far as its introduction into these various herds is concerned, at no time have I ever been able to trace where it came from originally.

PRESIDENT WISNICKY: Is there any further discussion? If not, we shall move on to our next subject, "Anthrax in Swine." The speaker who will open the subject needs no introduction. Dr. L. Van Es, Department of Pathology, University of Nebraska, Lincoln, Nebraska. Dr. Van Es has appeared before this body for many years and has presented many very able papers on various subjects. It gives me great pleasure to present to you Dr. Van Es.

... Dr. Van Es read his paper. ... (Applause.)

ANTHRAX IN SWINE

By L. Van Es, Lincoln, Neb.

Department of Pathology, University of Nebraska

Anthrax is not commonly considered so important a menace to swine as it is to other forms of farm live stock, in which the disease is apt to declare itself with terrifying severity. In comparison with the marked mortality frequently observed in cattle, the tangible losses caused by anthrax in swine seem negligible. As recent as 25 years ago, there still were observers who sincerely doubted the occurrence of the disease in hogs and this opinion found some support in the many reported failures to induce the infection in that animal species by artificial methods.

That these views and opinions were erroneous can no longer be doubted. In all probability they were largely based on a lack of understanding of anthrax as it occurs in swine. The well-known characteristic features of the disease in cattle, in which the acute and peracute septicemic form of the malady predominates, was quite naturally expected to be displayed also by infected swine, whereas in this animal, with few exceptions, anthrax is likely to be of a more benign nature, tending toward chronicity and often without being accompanied by any objective symptoms at all.

As a result of the investigations of Dammann and Freese,1 Elsässer and Siebel,2 Elsässer,3 Glage,4 Nieberle,5 and Zwick,6 the nature of swine anthrax has become better understood. They showed conclusively that in Germany, at least, the disease is by no means uncommon and that its characteristic features must be attributed to the fact that the susceptibility to anthrax on the part of this species is far less marked than the one displayed by other farm animals. This apparent resistance dominates the
patho-anatomic as well as the clinical manifestations presented by swine, when actually involved in the disorder.

The epizoötiologic backgrounds of swine anthrax in this country differ somewhat from those prevailing in Germany, but the fact remains that especially in our own anthrax areas, the disease in swine is by no means uncommon. In its more conspicuous form we see it or hear about it annually and it is quite probable that in its more chronic and benign forms, the majority of the cases escape observation.

There are large contiguous areas in this country where anthrax exists enzootically and as, in at least part of this territory, a rather dense hog population is normally maintained, a certain anthrax morbidity can be reasonably expected.

That the incidence of swine anthrax in Germany is apparently much higher than in the United States must probably be attributed to the fact that the latter does not, to the same extent, import raw materials of animal origin, such as bones, from the Orient and other regions and which eventually are apt to find their way into commercial feed stuffs.

It seems quite probable that aside from the cases of anthrax in swine which result from mere carelessness, the disease in this country does not exact a heavy toll from its swine-growers. On the other hand, the disease presents certain potentialities other than the immediate economic one and these give it a more than casual importance. Hence, in my livestock sanitary scheme to prevent and to control anthrax in general the malady in swine should also receive full consideration.

CAUSES

Anthrax in hogs is caused by the same microbic factors as in other animals.

The tendency of the swine disease to assume a more or less chronic form or even to occur as a latent infection, enables the animals thus involved to become instrumental as spreaders and may for the same reason present something of a public health problem.

Swine, as a rule, acquire the infection by the introduction of anthrax bacilli into the alimentary tract. This may come about by intimate contact with anthrax-bearing soil but probably oftener by the ingestion of contaminated foodstuffs. Evidence has been presented that the notable increase of chronic intestinal anthrax in Germany could be attributed to the feeding of fish meal to which bone meal was added, which had been prepared from imported raw materials. In this country, the rather com-
common practice of feeding the carcasses of cattle to swine is, without doubt, the most frequently observed mode of transmission.

**SYMPTOMS**

Anthrax in swine may present itself as an acute septicemic disorder or as a more or less chronic malady.

In the acute cases, general systemic symptoms are usually observed after an incubation period of from two days to one week. The affected swine are listless, dull and as they do in other acute diseases of the species, the animals tend to secrete themselves in the litter. There is a considerable degree of depression, the appetite fails and the body temperature is apt to range between 105° and 107.5° F. As an accompaniment of the fever, an increased respiratory frequency is usually observed and the pulse rate is also well above the normal. Muscular trembles (chills) are often noted and various observers have called attention to the presence of icterus, apparently associated with duodenal involvement.

In perhaps the greater number of cases of swine anthrax observed in this country, the acute manifestations are accompanied by disturbances of a local character, arising from the presence of pharyngeal or tonsillar primary lesions. The parts affected present edematous tumefaction, often progressively extending to the submaxillary space, the neck, the axillae, the pectoral region and occasionally even to the abdomen.

The skin covering these areas may be marked by dark red or livid patches. The parts are hot to the touch, without being particularly tender when pressed upon. As a result of mechanical obstruction thus brought about, deglutition becomes difficult and respiratory distress may be shown by a loud, snoring sound. Head and neck are rigidly extended and the mucosae as well as the skin becomes cyanotic. The animals struggle for air, strangle and attempt to vomit.

As a rule, the evolution of this form of swine anthrax is a rapid one and death is apt to occur in from 12 to 36 hours. However, recovery, even of the more alarming cases, is by no means exceptional. Glässer\(^5\) states that not less than 20 per cent of the cases recover without treatment.

In the cases of swine anthrax in which the infection entered through the intestines instead of through the pharynx, the local phenomena described above are absent. In this type the general systemic symptom complex is not uncommonly accompanied by such digestive disturbances as nausea, diarrhea or constipation,
which may or may not be conspicuous in accordance with the character and extent of the intestinal involvement.

In the chronic forms of anthrax with lesions of a purely local nature, as a rule, no distinct clinical manifestations can be observed. In the majority of such cases the swine present no evidence of sickness at all. The lesions may come to light only in the abattoir and Miessner and Lütje called attention to the fact that many such cases had never shown evidence of illness.

**LESIONS**

Either a less marked susceptibility or a more active resistance on the part of swine is accountable for the fact that the patho-anatomic picture of the malady is apt to present a greater variety of changes in this species than in other farm animals. Whereas, in the latter the disease is usually of an acute, septicemic type, leaving but little time for the development of specific manifest changes, in the case of swine, a less rapid course, a more marked tendency toward chronicity and local lesions may engage the observer's attention. Even in the more acute cases of swine anthrax, local lesions commonly indicating the ports of entrance of the infection are often seen.

Aside from these the phenomena of acute disease of the more susceptible species may be revealed. They are the tarry, liquid blood and the conspicuous congestion and enlargement of the spleen. In addition, a degree of damage to the parenchyma of liver, kidneys and heart may be noted. As a rule, such necrobiotic changes are cut short by early death and do not result in pronounced lesions.

In anthrax of hogs, primary local lesions are most commonly associated with the pharynx and adjacent parts, as well as with the intestines. They vary in extent and intensity in accordance with the acuteness or chronicity of the disorder as presented in the individual cases. They may appear as local or independent manifestations or as part and parcel of an acute systemic infection.

As observed in the pharynx and the peripharyngeal structures, the lesions manifest themselves by swelling and a more or less intense hyperemia. The parts may be intensely inflamed and are commonly marked by a very conspicuous edema which is apt to involve a considerable area.

The tonsillar tissues are commonly the seat of primary infection and the mucosae are frequently covered by a fibrinous exudate and marked by petechial and ecchymotic hemorrhages.
The latter may be extended to the integument covering the parts.

The intense hyperemia may be focal and then take on the form of small carbuncles. The inflammatory reaction often results in necrotic changes and the formation of vesicles. Shallow ulcers are frequently seen. The necrotic areas have a brownish or yellowish gray color which tends to assume a lighter tint as the disease endures. Upon section they present a rather dry consistency, a light pastel coloration and, as a rule, they are firmly attached to the surrounding structures.

**Intestines:** When the intestine supplied the site of inoculation, large and small lesions may be observed, especially in the duodenum and jejunum. Such changes may be slight and localized in some cases, whereas in others several feet of the gut may be involved. An intense enteritis may come under observation, which commonly presents a serohemorrhagic or hemorrhagic-necrotic character.

The affected mucosa is dark red and swollen, the changes frequently being confined to a certain section of the bowel only. The inflamed mucous membrane is somewhat raised above the level of the normal lining and frequently it is sharply delimited from the latter. Some hemorrhagic areas may be observed.

In the more or less prolonged cases, hemorrhagic-diphtheritic lesions may be seen and occasionally a hemorrhagic fluid fills the intestinal lumen. Owing to a progressive inflammatory process, the intestinal wall is prone to become thickened, rigid and, with a rounded lumen, may come to resemble a piece of garden hose.

Necrotic lesions are frequently encountered. They may be small and circumscribed or covering extended areas. Ulcers with ragged edges and a hemorrhagic or grayish base may thus be formed, especially near the mesenteric attachment. In some cases only one small ulcer may be found. The area involved is at first marked by a light red color which deepens into a dark red or brownish tint and finally assumes a slate-like coloration.

The ulcers are commonly preceded by the formation of an eschar apparent from the serous surface by a reddish gray or yellowish gray coloration. In the course of time, such eschars are apt to be cast off, after which healing may proceed. In that case cicatrization follows which, upon completion, leaves an irregular scar with contracted margins. When cicatrization is extensive it may cause intestinal stenosis accompanied or not by peritoneal adhesions.

The serous coat of the intestine may not present any lesions at all, but occasionally small areas of a deep red color may be
observed, most commonly at the level of Peyer's patches. In cases of some duration, a loosely attached fibrinous exudate may cover the serosa and even a plastic peritonitis may develop by which the intestinal coils become soldered together. In others small star-shaped scars may be seen, usually opposite the side of an intestinal ulcer.

The mesentery may be found without marked changes even if the lymph-nodes are thoroughly involved. When the mesentery does participate in the pathologic process, its blood and lymph-vessels are seen to be distended and the space between the mesenteric layers may be filled with a yellow serous fluid.

Occasionally an intestinal ulcer leads to perforation and then gives rise to an ichorous peritonitis, while secondary microbial invasion may result in abscess formation in which a fetid purulent material may be a marked feature.

*Lymph-nodes:* The lymph-nodes regional to the affected parts nearly always, although not constantly, become involved in the infection. The latter gives rise to a hemorrhagic fibrinous necrotic lymphadenitis. The affected lymph-node is often markedly enlarged and especially the nodes which receive the lymph drain of the pharynx and adjacent structures may appear as from two to five times their normal size. They are commonly distinguished by a dark, brownish red color and upon section they reveal a hemorrhagic and edematous interior.

In the more acute cases the entire lymph-node may be involved, whereas in the more chronically developing ones, only certain parts may present evidence of a pathologic nature. Particularly in the more chronic intestinal anthrax of swine the lesions may be confined to a single node only and even then the involvement may be a partial one. Such lesions are not always readily to be found.

Necrotic changes in the involved node may be an early manifestation. The dark red color of the organ then becomes lighter, brick-red or pinkish and finally assumes a grayish yellow tint.

The necrotic process may pertain only to a limited portion of the lymph-node, the diseased part being separated from the normal tissue by a yellowish line of demarcation. The consistency of the node gradually changes. Its tissue becomes drier and under the influence of pyogenic or other microbial invaders may finally soften. Part or all of the lymph-node may thus become affected and the node gradually becomes surrounded by a dense, connective tissue capsule.

*Spleen:* In the acute, septicemic cases of hog anthrax the spleen may present the same changes as may be observed in other
animal species similarly affected. The organ is greatly enlarged and intensely hyperemic. Its pulp, enclosed in a tense capsule, is of a blackish red color and of a softened consistency. Upon incision the pulp wells up from the intertrabecular spaces and a tarry blood exudes from the cut surface.

On the other hand, in the more chronic forms of the disease, the spleen may not display any gross lesions. However, in a part of the cases of swine anthrax, nodular formations of a very dark red color may be seen, either within the substance of the organ or hemispherically projecting from its surface. These so-called carbuncles have a rather firm consistency and when incised they present a dry appearance. These infarct-like lesions are the result of a localized hemorrhagic-necrotic inflammatory process.

Other organs: Aside from the parenchymatous changes, occasionally observed in the kidneys, liver and heart, anthrax lesions in the organs other than the ones mentioned are not commonly observed. In rather rare instances they have been observed in the lungs, and hemorrhagic areas are occasionally observed in the renal cortex.

DIAGNOSIS

In the acute form of the malady, in which blood and spleen show the changes peculiar to anthrax, the causative microbe can be readily demonstrated in various organs. In the chronic cases, on the contrary, a marked paucity of the bacilli is a rather usual feature. For the purpose of a bacterioscopic diagnosis in cases of this type, recourse must be had to material obtained from such local lesions as may be supplied by the retro-pharyngeal or mesenteric lymph-nodes, as well as by the carbuncular foci in the spleen.

The bacilli observed in smears from such organs are frequently conspicuous by an unusually thick capsule and by a marked variation in their affinity for the stains applied. Organisms of classical morphologic appearance and well stained are seen commonly enough, but among them there are bacilli in which the chromatin substance is unevenly distributed. Intensely stained, irregular clumps and granules are apt to be observed in the bacillary body (pycnosis).

Other types in which the bacilli are formed into chains of extraordinary length, often occurring as long, flexible filaments, may be seen. A common observation pertains to anthrax bacilli which are but faintly stained or not at all. In the latter case the microbes appear as empty capsules owing to the complete disintegration of the chromatin substance. Such microbic forms
are apparently involved in degenerative changes or even death, which may be attributed to the action of the defensive substances present in this more or less refractive animal species.

As a general rule, anthrax bacilli are entirely absent from the blood of the chronic cases. Nor are they to be found in the normal-appearing spleens of swine thus affected. In such cases the retropharyngeal and mesenteric lymph-nodes, particularly the former, may supply the most promising material for a bacteriologic examination.

In the cases in which the bacilli cannot be demonstrated microscopically, culture methods and animal inoculations may be successfully resorted to.

The anthrax bacilli gradually disappear in the course of the healing process, the microbes perishing under the influence of the cellular and fluid elements by which the body of swine defends itself against such invaders.

A prompt clinical diagnosis, even of acute anthrax, is not always possible and frequently must remain a tentative one when only objective symptoms have to be depended on. More secure in his suspicion of anthrax is the veterinary diagnostician, when, in anthrax territory, a number of swine sicken after having partaken of a bovine carcass dead of unknown causes. If such swine also manifest acute pharyngeal involvement, an accurate diagnosis of anthrax becomes possible.

The diagnosis of chronic anthrax in swine is even more difficult, if not utterly impossible, when clinical manifestations only can be considered. If autopsy material has already become available, the possibility of a correct diagnosis becomes materially enhanced. The lesions already described are always highly significant, even if not always conclusive without resorting to bacteriologic methods.

Differential Diagnosis

Swine erysipelas and hog cholera have occasionally been mentioned as possible problems in differential diagnosis. In connection with the former, certain skin lesions and the absence of necrotic changes in the lymph-nodes should, as a rule, prevent error. The presence of acute pharyngeal and peripharyngeal involvement speaks for anthrax, rather than for any other of the acute swine disorders. In cases of swine erysipelas, the spleen is often moderately enlarged, but the intensely hyperemic swelling and the dark tarry blood of anthrax cases do not occur in this malady. Certain nodular formations and infarcts in the spleen of erysipelas cases may constitute a source of confusion
in their differentiation from the splenic carbuncles seen in anthrax. In such cases the bacterioscopic examination will, as a rule, prove to be decisive.

In uncomplicated hog cholera, necrotic lesions of the lymph-nodes are not observed. When complicated with suipestifer infection, necrotic changes in the mesenteric lymph-nodes may be observed. As a rule, they are caseous, softened and do not resemble the dry appearance of the ones presented by anthrax cases. In the latter the lymph-node involvement is nearly always observed in those regional to the affected organs, whereas in hog cholera the more remote body lymph-nodes, such as the sub-maxillary and inguinal ones, are also apt to show the hemorrhagic changes peculiar to this disease. There the tendency to various hemorrhagic lesions throughout the body and the viscera should also serve as a means to rule out an anthrax infection.

**TREATMENT**

In the treatment of swine affected with acute anthrax the prompt injection of anti-anthrax serum is indicated, although in the more rapidly progressing form of the disease all attempts at therapy may be of no avail. Although some writers have reported good results from the internal administration of creolin, it seems very doubtful that anything can be accomplished by medicinal treatment. A certain proportion of the swine tends to recover without any therapeutic intervention at all and it is by no means improbable that this tendency is more accountable for the recoveries than any non-specific treatment.

For the purpose of prophylaxis, vaccination, combined or not with serum injections, has been found to yield satisfactory results. As a further attempt at prevention, especially in anthrax territory, the feeding of carcasses should be discouraged, as in this country, at least, the greater part of the cases of acute anthrax in swine can be traced to this source.

Although the economic losses due to anthrax in swine may not be great and are largely avoidable, the tendency of the disease in this animal species to assume a chronic form, not accompanied by manifest clinical phenomena, strongly suggests the possibility that affected swine may become instrumental in the establishment of new foci of infection.

Notwithstanding the fact that the anthrax bacilli in such hogs are never numerous and contained only in lymph-nodes, they will, in the presence of open lesions in the alimentary tract, be eliminated with the feces. Soil, foodstuffs and water supplies may thus be contaminated with the always possible result of the
disease appearing among the live stock on farms quite remote from known anthrax districts.

What the extent of such a hazard may be is not known at the present, but its existence cannot be gainsaid. Within recent years, outbreaks of anthrax, in which cattle, swine and humans were involved, have been observed in a number of hitherto exempt places, far removed from recognized anthrax territory. It has not been possible to determine the manner by which the infection was transmitted. The uncontrolled movements of vehicles now largely used in the shipment of hogs and other live stock, and which operate over long distances have, of course, been suspected, but dependable evidence has not become available. The possibility that in addition to such inanimate carriers, live ones must also be given consideration if the problem of anthrax dissemination is to be adequately solved.

The public health relations of swine anthrax are likewise of importance. From time to time, chronic intestinal or lymph-node lesions have been encountered by the meat inspection service. In abattoirs which receive swine from anthrax territory, vigilance in this connection should never relax, not only as a public health measure, but also in order to identify the swine concerned and their place of origin. State live stock sanitary departments should then be promptly notified so that eventually adequate control measures may be inaugurated.

REFERENCES

5Glässer: Die Krankheiten des Schweines (1927).
7Miessner und Lütje: Arch. Tierhrn. knd., xi (1914), p. 245.

PRESIDENT WISNICKY: Thank you, Dr. Van Es. This very fine paper on anthrax in swine will now be discussed by another person who, I think, can qualify to the reputation of being competent to follow such an eminent authority as Dr. Van Es. I am pleased to introduce to you Dr. Frank Breed, of Lincoln, Nebraska.

DR. FRANK BREED: Dr. Van Es' presentation of "Anthrax in Swine" firmly convinces us that this disease is of importance, both as one of our infectious diseases and from the public health aspect. This disease, in swine, as well as other species, is caused by the ingestion of the specific organism, Bacillus anthracis. The occurrence of anthrax in swine in the United States is a recognized fact, but is of less importance economically than in other species, notably cattle, sheep and horses. The infection usually takes place either through the tonsils or the intestinal tract, resulting in a septicemia, with sudden death, a localized infection of the tonsils with involvement of the adjacent lymph-nodes, or a localization of the infection in the walls of the intestina!
FACTORS INFLUENCING COCCIDIOSIS

tract, causing a severe inflammatory process which results in hemorrhage, ulcer formation and in instances where the animal has sufficient resistance, the formation of scar tissue.

In reviewing the incidence of the disease in the United States, it appears that the tonsillar or pharyngeal type of the disease is far more prevalent than either the septicemic or the intestinal forms. When one observes swine with pronounced swelling in the throat region, with difficult respiration accompanied with sonorous sounds, the possibility of anthrax should always be given consideration, and treated as a possible anthrax infection until proven otherwise. One disease which has been confused with this type of anthrax is malignant edema. The clinical cases observed differed somewhat in that the involvement included the ears and shoulders, extending backwards over the side. There was a lack of skin discoloration and too great a quantity of edematous fluid.

Anthrax in swine usually results from the animals feeding on a carcass dead of anthrax, following cattle in years where the disease exists, or by ingesting foods or water contaminated with the anthrax organism or spore.

One of the most important aspects of this disease in swine is the possibility of infected swine acting as carriers without clinical manifestations. This may result in possibly transmitting the disease to persons handling pork products and may also be the cause of creating new centers of infection far removed from our present known anthrax areas.

In closing, let us keep in mind the fact that swine are susceptible to a greater or lesser degree to anthrax infection and that the septicemic form must be differentiated from erysipelas and cholera. The pharyngeal and intestinal forms should be submitted to a diagnostic laboratory for the final determination.

DR. E. A. WATSON: I should like to ask whether, during an outbreak of this swine form of anthrax, cattle and horses and other animals on the premises are liable to suffer at the same time. Is it as transmissible as in the other species?

DR. VAN ES: We have never seen anthrax in swine in our state unless it came from farms where other live stock had died of anthrax. In other words, swine would get it from the infected soil where other animals had died of it or by the eating of the carcasses or contaminated foodstuffs that have had contact with infected animals. We have always found anthrax in swine following the death of animals on the farm with anthrax.

PRESIDENT WISNICKY: Now we shall proceed to parasitic diseases and we have for our first paper “A Discussion of the Factors Influencing the Course of Coccidiosis,” by Professor E. E. Tyzzer, Department of Comparative Pathology, Harvard University School of Medicine, Cambridge, Massachusetts.

. . . Professor Tyzzer read his paper. . . . (Applause.)

A DISCUSSION OF FACTORS INFLUENCING THE COURSE OF COCCIDIOSIS

By Ernest Edward Tyzzer, Boston, Mass.
Department of Comparative Pathology, Harvard Medical School

After reviewing, with the aid of lantern-slides, certain general facts and principles regarding coccidium infection, I shall then endeavor to outline some of the problems having to do with cer-
tain aspects of coccidium infection, concerning which I feel that very little is known. I shall undertake no general survey of recent work in this field and my remarks will apply chiefly to coccidium infection in poultry with which I have a more intimate acquaintance.

The character of the disease encountered is determined primarily by the species of coccidium present. Thus in the chicken there are severe acute types, one for example characterized by cecal hemorrhage and due to *Eimeria tenella*, another by extensive hemorrhage and fibrinous exudate in the small intestine associated with *Eimeria necatrix*. A severe form of disease of the small intestine is also found in association with *Eimeria maxima* infection.

The severity of the disease or degree of injury as well as its duration is correlated with the weight of the infection, i.e., the number of organisms present. Thus it is found that, with very heavy infection, there is severe disease often manifested by copious hemorrhage; with a moderate degree of infection, there are mild symptoms but often associated with serious malnutrition, while very light infections, even with highly pathogenic species such as *E. tenella* and *E. necatrix*, are clinically inapparent. With both these species, it is the cases of light, inapparent infection which are the chief sources of infective material, for few oocysts are produced by the severe cases with copious discharges of blood.

In contrast with the severe acute infections in which extensive damage to the intestine is quite obvious, there are other types due to species of coccidia which produce less obvious injury and which may not immediately affect the health of the host even when present in enormous numbers. What effect such organisms eventually may have when present over long periods or when associated with other species in mixed infection constitutes a most difficult problem. In the so-called chronic coccidiosis, very heavy infections of such relatively mild species may be encountered and are so impressive that it is natural to assume an etiological relationship for the rapid wasting of the individual bird examined. It is disconcerting, however, to find associated birds of good weight and color that may be carrying quite as heavy infections as the emaciated ones.

Chronic coccidiosis appearing in maturing flocks at once raises the question as to why an immunity has not developed during the growth period of the bird. The subject of chronic coccidiosis presents two closely related problems: (1) the ques-
tion as to the nature of the condition and (2) that of the etiological factors upon which it is based.

THE NATURE OF CHRONIC COCCIDIOSIS

The population of the infective agent first deserves attention in the consideration of the nature of chronic coccidiosis. The number of oocysts discharged daily is the only available index, during the life of the host, of the degree of infection. While it furnishes no reliable information as to the population of the asexual forms of any species of coccidia, it serves to show how many are developing into oocysts. Considered theoretically and in the absence of all reinfection, there are three possibilities as to the continuance of a coccidium population.

A. Generally speaking, a population in which the number of surviving progeny does not equal that of the parent generation fails to perpetuate itself and soon disappears, in other words, a declining population. However, those organisms which develop into oocysts multiply no further in the host of their origin. They are like emigrants being constantly removed from the population and having no part in its maintenance. With any increase in the proportion of organisms differentiating into sex forms with the production of oocysts, there is a corresponding diminution in multiplication. Hence, if all the organisms of a coccidium infection should develop into sex-forms, multiplication would be at an end and the infection would terminate at once. Apparently it is this tendency to sexual differentiation which makes this type of infection self-limited. It is not due to any protective reaction of the host, for the latter remains susceptible to reinfection. I believe that I am largely responsible for the hypothesis that coccidium infections in chickens are self-limited when all sources of reinfection are eliminated. While this is apparently true of experimental laboratory infections, its universal application is perhaps open to question, as we shall see later on.

B. A more or less stable population may be maintained in some cases, in which the number of each generation of progeny, capable of further multiplication in the same host, corresponds closely with that of the parent generation. Boughton's studies proved this to be the case with the coccidium of the European sparrow. Here all measures taken to prevent the ingestion of oocysts have failed to terminate the infection. It is quite probable that there are more coccidium infections than are generally recognized, maintained indefinitely at a low level. This possibility will be obvious when it is considered how difficult it may be
to demonstrate oöcysts when they are present in small numbers in the bulky fecal mass of a large animal.

C. An increasing population results from a continuous or consistent increase in the number of organisms in successive generations. Such increase can have but one result, i. e., overwhelming infection.

Formerly cases of emaciation in the chicken in association with a mild species of coccidium such as *E. acervulina* were thought to be due to a lack of immunity in combination with exposure to an excess of infective oöcysts. This question should be reopened, for more recent observations show that if reinfection be prevented as far as possible, the infection may be maintained indefinitely. Thus such birds not only have failed to develop immunity but now furnish a soil more favorable to the maintenance of infection than the normal young bird in which infection is self-limited. It is important to note that the degree of the infection may increase under conditions which appear to preclude the ingestion of oöcysts. Are we to conclude that the young host favors sexual differentiation of the coccidium while the non-immune, maturer host, not quite so favorable to this type of development, thereby tips the balance toward the multiplicative phase and hence favors a continued increase in the coccidium population?

**ETIOLOGY OF CHRONIC COCCIDIOSIS**

In regard to etiological factors underlying chronic infection, various possibilities suggest themselves but we can as yet offer no proof for any of the hypotheses under consideration. The possibility that mixed infection may in some way delay the development of an effective immunity against a given species has been discussed previously. Thus while immunity develops rather promptly following infection with *E. maxima* alone, in mixed infections this species persists for long periods. Owing to differences in the regional habitat of the various species of coccidia found in the chicken, there is obviously more extensive damage to the intestinal tract in mixed infections than when only a single species is present. The effects of mixed infections require further study. The possibility of changes in the reaction of hosts due to intercurrent infection with bacteria or viruses should also be considered. Changes of reaction may possibly result from nutritional disorders based on dietary deficiency. Becker and Morehouse* have shown that in the rat B and G vitamin deficiency caused a reduction in the number of oöcysts discharged. A modification of the reaction of the host may possibly result from lack
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of vitamins, sunlight, exercise, and other factors, or they may be based on the faulty absorption by an intestine damaged by previous coccidial infection. It has been noted (Tyzzer\textsuperscript{3}) that a ration that is sufficient to maintain normal development in laboratory-reared chickens fails to prevent the widespread occurrence of rickets in those experimentally infected with coccidia. Since the chronic form of coccidiosis has not yet been produced experimentally, proof is not at present available for any of the above hypotheses.

In a case that has developed spontaneously, daily oocyst counts have been made over a period of a month and a half and are still being followed. There appears to be a rather regular rhythm with high counts for four or five days and a corresponding period of low counts. The troughs of the waves are regularly smoother than the crests which are somewhat jagged. The counts vary from around 9,000,000 to 670,000,000 per 24 hours. If we reckon the total volume of the oocysts for the higher 24-hour counts, it is found that the bird, which in this case weighs less than 2\(\frac{1}{2}\) lbs., is discharging considerably over 1 cc of oocysts per day. This also signifies the daily demise of over a half a billion intestinal epithelial cells, while several times that number are constantly occupied by growing immature organisms.

Since the bird now under observation shows the effects of a severe degree of rickets, additional cod-liver oil has been furnished in its ration. The oocyst count has since been considerably lowered—for one day less than half a million, but the infection persists and still shows fluctuations.

In conclusion, it may be pointed out that the problem of chronic coccidiosis in poultry is a baffling one and requires further investigation. We may even speculate whether the diagnosis itself is not open to question in that the infection under some circumstances furnishes an index to the physiological state of the host rather than an essential cause of that condition.

It appears that we lack a true specific for coccidium infection, but even if such a specific were available it would furnish no control for subsequent reinfection. From a practical point of view, it seems quite clear that coccidiosis problems, in poultry at least, arise mostly from measures employed in mass production, \textit{i.e.}, they are man-made. When faced with a severe epizootic, the more rational attack appears to lie in the treatment of the flock rather than in attempts to eliminate the organism. Milk flushing may be beneficial when the small intestine is obstructed with adherent blood-clot and exudate in \textit{E. necatrix} infection. However, with weak, exsanguinated birds, too radical
treatment should be avoided. Above all, the maintenance of nutrition should be aimed at—milk powder, additional cod-liver oil and any measure which will maintain the appetite. When the matter of the rearing of subsequent hatches in the same plant comes up for consideration, a change of regime with a return to less artificial conditions should be put into effect.

REFERENCES


PRESIDENT WISNICKY: We shall now proceed to the report of the Committee on Parasitic Diseases, by Dr. Benjamin Schwartz, Chairman. I am pleased to present to you Dr. Schwartz.

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

REPORT OF COMMITTEE OF PARASITIC DISEASES

DR. BENJAMIN SCHWARTZ, Chairman, Washington, D. C.

Dr. James E, Ackert, Manhattan, Dr. H. M. Martin, Philadelphia, Kan.
Dr. W. T. Huffman, Salt Lake Dr. J. E. Shillinger, Washington, Utah City, Utah

During the year 1936, there has been uninterrupted progress in research in parasitology and in the application of facts elicited in the course of research to the control of parasites of live stock and poultry. Notable progress has been achieved in the control of swine parasites, the control of liver flukes in sheep and cattle and the control of screw worms that affect all classes of live stock.

CONTROL OF SWINE PARASITES

Efforts to control swine parasites in the South have had as their main objective the keeping of kidney worm infestation within reasonable bounds. As a result of investigations on the life history of the swine kidney worm, including detailed investigations on the ecology of the infective larvae, the federal Bureau of Animal Industry has developed and tested on a large scale control measures designed to break the vicious cycle of this serious pest. The control measures are based on a system of management involving bare strips on hog pastures in order to expose the eggs and larvae of these parasites to the combined action of sunlight and air drying, and an arrangement for feeding the sows and their litters separately. Postmortem examinations, over a period of years, of hundreds of hogs raised under the special setup has shown that the infestation is reduced materially both in percentage and in intensity. In an area in which 90 per cent or more of hog livers, kidneys and surrounding fat are condemned because of infestation with kidney worms and as much as 10 per cent of the loin muscles require trimming to remove worms and lesions, the losses in hogs raised under the kidney worm control plan were reduced to a point at which only approximately 20 to 25 per cent of the livers and only about 15 per cent of the kidneys and perirenal fat contained lesions
and worms in sufficient numbers to warrant condemnations under federal meat inspection procedure. The infestations in all cases were relatively slight and in no instance were the loin muscles involved.

Control methods for kidney worms were first tested in southern Georgia over a period of years, and during the year 1936, demonstrations on control measures for these parasites were extended to Alabama, Florida, Mississippi, Kentucky, South Carolina and Tennessee.

These control measures are effective also for the large intestinal roundworm, and are based for the most part on the well-known plan for controlling ascarids, with special modifications designed to control kidney worms. Experience has shown that the control measures are equally effective in sharply reducing infestations with lungworms and in reducing to some extent infestations with nodular worms. In short, the application of hygienic measures to swine husbandry operations has been found to be of value in controlling parasites and in producing better types of hogs. Some of the southern meat packing establishments have paid as much as one dollar more per hundredweight of live hogs raised under sanitation than the prevailing top prices at the nearest market.

CONTROL OF LIVER FLUKES

An allotment of funds from the Emergency Relief Appropriation Act of 1935, for the control of liver flukes in sheep and cattle in Washington, Oregon, Idaho and Utah, afforded an opportunity to gauge the results of control measures conducted on a large scale. Liver flukes occur in the bile-ducts of cattle, sheep, goats and related wild ruminants. These parasites, which pass part of their life history in aquatic snails, are deadly to sheep, stunt the growth of cattle and may kill calves. In a single county of a western state the losses among sheep from liver flukes was $100,000 in 1935, according to an estimate made by authorities of the state university in conjunction with farm advisers of that state. According to the same estimate, approximately 50,000 sheep in that county are infested and the losses range as high as 50 per cent in affected flocks.

Investigators and field agents of the U. S. Bureau of Animal Industry have shown that drainage of wet, marshy and boggy pastures is the most effective method of controlling liver flukes. The broadcasting of copper sulfate to destroy the snail intermediate hosts is at best only a temporary expedient and must be continued from year to year to insure the destruction of fresh crops of snails which reappear sooner or later. Drainage, on the other hand, is an effective weapon against aquatic snails which invariably perish on dry land. Recently reclaimed boggy pastures contain thousands of dead snails, many of which are the potential and actual conveyers of liver flukes.

Aside from controlling liver flukes, drainage of wet pastures results in a marked change in the type of vegetation. The coarse aquatic grasses containing little or no nourishment for live stock disappear as the pastures become dry and, as a result of natural seeding, highly nourishing forage crops, including clover, timothy, and other nutritious plants, take their place. This results in a permanent improvement of the land. In the western states where liver-fluke control is in progress, drainage of marshy meadows makes considerable water available for irrigation. In Utah, particularly, the water from the drainage ditches is being diverted to irrigation canals, thereby adding materially to the supply water available for irrigation. Incidentally drainage of wet and boggy lands has considerable value as a mosquito-control measure.

An additional allotment of funds contained in the Emergency Relief Appropriation Act of 1936 has made it possible to extend the liver-
The actual accomplishments on the liver-fluke project up to September 1, 1936, are as follows:

**Washington:** On 244 premises, covering a total of 22,576 acres, 2,124 acres of swampy land were drained, 12,076 rods of drainage ditches were dug, 5,346 rods of streams were cleared and 15,000 pounds of copper sulfate were used to poison snails.

**Oregon:** On 147 premises, 9,833 acres of swampy land and 26,140 acres of semi-swampy land were drained, 18,548 rods of drainage ditches were dug, 12,850 rods of streams and ditches were cleared and 41,950 pounds of copper sulfate were used to poison snails.

**Utah:** On 55 premises, covering 10,022 acres, 1,260 acres of swampy land were drained, 1,908 rods of drainage ditches were dug, 1,125 acres were treated with copper sulfate and 14,445 pounds of this chemical were used to poison snails.

**Idaho:** On 74 premises, 1,157 acres of swampy land were drained, 4,542 rods of streams were cleared and 8,172 rods of drainage ditches were dug.

**Screw-Worm Control**

**Outbreak of 1934:** The rapidity with which screw-worm infestation can become established and develop into serious outbreaks was strikingly illustrated in the southeastern states, where more than 100 cases could be traced directly to a single neglected animal. During the summer of 1933, infestations were found in southern Georgia and northern Florida. By the end of that year, the infestation was present in 19 counties of Florida, and it was estimated that 75,000 cases occurred in 64 counties of Georgia. For 1934, the following estimates of cases of screw-worm infestation were received from workers of the Bureau of Entomology and Plant Quarantine, extension agents, and others: Florida, 450,000 cases in 57 counties; Georgia, 480,000 cases in 126 counties by November 8; Mississippi, 29,095 cases; Louisiana, 82,431 cases; Alabama, 48,875 cases; in South Carolina infestations were present in 14 counties. In these newly invaded areas stockmen and farmers were not familiar with methods of control. Approximately 12 per cent of the animals were infested with an estimated mortality of 12.4 per cent of the animals harboring the parasites. In the sheep and hog sections the mortality often approached 40 per cent. An educational program conducted with emergency funds for periods of six to eight weeks tended to reduce the death losses, but did not noticeably affect the number of cases during the fall of that year.

**Control work of 1935:** During 1935, screw worms were generally distributed over the area infested during the previous year, and there were strong indications of another severe outbreak. These parasites were present in southern Georgia during April, and near the Tennessee-Georgia boundary as well as in South Carolina during June. With an appropriation of $480,000 made available by the Congress of the United States, an educational control program was undertaken in 316 counties. Meetings, demonstrations, visits to individual stockmen and furnishing of proper materials for treatment of animals, checked the spread of screw worms and prevented the outbreak from reaching alarming proportions. By the end of December, the following were the totals of infestations in the southeastern states: Florida, 126,886 cases in 66 counties; Georgia, 75,630 cases in 139 counties; Alabama, 9,574 cases; Mississippi, 252 cases in the southern counties; Louisiana, 9,895 cases in the southwestern part of the state; South

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*Data supplied by Dr. F. C. Bishopp and Dr. W. E. Dove, of the Bureau of Entomology and Plant Quarantine.
Carolina, 6,373 cases generally distributed over most of the counties of the state; in 15 counties of southeastern Texas there were 14,652 cases, or 191 cases per 100,000 animals. The reported incidence for the southeastern states averaged 2,526 cases per 100,000 animals. In addition to a marked reduction of cases as a result of the control measures taken, the average number of deaths was reduced to 2.13 per cent of affected animals in the southeastern states, with a maximum mortality of 3.37 per cent of affected animals in Florida and a minimum mortality of 0.2 per cent of affected animals in Louisiana.

**Outbreak in the Southwest during 1935:** Questionnaires, received from 96 counties in Texas, revealed estimates of 1,210,117 screw-worm cases, which indicated that probably more than 3,000,000 cases of screw worms occurred in that state. In New Mexico it was reported that approximately 40,000 cases occurred in the southern counties. The spread of the pest from the southwestern states resulted in cases in western states and in several of the north central states. In 25 to 30 counties of Kansas 30,000 cases were reported; in Iowa there were almost 1,000 cases; for 13 counties of Illinois it was estimated that there were 6,000 cases; in Missouri and Arkansas a general but scattered infestation occurred; and in Tennessee there were a few cases.

**Control work of 1936:** For 1936 the Congress of the United States appropriated $460,000 for a continuation of screw-worm control work in the southeastern states on a reduced basis, and for new work in other states. Trained men were employed to hold meetings and demonstrations, and to secure cooperation of stockmen in conducting demonstrations in various communities from South Carolina to California. Benzol and pine tar oil were furnished for treatment of animals. By October 23, a total of 39,873 cases were reported in the southeastern states, the cases being distributed as follows: Alabama, 499; Florida, 37,429; Georgia, 1,289; Louisiana, 240; Mississippi, 297; South Carolina, 119. From these figures it is evident that a high degree of control had been obtained and that the infestations were most numerous in Florida. In Georgia most of the cases were reported from the southern counties during the autumn months. Of 37,429 cases reported from Florida from January 1 to October 23, 21,992 occurred from June to October, periods when screw worms would normally be most prevalent. Cases were widely distributed in Florida throughout the year, but they were held in check so that no outbreak occurred in any locality.

From June 19 to October 23, 120,632 cases were reported from the southwestern states, of which 97,834 occurred in Texas; 20,587 in New Mexico; 836 in Oklahoma; 374 in California; and 1,001 in Arizona. The weather during this period was such that screw worms would ordinarily be expected to occur in large numbers. The rainfall was sufficiently regular to keep wounds moist and attractive to flies, but not sufficient to result in drowning of larvae and pupae in the soil. In view of the low incidence, and on account of the wide distribution of the pest during the summer months, it is concluded that the control work carried on by farmers and ranchers in cooperation with the Bureau of Entomology and Plant Quarantine effectively held the pest in check and prevented large numbers of cases and death losses.

The services of workers of the Bureau of Entomology and Plant Quarantine will be available during the winter months in areas where there is evidence of螺-worm activity in attempts to reduce the winter reservoir of infestations. It is believed that such work will result in material reductions in the stock of parent flies next year, and should delay the building up of big infestations.

Even though a high degree of control was obtained for screw worms in the southwestern states, the spread of the pest resulted in cases in six counties of Oklahoma, several localities in Kansas, and in Mis-
souri, Illinois and Tennessee during the early part of the season. In the stockyards investigators looked for cases of screw worms, treated the animals, and aided in getting specimens for identification. At Kansas City, Missouri, there were ten such infestations; at East Saint Louis, Illinois, 39; at Kaplan and Church Point, Louisiana, three cases in horses and mules; at New Orleans ten cases, and at Nashville, Tennessee, one case was found. In the vicinity of Memphis, Tennessee, screw worms became established and caused losses in several of the southwestern counties of that state. These records of introductions of the pest show that shipments of animals are of great importance in the annual spread of screw worms. They suggest the danger of rapid spread during the early part of the season when feeder cattle are shipped for fattening to the Osage country of Oklahoma, the Flathead region of Kansas, to Illinois and elsewhere. They emphasize the need for treating animals before shipment to prevent early introductions of screw worms into uninfested territory.

SCREW WORM RESEARCH

Hibernation studies to determine the northern limits in the infested areas where the screw-worm fly can overwinter show that, during the winter of 1935-36, the fly survived as far north as the south line of counties of Georgia, throughout most of Florida, and in southwest Texas as far north as Uvalde. It appears that the fly also overwintered in Arizona and southeastern California. The northern limit of the overwintering area will vary from season to season, but in general it has been found to correspond fairly closely to the line of the 55° isotherm.

Observations on the rate and extent of seasonal natural dispersion of the fly from areas in which it overwintered to adjacent localities where spring and summer temperatures are favorable for its propagation and the factors influencing this clearly indicate that the primary screw worm, Cochliomyia americana, is capable of spreading very rapidly under certain conditions while under other conditions natural dissemination is very limited. During the spring and summer of 1936, it migrated from the northern limit of hibernation in Texas to the southern border of Kansas at the rate of about 40 to 50 miles per week. This migration was west of the line of heaviest rainfall. Very little spread appeared to take place in East Texas east of San Antonio, Hillsboro, Dallas and Sherman. Heavy rainfall during May in that section apparently prevented migration into the eastern part of the state. The dry weather which prevailed in East Texas during the latter part of July and continued through August was coincident with an eastward spread of the fly at about the same rate as the northward migration which occurred from the western part of the state.

During 1936, there was no marked tendency for the species under discussion to spread rapidly northward from the area of overwintering in Florida, Georgia, and other southern states. This diminished northward spread, as compared with the rapid rate of dispersion in the two previous years, may be chargeable to climatic conditions and to the better care given to live stock by the owners in that region.

PARASITES OF POULTRY*

Infestation with tapeworms still remains one of the major ailments of chickens. The examination of a thousand farm chickens during all months of one year showed that 49 per cent of the fowls had one or more species of tapeworms. While much progress has been made in the development of anthelmintics for the control of roundworms,

*Data supplied by Dr. James E. Ackert, of Kansas State College.
much less has been accomplished in the development of an effective anthelmintic for chicken tapeworms.

Roundworms can be controlled largely by rearing chickens on clean ground or over wire screens; tapeworm infestations, however, cannot be reduced in this manner, as house flies and other insects having access to fowl tapeworm eggs get to the chickens and are eaten by them, thereby transmitting tapeworms.

In the summer of 1936, tests were made upon the importance of the house fly (Musca domestica) in fowl tapeworm transmission. It was found in earlier work done at the Kansas Station, that the feeding to chickens of skim milk and buttermilk in open dishes resulted in attracting numerous house flies to the drinking receptacles and thereby increasing the incidence of chicken tapeworms. As a result of this observation, poultrymen in Kansas largely adopted the practice of feeding evaporated milk as a part of the dry ration. In one test involving 20 young chickens originally free from parasites, it was found at the end of 46 days of exposure to flies that 15 of the 20 birds were infested with Choanotaenia infundibulum and Raillietina cesticius, mostly with the former. The range of infestation was from one to 28 tapeworms, with an average of 9.8 worms per fowl.

Various investigators have shown that species of small dung beetles are the intermediate hosts of chicken tapeworms, especially of Raillietina cesticius. As many as 626 cysticercoids have been found in the body cavity of one beetle. Among the beetle genera represented are: Anisotarsus, Choeridium, Selenophorus, Aphodius, Cratacanthus, Calathus, Amara, and Stenolophus. Cram found that the thread-like tapeworm Hymenolepis carioca could be transmitted by the beetle genera Aphodius and Choeridium; and Jones and Horsfall (1936) have found that an ant (Tetramorium sp.) may serve as the intermediate host of the large fowl tapeworm Raillietina echinobothrida.

Other known intermediate hosts of North American chicken tapeworms besides house flies, beetles and ants are as follows: Slugs (Limax sp., Arion sp., Capaea sp., and Agerolimax sp.) as intermediate hosts for a minute tapeworm Davainea proglottina; and earthworms (Ocnerodrilus sp.) as the intermediate host of Amoebotaenia sphenoides. The last two species of tapeworms apparently are of rather rare occurrence in some parts of this country.

With the addition to our knowledge of several species of dung beetles as intermediate hosts of chicken tapeworms and the fact that the ever-present house fly is still a potent factor in the spread of these parasites, the control of fowl tapeworms will involve vigilance in the prevention of fly breeding and the removal of rubbish as breeding and hiding places of the beetles.

Studies made at the Kansas Agricultural Experiment Station on the host-parasite relationship of the fowl nematode, Ascaridia lineata, have yielded the following results:

Breeds of chickens resistant to Ascaridia lineata: Evidence was presented for the first time on different degrees of resistance among breeds and varieties of chickens to the same helminth. The data supporting the conclusions were derived from experiments on 1,351 chickens of four breeds and two varieties of a fifth breed, all birds being given the same number of Ascaridia eggs. The criteria for judging the resistance were the average number of worms present and their size in each group of chickens under comparison.

The heavy breeds and varieties, namely Rhode Island Reds, White Plymouth Rocks and Barred Plymouth Rocks, were the most resistant; the most susceptible breeds were the White Leghorns, Buff Orphingtons and White Minorcas.

Age resistance of chickens to Ascaridia lineata: Earlier studies by Ackert and Herrick showed that young chickens were much more
susceptible to *Ascaridia lineata* than were older chickens. Further studies by these authors showed that, if chickens are kept free from *A. lineata* until they are approximately three months old, they may swallow considerable numbers of these worm eggs without apparent injury. More exhaustive tests upon age resistance of chickens to this nematode were made by Ackert, Porter and Beach. These results confirmed those obtained earlier and indicated that in chickens 1½ months old every additional week that the birds are on an adequate diet markedly increases their resistance to these nematodes. Ordinarily age continues to increase the resistance until the chickens are about 93 days old, after which the resistance to the nematode no longer appears to increase.

**Resistant and susceptible strains of White Leghorn chickens:** By selecting the most resistant cockerels and pullets from a sturdy flock of chickens, a resistant strain of White Leghorns was developed. When the resistance of their offspring to *Ascaridia* was compared with that of the offspring from another sturdy flock, it was found that the offspring of the selected group were markedly more resistant to the nematodes than were the offspring of the other group designated as the susceptible group. During the next year, father-daughter and brother-sister matings from the resistant group were made, giving a second generation which produced offspring that were more resistant than were similar offspring of the susceptible group. The tests have been carried out for three generations and still show significant differences either in numbers or sizes of worms. Since Waters and Lamb have shown that inbreeding, after preliminary selection, does not necessarily result in deterioration of desirable qualities, the prospects are favorable for success in developing strains of chickens within a breed that are very resistant to *Ascaridia lineata*.

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**President Wisnicky:** Thank you, Dr. Schwartz, for this instructive report.

**Dr. H. C. H. Kernkamp:** I move that the report be accepted and referred to the Executive Committee.

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

**President Wisnicky:** It is now 12:30 o'clock. The report of the Committee on Bang's Disease is now ready for distribution. I suggest that you get your copy and be prepared to act upon it in executive session this evening.

**Dr. R. A. Hendershott:** I move that the meeting recess until 1:30 p.m. this afternoon.

. . . The motion was seconded, put to a vote and carried, and the meeting recessed at 1:30 p.m. . . .

**Recess**

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**Thursday afternoon, December 3, 1936**

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

**President Wisnicky:** The meeting will now come to order. This afternoon we have on our program discussions on tuberculosis and the first number is "Progress and Status of Co-operative Tuberculosis Eradication Work," by Dr. A. E. Wight, Chief, Tuberculosis Eradication Division, U. S. Bureau of Animal Industry, Washington, D. C. Dr. Wight is very closely in touch with tuberculosis eradication, superintending the work over the entire country, and it is a pleasure to present to you Dr. Wight.

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

By A. E. Wight, Washington, D. C.
Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, U. S. Department of Agriculture

It is again my privilege to present to this Association the customary annual report on the progress made in, and the status of, the cooperative campaign to control and eradicate animal tuberculosis in the United States. Since our last meeting, a great deal of progress has been made in the tuberculosis eradication project for the reason that emergency federal funds continued to be available. These additional funds were used for both operating and indemnity purposes.

During the fiscal year ended June 30, 1936, almost 23,000,000 tuberculin tests were applied to cattle, disclosing about 165,000 reactors, (0.7 per cent). The incidence of tuberculosis among the cattle tested was just about one-half of what it was during the previous fiscal year.

This work was conducted in many different sections of the country. In some states but very little tuberculosis was found among the cattle tested, while in others the degree of infection was quite high. The great volume of work which has been accomplished during the past year has produced results which made it possible to place many additional counties in the modified accredited area, and to further the work to a degree which would have required a much longer time if additional federal funds had not been made available.

STATE AND FEDERAL FUNDS

State appropriations for this work were somewhat reduced because of the fact that so much has been accomplished in tuberculosis eradication work, but it is estimated that the states and counties did use approximately $4,500,000 during the past year. The regular federal appropriation for this work during the fiscal year ending June 30, 1937, is $1,500,000, which is less than has been provided as a regular appropriation for many years. This is being used for operating expenses and indemnity.

ACCREDITED HERD WORK

According to the records of the Bureau of Animal Industry, there were, on October 1, 1936, about 256,000 fully accredited herds, containing about 3,750,000 cattle. This is about the same
number that has been reported for the past three years. The accredited-herd feature of the work continues to be of much importance in several states, and especially in herds of purebred registered cattle. However, in some states not much attention is given this feature of the work. In New York and a few other states, the retesting of accredited herds is done by local practicing veterinarians at state expense. It will be noted from the summary of tuberculosis eradication work that New York continues to have the largest number of accredited herds.

**Area Work**

As usual, the greater part of the tuberculin testing of cattle was conducted under the area plan. During the year from November 1, 1935, to November 1, 1936, 166 counties have been added to the list of those in the modified accredited area, indicating that bovine tuberculosis in such localities exists to less than 0.5 per cent. In addition to these counties, nine municipalities in Puerto Rico were placed in that status.

The uniform plan for maintaining modified accredited areas requires that either a portion or all of the cattle within such areas be retested at certain intervals, depending upon the degree of infection found on the original test. A certain amount of retesting every year is necessary in a large number of counties in order that their modification may be continued. On December 1, 1935, the states of Iowa and Montana were added to the modified accredited area, and since that time Delaware, Mississippi, Oklahoma, Arizona, Texas, Connecticut, Nebraska, Rhode Island, Vermont and Pennsylvania have been added in the order named, making an increase of twelve states since December 1, 1935.

In the three states in the eastern part of the country that are not, as yet, entirely in the modified accredited area, the work is progressing in a very satisfactory manner, and it is expected that they will all be added to the modified accredited list by July 1, 1937. The situation in California and South Dakota is somewhat different, and the prospects of completing the work in those states is, at this time, not so encouraging. It is interesting to note that during the past year the largest state in the Union, and the one containing the greatest number of cattle, was among those placed in the modified accredited area. I refer, of course, to Texas. Of further interest is the fact that the smallest state in size as well as cattle population, namely, Rhode Island, also was placed in the modified accredited area during this period. Good progress is being made in the area tuberculosis eradica-
tion plan in Puerto Rico, in cooperation with the Department of Agriculture and Commerce of that territory.

CATTLE TUBERCULIN TESTED FOR INTERSTATE SHIPMENT

The greater part of the tuberculin testing of dairy and breeding cattle for interstate shipment is performed by private practicing veterinarians who, during the past fiscal year, applied such tests to approximately 265,000 cattle. About 38,000 cattle were tested for interstate shipment by veterinarians employed by the Bureau of Animal Industry.

CHANGES MADE IN REGULATION 7, B. A. I. ORDER 309

The Bureau of Animal Industry has had under consideration for a considerable length of time a modification in the tuberculosis feature of Regulation 7, B. A. I. Order 309, which pertains to the interstate shipment of cattle. It will be recalled that little or no change has been made in this regulation since May, 1928. Effective September 10, 1936, Regulation 7 was revoked, and a new Regulation 7, included in Amendment 2 to B. A. I. Order 309, was issued. The effect of this amendment is to limit the federal restrictions on the movement of cattle from modified accredited areas, but to place additional restrictions on cattle moving from localities not in the modified accredited area. The interstate shipment of cattle is, of course, subject to the regulations of the state to which such animals are consigned. This amendment has been in effect for almost three months and appears to be quite satisfactory.

AVIAN TUBERCULOSIS

Officials of the federal Bureau of Animal Industry have cooperated with the live stock sanitary officials in several states where avian tuberculosis is known to exist to a considerable extent, with a view of reducing the infection among poultry and swine. It has been possible to interest a large number of flock-owners in the project, as well as many agencies interested in the poultry and swine industry. Avian tuberculosis continues to be very prevalent in certain localities in the central and north central states. Some infection is also found outside of that area from time to time. The officials of the states and the Bureau who are working on this problem are to be complimented in their continued interest and efforts to handle it. It is, indeed, a difficult one.

DECREASE IN AMOUNT OF TUBERCULOSIS FOUND AMONG CATTLE AND SWINE

The records of the Meat Inspection Division of the United States Bureau of Animal Industry continue to show some re-
duction in the number of cattle found infected with tuberculosis to any degree. During the last fiscal year, these records indicate that of approximately 10,000,000 cattle slaughtered under federal inspection only about 19,000 (0.19 per cent) showed any evidence of tuberculosis. These figures do not include known reactors. Of the total number of cattle showing any infection, only about 4,800 were either condemned as unfit for food or passed for cooking purposes. This is about 0.05 per cent of the total cattle slaughtered under federal inspection.

During the fiscal year ended June 30, 1936, there was a slight decrease in the number of hogs which showed any evidence of tuberculosis upon postmortem examination made by veterinarians of the Bureau of Animal Industry. Of the total number retained for tuberculosis, which was 10.26 per cent of the total killed under federal inspection, only about 15,000 (0.05 per cent) were condemned as unfit for food, and about 16,000 additional carcasses (0.06 per cent) were passed for cooking purposes. The remainder of the hogs showing very slight lesions of tuberculosis were passed for food purposes after the slight lesions were removed.

The tracing of the origin of hogs and cattle that show tuberculosis on autopsy continues to be one of the features of the tuberculosis eradication program. This work is of considerable value in locating the sources of infection, and it is hoped that it will be developed to a point where it may be of much more value in this connection.

JOHNE'S DISEASE (PARATUBERCULOSIS)

During the past fiscal year, Johne's disease was reported from eleven states, and 134 cattle were condemned on account of infection. This is approximately 5.23 per cent of the total cattle tested. It will be recalled that a splendid paper on this subject was presented at this meeting last year by Dr. A. J. DeFosset, of Columbus, Ohio.

PERSONNEL

The state and the territorial authorities employed a total force of about 245 veterinarians on this work throughout the year, in addition to 170 veterinarians on full-time pay in the employ of the various counties. An average of about 900 veterinarians were employed by the federal government and paid from emergency funds. Many of them, however, are working at a per diem rate or part-time basis. In certain localities, laymen were employed to assist the veterinarians in field work. The regular employees of the Bureau who have been engaged in this program
deserve much credit for the work they have conducted during the past year, not only on tuberculosis eradication, but also on the Bang's disease project, which is being conducted very extensively in some states.

APRAISAL, SALVAGE AND INDEMNITY

The owners of tuberculous cattle received an average salvage amounting to $26.50 during the past fiscal year, which is about $11.00 greater than was received during the previous year. The average appraisal was $77.66 during the past fiscal year, as compared with $57.55 for the previous year, an increase of approximately $20.00, but the combined state and federal payment was practically the same for both years. The maximum federal payment continues to be $25 for grade cattle and $50 for purebred registered cattle. Of the reactors slaughtered during the year on which federal indemnity was paid, approximately 4.0 per cent were purebred registered cattle.

PUBLICITY

Although tuberculosis-eradication work among livestock has been in progress for many years, the press continues to give the subject considerable publicity throughout the country, which is most helpful to the progress of the work. Much of this is in the nature of progress reports of the work. Similar information also has been given publicity on radio programs at various times and places throughout the year. Some exhibits continue to be shown at various places, such as state and county fairs. The small pictures and film strips, which can be handled so conveniently and readily obtained through the Extension Service of the Department of Agriculture, at a cost of about 45 cents, are called for from time to time.

CONCLUSION

As predicted in the closing statement of my report last year, several additional states were placed in the modified accredited area, and, from present indications, all but one or two of the entire number of states in the country will be in that status this time next year. The work in Puerto Rico should progress to an extent whereby all of that territory may be added to the modified accredited area in the course of another year.

The report you have just heard necessarily contains some statistical material, but, in order that you may have a more complete statistical report containing other features of the campaign, a pamphlet has been prepared by the Bureau of Animal Industry of the United States Department of Agriculture for dis-
tribute at this meeting. If additional copies are desired by anyone especially interested, they will be furnished upon request.

In closing, please permit me to express my thanks and appreciation for your very kind attention.

PRESIDENT WISNICKY: Thank you, Dr. Wight for your interesting paper. We shall continue our program on tuberculosis by calling on Dr. W. J. Butler, State Veterinarian, Helena, Montana, to carry on a discussion of "Reaccreditation of Range and Semi-Range Modified Accredited Tuberculosis Free Areas."

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

REACREDITATION OF RANGE AND SEMI-RANGE MODIFIED ACCREDITED TUBERCULOSIS-FREE AREAS

By W. J. Butler, Helena, Mont.
State Veterinarian

With minor exceptions, sentiment does not enter into the control of live stock diseases. Aside from the scientific knowledge involved, the control of live stock diseases, to be successful, must be viewed and handled from an economic standpoint.

Most of us will concede that certain cases of tuberculosis in cattle may be cured, although we do not attempt to cure tuberculosis in cattle. Why? Simply because it would be an economic mistake. It would cost more to cure the animal than the animal is worth, without taking into consideration the danger of the disease spreading to other susceptible animals. Time and experience have proved to us that it is more economical to destroy than to attempt to cure animals affected with a dangerous disease.

The reaccreditation of range and semi-range modified accredited tuberculosis free areas also must be considered from the economic standpoint. Our present system of reaccrediting tuberculosis-free areas is a kind of hit-and-miss system. The methods to be used are left pretty much to the discretion of the state live stock sanitary official and federal veterinary inspector-in-charge. The methods used are primarily not designed to pick out new areas of infection. They are designed more to clear up old foci of infection. When we are fighting a disease like tuberculosis, we must always take into consideration its insidious character and remember that as yet it is not whipped. How, then, can we develop a system to pick out new areas should there be any, without adding additional cost to the live stock grower?

Postmortem inspection offers the ultimate method of disclosing new, as well as old, centers of tuberculosis and other live
stock diseases in cattle from range and semi-range areas. We ship approximately 25 per cent of our cattle each year from such areas to market centers, and I believe I am safe in saying that 80 per cent of these animals eventually find their way to abattoirs and slaughter-houses where official meat inspection is carried on. If we ship 25 per cent of our cattle each year, that means, excluding old dairy and breeding animals, that we have a complete turnover of our cattle population every four years. If 80 per cent of these animals are subjected to a postmortem inspection, surely that postmortem will disclose any chronic disease conditions in our cattle population. We do, at the present time, and always will have to depend mainly upon the private practitioner and the field veterinarian for the disclosure of acute disease conditions.

The United States Bureau of Animal Industry has an admirable system of meat inspection. If full advantage is not taken of this system and disease conditions found on postmortem inspection are not reported to sanitary officials, we are wasting a golden opportunity.

DISEASES REPORTED IN MONTANA

In Montana, any disease condition found in animals on postmortem inspection at any slaughter-house or abattoir within the state is immediately reported to the Livestock Sanitary Board. We also receive reports from abattoirs that are under federal inspection in other western states when postmortem inspection reveals a disease condition in livestock shipped from Montana. These various reports have been of inestimable value in our locating disease centers and eradicating not only tuberculosis but other diseases.

We do not receive such reports from river market centers. There have been many excuses advanced for our not having received such reports, but none of the excuses received so far can be accepted as final. We know very well that packers keep track of the animal carcass and can tell from whom that animal was purchased. Surely the veterinary profession that was capable of eradicating pleuro-pneumonia and foot-and-mouth disease, and is on its way to eradicate bovine tuberculosis, can solve the problem of identifying cattle carcasses and reporting disease conditions found on postmortem inspection.

Are we willing to admit that we are incapable of solving such a problem? When one thinks of the opportunities that postmortem inspection offers in the way of locating disease centers, it is really criminal neglect on our part not to take advantage of
that opportunity and develop a system of locating disease centers that will have the admiration of the medical world.

We advocate the inauguration of such a system and recommend that postmortem findings be used in conjunction with the tuberculin test, in reaccrediting modified accredited tuberculosis-free areas. Such a system should not be sectional. It should apply eventually to all areas in the United States. We recommend, inasmuch as western states ship practically all of their cattle to primary market centers, that postmortem reports be accepted in the accreditation and reaccreditation of range and semi-range modified tuberculosis-free areas, just as quickly as the United States Bureau of Animal Industry will report postmortem findings to live stock sanitary officials.

CONTINUE TUBERCULIN TESTING

We do not advocate for one moment the discontinuance of the tuberculin test. The tuberculin test is and will continue to be the method used to disclose the number of infected animals in any infected herd, and must also be used in the constant testing of dairy cattle and old breeding cattle. What we do contend, however, is that it is a waste of energy and a costly work, both to the state and to the stock-grower, to subject range cattle to repeated tuberculin tests unless infection is known to exist in the herd. If we let herds go without testing or without checking in some way to determine whether or not new foci of infection have sprung up, we may regret such a policy. Insofar as range and semi-range cattle are concerned, we can, through postmortem inspection, determine very effectively whether or not new foci of infection have developed. Herds found to be infected through postmortem inspection must be immediately placed in quarantine and the entire herd subjected to a tuberculin test and the herd must pass two negative tests before being released from quarantine. In other words, the same regulations that pertain to herds of cattle found tuberculous by the tuberculin test must apply to herds found through postmortem inspection to contain tuberculosis infection.

As we have stated, this system may eventually be put into operation in all sections of the United States when a uniform system of meat inspection has been developed. However, we are of the opinion at this time, that it should not apply to any herd or herds excepting where at least 20 per cent of the herd is shipped each year.

COUNTRY-WIDE MEAT INSPECTION

We advocate that a definite coöperative system of meat inspection be inaugurated throughout the entire United States, and
that such a system be sponsored by congressional laws and supported in part by federal appropriations. We recommend that a law providing for such a system be passed and that the U. S. Bureau of Animal Industry draw up rules and regulations governing cooperative meat inspection and that federal allocations in support of cooperative meat inspection be subject to U. S. Bureau of Animal Industry approval.

Monies allocated to the states for such meat inspection should be allocated to the state live stock sanitary department in charge of meat inspection within the state just the same as the federal government today allocates money for the building of public highways.

Just as soon as a definite method of reporting postmortem findings is inaugurated by the U. S. Bureau of Animal Industry, we will be safe in extending, for an indefinite period, the period of time for which an area is accredited, subject, of course, to the present disease-finding restrictions. There will be no need for any limited period of time in that there will be a continual and constant check by postmortem findings.

We do not advocate that this particular system be put in full force and effect tomorrow, but we do recommend that the Committee on Tuberculosis incorporate, in the uniform methods, a provision for the recognition of postmortem findings and that the U. S. Live Stock Sanitary Association recommend to the U. S. Bureau of Animal Industry the establishment of a definite and accurate system of reporting postmortem findings to field inspectors in charge and to live stock sanitary officials.

While our subject deals with tuberculosis, nevertheless, such a system would assist in locating many other disease conditions in live stock. We have no desire to enter into a long discussion of the merits or demerits of this particular method. It is the purpose of this paper to call to your attention the fact that we are missing one of the greatest opportunities ever presented to the veterinary profession, and that is to create a system of locating disease centers, through postmortem inspection, and to establish a uniform system of meat inspection throughout the United States that will be of inestimable value to the live stock industry and tend to stabilize the veterinary profession. If we do not recognize and grasp the opportunity, we may be considered guilty of gross negligence.

We realize the subject of this paper, but nevertheless we trust we may be permitted to state that the people of the United States are entitled to an adequate meat inspection system, not only for meats that are shipped interstate, but for meats that are consumed within the borders of their own state. They are entitled
to know that the food which they purchase is from disease-free animals, and is of the quality and grade represented. Wherever official meat inspection is established, there should also be established a uniform system of grading meat. This would not only protect the stock-grower but the housewife, and would save meat consumers many, many thousands of dollars a year in that they would not have to pay a top price for inferior grades and cuts of meat. One of the greatest rackets we have today in the meat industry, in many sections of the country, is the pawning off of inferior cow meat for prime steer meat, and it is the consumer and housewife who pay the bill.

Briefly summarized, our ideas on this subject are as follows:

1. Our present system of reaccrediting areas is not searching enough. Present methods limit the period of accreditation to three or six years, and leave many loop-holes for new foci of infection to establish themselves, and perhaps not be discovered for a period of several years.

2. Postmortem findings as disclosed at all centers where meat inspection is carried on will be a constant and ever-alert factor in disclosing foci of disease.

3. We recommend that the United States Bureau of Animal Industry inaugurate immediately a system of identifying disease carcasses found on postmortem inspection at all abattoirs and slaughter-houses where federal meat inspection is carried on and that they report disease findings to interested live stock sanitary officials.

4. We advocate a closer co-operative and understanding agreement between the Meat Inspection Division of the United States Bureau of Animal Industry, the Field Inspection Division and state live stock sanitary authorities.

5. We recommend that postmortem findings, in addition to the tuberculin test, be officially recognized in the accreditation of range and semi-range areas and that, under such a system, the period of accreditation be extended.

6. We recommend that the United States Live Stock Sanitary Association, the United State Bureau of Animal Industry and live stock sanitary officials of the various states work for the inauguration of a uniform and adequate meat inspection system to be established throughout the United States.

7. We recommend that Congress, at its next session, pass a law providing for co-operative inspection and that they also provide sufficient funds to aid in the support of co-operative meat inspection.

8. We recommend that under this uniform system of meat inspection a definite system of grading meat be established.
9. An opportunity is presented to the veterinary profession to create a system of locating disease centers through postmortem inspection that will benefit the livestock industry and tend to stabilize the veterinary profession.

Professor Smith read his paper. . . . (Applause)

PROBLEMS AND POLICIES IN COMPLETING TUBERCULOSIS ERADICATION

By H. R. Smith, Chicago, Ill.

Live Stock Commissioner, National Live Stock Exchange

The success of the national campaign of tuberculosis eradication is the more remarkable in that it has been pioneer work. No other nation has attempted such a task and we have had, therefore, no precedents to follow. It is a product of American initiative, ingenuity and perseverance. In this accomplishment, the veterinary profession of the United States deserves much credit. Neither must we fail to mention others who have cooperated so well—the live stock owners, the live stock markets, legislatures, railroads, banks, civic clubs, public health officials and farm papers.

Do we comprehend fully the significance of this great undertaking? What has it already done to eliminate waste? What has it done to reduce the incidence of this disease in man? As to waste, we must know what the conditions were previous to the initiation of the national campaign of eradication 20 years ago. We get a true picture of the situation from the records of the Division of Meat Inspection of the U. S. Bureau of Animal Industry.

In 1916, of all cattle slaughtered under federal inspection, 2.3 per cent showed lesions of tuberculosis on postmortem examination. It had increased from 0.9 per cent in 1908, nearly trebling in eight years. A total of 30,720 cattle and 74,109 hogs were condemned as inedible for tuberculosis that year, the equivalent of a trainload 20 miles long. Since 1916, 3,500,000 reacting breeding and dairy cattle have been removed from the herds of the United States by the tuberculin test.
Today, 43 states and 96 per cent of all counties are accredited as being virtually free from this disease. New York, New Jersey, Maryland and South Dakota will be officially accredited within a year. California is confronted with organized opposition, as has previously existed in many states, but will be overcome by aggressive educational work. The percentage of reactors is high in California, which will require more time.

**Testing Breeding Cattle Has Nearly Eliminated Disease in Market Cattle**

During the fiscal year ended June 30, 1936, only 0.18 per cent of all cattle slaughtered, exclusive of reactors, showed lesions of tuberculosis and were designated as retained, as compared with 2.3 per cent in 1916. There were only 4,027 cattle, exclusive of reactors, and 15,195 hogs condemned for tuberculosis in the United States that year—a trainload only three miles long as compared with 20 miles long in 1916.

The decline in cattle condemnations at Chicago is more impressive than for the nation as a whole—from 4.5 per cent retained for tuberculosis in 1916, to 0.13 per cent in 1936. A total of 16,496, or 0.85 per cent of all cattle slaughtered in Chicago during the fiscal year 1916, were condemned for tuberculosis. During the fiscal year ended June 30, 1936, only 538, or 0.03 per cent of the total kill of cattle that year, exclusive of reactors, were condemned for this disease.

Twenty years ago, the cattle and hogs condemned for tuberculosis in one year at Chicago alone would fill a train ten miles long, whereas during the past fiscal year, all cattle and hogs condemned for this disease would fill a train two-fifths of a mile long. When South Dakota is accredited, which will be soon, the number of cattle condemned for tuberculosis at this market will be almost nil. This nation-wide cattle-testing program has thus largely removed a waste of great magnitude and a serious handicap to every producer.

One of the great lessons in these statistics is the efficacy of the tuberculin test. It certainly finds the cattle that have this disease even in the most incipient stage. To Dr. Koch, of Germany, its discoverer, we owe a profound debt of gratitude and in this tribute we include our own great scientist, the late Dr. Dorset, of the U. S. Bureau of Animal Industry, for his work in perfecting it. While Dr. Koch originally prepared tuberculin as a cure for human tuberculosis and while its use for that purpose is very limited, this has been most valuable as a preventive measure through the removal of the tuberculous cow as a source of our milk supply.
DECLINE IN HUMAN DEATH-RATE

The elimination of tuberculosis in cattle has consistently lowered the incidence of this disease in man. Public health records show a slight increase in the death-rate from non-respiratory tuberculosis from 21 deaths per 100,000 population in 1900 up to 22 in 1916. During that period, there was a considerable decline in the death-rate from respiratory tuberculosis as a result of improved medical practice and better sanitation. This should have brought about a decline also in the death-rate from other forms, including those of bovine origin, such as glandular, bone and abdominal tuberculosis, but was offset by the increase in the prevalence of tuberculosis in cattle during that period. Since the beginning of the federal-state coöperative cattle testing program in 1917, the human death-rate from non-respiratory tuberculosis has declined to 5 per 100,000 population.

LARGE AREAS NOW ENTIRELY FREE

The fact that there are now a large number of counties in which not a single reactor was found on the last complete test, leads one to the conclusion that if the testing is continued, the entire nation may eventually be virtually free from bovine tuberculosis. Were it not for the fact that little or no tuberculosis is contracted by cattle from people, this would not be possible.

There is little probability that live stock owners will refuse to continue the tests for reaccreditation because our cities will refuse to accept milk or milk products from counties that lose the accredited status. When the entire nation is officially accredited, which will be soon, we should have federal legislation to bar from this country the importation of milk and milk products that do not originate from officially tuberculosis-free areas in foreign countries.

As complete eradication is more nearly approached, the necessity of testing all cattle each three-year period will become less. It is apparent that a complete test once in six years is sufficient when less than 0.2 per cent reacted on the last county-wide test.

POSTMORTEM REPORTS HELPFUL

If there can be developed some accurate way to check on conditions without the work and expense of applying the tuberculin test to all cattle at relatively short intervals, it should be adopted. The present practice in some states, of identifying with ear-tags bearing recorded numbers all cattle tested so that the few remaining cases of tuberculosis can be reported by the federal Meat Inspection Service, is excellent.
Range cattle are already branded for identification. It is estimated that 60 per cent of all cattle are slaughtered under federal inspection. If nearly all others were slaughtered under city or state inspection, it would seem that some plan could be devised where nearly all cattle could be identified at point of slaughter and the origin of those diseased made known.

AVIAN TUBERCULOSIS

The number of cattle condemned for tuberculosis in the United States in proportion to kill is now only one-twelfth as large as 20 years ago. The number of hogs condemned is one-fourth as large as then, in proportion to kill. While the decline in the condemnations in hogs could hardly be expected to keep pace with that of cattle, the principal source of generalized cases in hogs, the decline in hog condemnation is so much less that we may conclude that a considerable number of hogs are condemned for the avian type of infection. From the number of heads sterilized and condemned last year, nearly all of which were infected with the avian type, we estimate the loss on heads at $2,500,000 per year at current values. The wide prevalence of this disease in poultry, particularly in the north central states, constitutes a real problem.

The loss to the poultry industry through reduced vitality and premature deaths is many times that of hogs. Then, too, this disease in poultry confuses the testing of cattle in the reaccreditation of counties. We know that avian tuberculosis is communicated to cattle to a very limited extent and that cattle reacting from this type of infection are usually sensitized temporarily and rarely show lesions. However, the existence of this disease in poultry may cause some valuable breeding cattle to be sacrificed unnecessarily.

The work already done on poultry, particularly the educational program to persuade flock-owners to keep only young birds, has reduced the prevalence of this disease in certain communities, as indicated by the lower percentage of hogs retained at markets which receive supplies from such areas. The number of hogs retained for tuberculosis, in proportion to kill, has decreased nearly 50 per cent at Chicago, Sioux City and Omaha during the past ten years. For the nation as a whole, exclusive of these three markets, the number of hogs retained for tuberculosis, in proportion to kill, has decreased only 19 per cent. The fact that at some markets outside of the north central group, there has been an increase in the percentage of hogs retained for tuberculosis would indicate that this disease in poultry covers a larger area than formerly.
In recent months surveys have been conducted in Illinois, Indiana, Iowa and Nebraska to determine by the tuberculin test the prevalence of the disease in poultry. A typical township was selected in each of several counties in various sections of these states. An average of about half of the flock-owners requested the test. It is of interest to know that an average of 54.7 percent of all flocks tested in these states disclosed one or more reacting birds. It is significant that of the total of 94,502 birds tuberculin tested, 14.2 per cent of those over 18 months of age and only 2.1 per cent of those under 18 months of age, reacted. Approximately one-half of the young birds tested were nearly 18 months old. Of the spring pullets tested, only 0.5 per cent reacted.

It required the services of from two to three veterinarians to test one township in two weeks. Clinics were held one day and many specimens were brought in for posting. The testing and clinic created local news and ample space was given in the county newspapers for intensive publicity. In this, particular emphasis was given to the high percentage of old birds reacting. It offered excellent opportunity to urge all farmers in the county to dispose of the entire flock at the end of the first laying year, not only to eliminate tuberculosis gradually, but also to get more eggs from the same feed consumed. Some will adopt the plan and the disease will be reduced to that extent.

The fact that we do not have postmortem inspection of poultry is in some measure responsible for the complacency of flock-owners. If such inspection is established, as many predict, the losses on condemnations would be exceedingly large in the older birds.

Unquestionably, the prevailing practice of keeping only young birds in the eastern states accounts for the low percentage of avian tuberculosis in that section. There the farms are smaller, poultry is an important source of income and more attention is given to economical egg-production.

Commercial Hatcheries

In the case of valuable breeding flocks that the owners desire to keep for more than one year of egg laying, the tuberculin test can be applied annually, as such flocks constitute less than 10 per cent of the total. Indiana has under test for the elimination of tuberculosis and pullorum disease the flocks of twelve commercial hatcheries. Michigan has six hatcheries under such supervision. If such a program can be developed in other states, it will help materially in solving the avian tuberculosis problem.
SELLING BY GRADES

The recent adoption of the plan of selling poultry by grades should also help, as those that have inferior birds, through disease or any other cause, will receive more nearly the real market value for such specimens, which is necessarily very low.

There are other states where tuberculosis is just as prevalent as in the four where surveys have recently been made. In some it may be worse. It offers a real problem and will require the best efforts of sanitary officials to cope with the situation. Unless it can be substantially improved, there may develop a revolt against the consumption of poultry. The industry is too important as a source of revenue to permit this.

The campaign against bovine tuberculosis has been so successfully waged, there is every reason to believe that some plan will be evolved to complete the job by eliminating this disease in poultry as well as in cattle, to the great advantage of both the poultry and swine industries.

DR. A. E. CAMERON: I should like to emphasize Professor Smith's remarks in regard to poultry. It is well known that tuberculosis develops in poultry after, generally speaking, they are a year old. So, if the poultry man could be educated to disposing of his flock after the heavy laying period, he would practically eliminate tuberculosis in a period of five years. This, in turn, would reduce the infection in swine.

There is another point and that is if poultry is killed at the end of the year, you would eliminate many carriers of disease such as laryngotracheitis. You would reduce the carriers of parasites and such an action would have a very far-reaching effect.

DR. K. W. NIEMANN: Just one question. If I understood correctly, Professor Smith made the statement to the effect that the tuberculin test was the only accurate means of determining the incidence of infection in poultry. I had occasion to look into that several years ago and we failed to substantiate that, either with our own work or where we could find literature regarding it. I wondered what was the basis for that statement.

PROFESSOR SMITH: It is the only test that we know of that will disclose tuberculosis. I do not know that it can be said to be 100 per cent accurate any more than in cattle, but it is the most accurate test we have. It has done the business, as shown by these records. We are not advocating the testing of all flocks. I think that would be unnecessary. What we are advocating is the testing of the valuable breeding flocks that the owner may wish to hold over. We are advocating that all others be sold at the end of the first twelve months of the laying year.

DR. NIEMANN: We attempted to eliminate the disease in a flock of turkeys in California and failed.

PROFESSOR SMITH: You get my point? General application only on valuable flocks. In Iowa they found in the survey where they tested a township in each of three counties in each of three parts of the state, that the average flock infection was 67 per cent—two-thirds of the flocks showed one or more reacting birds. The average young-bird infection was 0.5 per cent and the average old-bird infection was 15 per cent. Now, all those young birds were spring pullets. That is the reason they were down to 0.5 per cent.
COMPLETING TUBERCULOSIS ERADICATION

In five counties in Illinois the average flock infection was 52 per cent; the average young-bird infection was 1.1 per cent and the average old-bird infection was 11 per cent. In Illinois at least half of the young birds were approximately 18 months of age. The other half were spring pullets. That gave a little higher average. I think in Indiana, most of these young birds were past twelve months and almost 18 months. They have a high percentage in young birds—5.6 per cent; 16 per cent of the old birds.

In Nebraska, their average flock infection in two counties was 49.6 per cent; average young birds, 0.26 per cent, and old birds, 8.7 per cent.

I do not have the Colorado figures here but the general average for all these states was 52.7 per cent flock infection; 12.6 per cent old birds and 1.8 per cent young birds. That shows the problem in the Middle West.

I wish to mention one thing that I omitted. Some poultrymen are inclined to frown on the idea of selling the old birds. We had some information on this from a breeding standpoint. We are fortunate in having with us Dr. C. L. Martin, of New Hampshire, where they have almost no avian tuberculosis. Dr. Martin, will you make a brief statement on your condition?

Dr. Martin: It has been a practice in New Hampshire, for the last 20 to 25 years, of not holding any of the old stock. That is the so-called plan of pullet breeding; and together with that, which is the main point in the program, is the second point, that the birds are raised entirely in confinement. By that, I mean away from other live stock.

Since the laboratory was instituted in 1925, we have one case on record of avian tuberculosis. Now, some of you probably will raise the question about the breeding of these birds—not carrying them over more than one year. It is quite common practice there to hatch stock early, perhaps in February or late January or by the first of March. That is when the stock is hatched which is to be used for their replacements. They come into production rather early—two and one-half to five and one-half months of age. And then along in December, as a flock, they have some slowing up in production. What you might call a partial rest period. Then you have them coming into production again and they are suitable to produce the eggs from which to hatch the next year's stock. From that program, the birds have proved themselves, we think.

The Home Economics contest records show we have had a very substantial increase in the number of eggs per flock within the last ten years for which we have records.

Another good measure, we feel, of the soundness of this program is the proposition of hatchability and livability. Many flocks show better than 80 per cent for hatchability. I think that as far as livability is concerned there can be no question about the fact that they should live very well. I do not know what further proof is necessary to prove that, as far as breeding is concerned, in general, not the advanced breeder so-called, but the general farm poultry flock, this is the best system.

President Wisnicky: We now come to the report of the Committee on Tuberculosis. Dr. Axby is chairman of that Committee and he and his committee members have been busy during a considerable portion of the time of this meeting working hard on this report. I think they deserve special commendation for their diligent efforts. I am pleased to present Dr. J. Leonard Axby, who will give us that report.

Dr. Axby: I wish to give you my personal reactions first. I wrote to each member of the Committee on Tuberculosis and asked him to submit to me the names of the men they should like to have on the
program and the peculiar coincidence is that the men who were on the program were unanimously selected. I wrote to the men whom you have just listened to as participators and I got a fine response and they agreed to be on the program. I wish to say to you in desiring to be conscientious and honest and at the same time frank, that I recognize that these men may have equals in the United States Live Stock Sanitary Association but I do not think they have any peers. And I am proud, not only to have been associated with these men who have been coworkers with me on the Committee on Tuberculosis but to have been chairman of this Committee and then furnish you this program. I believe that when I refer to it that it will be a long time before any man will ever be able to give you a program that will exceed the one you have heard today.

Now, those are my personal feelings in the matter. Now, speaking for the Committee as a whole, I beg to present the following report:

Dr. Axby read the report. (Applause)

REPORT OF COMMITTEE ON TUBERCULOSIS

Dr. J. L. Axby, Chairman, Indianapolis, Ind.
Dr. E. T. Faulder, Albany, N. Y. Dr. H. D. Port, Cheyenne, Wyo.
Dr. George Hilton, Ottawa, Can. Dr. H. A. Seidell, Des Moines, Iowa
Dr. C. C. Hisel, Oklahoma City, Okla. Dr. A. E. Wight, Washington, D. C.

Your Committee on Tuberculosis endeavored to have presented to you a program that would furnish such information as would give you a better understanding of the problem of tuberculosis eradication, including not only its present status but also some of the problems and policies for consideration in completing the work.

To the men participating in this program, the Committee is indeed grateful, and sincerely thanks them for their fine work.

RECOMMENDATIONS

A. We request the United States Bureau of Animal Industry to amend Order 309, Regulation 7, Footnote 9, to read as follows:

"The regulations of the state of destination must be complied with,"

and that this footnote be incorporated as a part of the Regulations. Also, the use of Form T. E. 15-C be discontinued and that laymen other than live stock sanitary officials be prohibited from issuing certificates for the interstate movement of live stock.

B. We recommend to the Bureau of Animal Industry that a uniform method of reporting postmortem findings of tuberculosis be inaugurated, and that a prompt report be mailed to the chief state sanitary official and Bureau of Animal Industry inspector-in-charge in the state in which the shipment originated. We further recommend that postmortem findings, together with the required tuberculin testing of cattle, be used as a basis for the reaccrediting of modified accredited range and semi-range areas.

Dr. Axby: Now, Gentlemen, Recommendation A was unanimously approved by the Committee and submitted to the Executive Committee on December 2 and was approved by said Committee. Recommendation B received the unanimous approval of the Committee. Mr. President, I move that the report be referred to the Executive Committee.

Dr. C. C. Hisel: I second the motion.

President Wisnicky: Is there any discussion?

Dr. W. T. Spencer: Do we understand that report to mean that the present method of handling cattle from accredited areas on a certificate of the agent of the owner is recommended to be discontinued?
DR. AXBY: Yes sir.

DR. SPENCER: That is going to bring about a very serious problem in the handling of market live stock. I think, at the present time, practically all the feeder cattle, both female and male, are handled on the basis of a certificate from the agent of the owner at the public markets, that these cattle originated in accredited territory. If that is discontinued, I cannot see how we can handle the problem in territory like western Nebraska, Colorado and Montana on feeding cattle going into other states. I should like to have it cleared up just a little, just what is intended to be conveyed by that recommendation. If it does mean that no cattle can move without a certificate from an approved veterinarian, it really is going to be a very serious problem from the public market standpoint.

DR. AXBY: I am not surprised at your question. You refer to some areas of the country, however, from which the very objection originates and I think some of those fellows are here. Take myself in Indiana where the railroads accept Form T. E. 15-C as a health certificate. It is not a health certificate. It just states the cattle originate in a modified area. There comes a consignment to a county agent. Fifteen or 20 days afterward, I get a copy of this form and I go to trace these cattle in Indiana and they have been sold 55 or 60 different ways and it is impossible for me to find them.

The Indiana law says that if they are breeders they must be tested for Bang's disease. So I am confronted with the proposition whereby with one hand I have been asked to urge the giving of Bang's disease money, or federal cooperation that we might eradicate Bang's disease, then this thing out of the other direction comes along and they say, they are not feeding cattle, they are breeding cattle and they are disseminated among the very cattle in which we have been carrying on this program. So we found that that form was despoiling the purposes of the elimination of the thing we did not want. They are not health certificates although the railroad accepts them as such and that this problem might be brought to your attention, not to render any hardship on anyone in the West or Central West, we bring it to you in this form. We recognize the promises that have been made—the statements that have been agreed upon, but as a result, we find we are endangering ourselves and are liable to bring about a condition that we did not anticipate if these forms are continued in use. Now does that in any way clear up your thought?

DR. SPENCER: No, it does not. The point that I have in mind you did not answer specifically. And that is, whether or not it was intended to replace entirely this present method of handling these cattle.

DR. AXBY: The recommendation says, "be discontinued." I think that should answer your question specifically.

DR. SPENCER: I think, Mr. Chairman, it is absolutely unnecessary to require such a drastic movement as that. We have gone ahead and cleaned up the map there that Dr. Wight presented on the condition of the entire United States and it shows that only five states have any amount of tuberculosis left and it seems to me that these people who have gone ahead in good faith and cooperated and extended every effort to carry this program to the place where we have, should certainly be entitled to some consideration in the handling of their products and this proposition is going to interfere so seriously with the normal business of selling and buying cattle that it will cause a very marked resentment to any kind of live stock sanitary control work. I do not think it is needed and I think it is very unwise for this Association to go on record recommending such a drastic movement. I think it should be fully discussed because many states will be vitally affected by such a regulation. I think we ought to have a very careful consideration of this before we go on record as approving it.
Dr. C. E. Cotton: I think, perhaps, I can enlighten you, Dr. Spencer. I think, perhaps, I am the originator of that. I wish to state that this has been argued before the Association of Live Stock Sanitarians on Tuesday and also before the Executive Committee of this Association and explained somewhat as follows: There was no intention that this certificate Form T. E. 15-C shall not be respected. But heretofore, under Regulation 7 and Order 309, that has been in effect since July 1, 1919, they have always given cognizance of and respect for the requirements of the various states for importation of cattle as far as tuberculosis is concerned. As a result of this, amended Order 309 is in force. It provides that feeding animals can go interstate on a certification of the owner or his agent and, as Dr. Axy has explained, that it does not provide for any certificate of health and as a result of this, in the last month, in Minnesota I have had at least 20 such certificates and I know some cattle have come in without any certificate because there was no provision that provided for Form T. E. 15-C or a copy thereof being sent to the state of destination as in the health certificate.

We had one instance where 57 cattle were shipped by the agent, the American Shorthorn Association, and 15 days afterward a copy of that form was on my desk. In the meantime, I happened to locate these animals in the railroad yards, 57 of them going to 57 different farms and they had already been sold. There was no certificate of health. Now the federal government requirements are, and have been prior to this amended regulation, such that no animals affected with any communicable disease can go interstate. What does this mean? That animals are accepted by the railroad agent at the point of shipment with this certificate Form T. E. 15-C, which simply states that any truck-driver, scalper, or whatnot, can buy ten cattle and make a statement that they come from an accredited area, and we have to accept it. In your stockyards, that is not allowed. They certify, but on the face of it you must have a health certificate. We are not accepting that it be done away with. I know that we all know what is behind it. We do not want any more restrictions than we had prior, but we want that health certificate. We will accept T. E. Form 15-C provided it is accompanied by a health certificate.

Dr. Spencer: Here is one definite question. We have a man at Hyannis, Nebraska, who loads a carload of cattle and ships them to the public market. Those cattle, heretofore, have been permitted to go to Minnesota or some of the other states on this Form T. E. 15-C. Under this ruling or this recommendation, those cattle do not move from the public market into your state or to any other state until they have a certificate from a veterinarian at the point of origin?

Dr. Cotton: No. They can stop in transit. We are respecting your certificate but we do want the protection in so far as the health certificate is concerned.

Dr. Spencer: You want a certificate from the Bureau of Animal Industry at the public market or some approved veterinarian? Dr. Murdock is here who has charge of the inspection work in Omaha. I should like to have him tell us how they have been handling it out there.

Dr. J. W. Murdock: As far as health certificates are concerned, federal regulations in the past did not provide for a health certificate for stock moving interstate except from public stockyards. That is not a health certificate as written now. It is an inspection for scabies and we could not move the cattle at all out of the public markets unless we obtained this certification. Cattle moving interstate without a health certificate are not doing any more now under this amended regulation than they have been doing for years because they have been moving right along without health certificates, and in many cases permits are written to receive through shipments from the Omaha
yards on permit of state veterinarians. It would be just a permit to move so many head of cattle.

When they move through a public stockyard under federal regulation, if moving in violation of state regulations, we are supposed to stop those cattle. At the present time, we are having all kinds of trouble because under federal regulations those cattle are moving with a modified accredited area certificate. We are not stopping the cattle at the present time because most of them are moving under the statement of a veterinarian which specifies that they move only from modified accredited areas. I think railroads have been somewhat mixed up in accepting these modified accredited area certificates in lieu of health certificates. There has been some movement made in good faith both by the owners and accepted by the railroads on the strength that this modified accredited area certificate was a health certificate, but there is no need of that. They have been doing that for years. Cattle have been moving interstate without those certificates and it is up to the state. They have to follow the state regulation.

MR. R. L. CUFP: Dr. Murdock, here is the way we are doing it in Kansas City. We use a modified form of this T. E. 15-C for an application to the Bureau of Animal Industry to ship and then the Bureau of Animal Industry issues one Form F. I. 48 and puts on a statement that the cattle are from a modified accredited area and that is the way they are released there. This new form is used only as an application to the Bureau for Form F. I. 48.

Dr. Murdock: We are doing the same thing, and whenever live stock moves out of the market to any state, they are furnished with a copy of Form F. I. 48 and the Bureau's certificate. But we are having trouble with moving stock. They ask us to make the certificate when they are stopping for feed and water. We are refusing, in many cases, either to write the certificate or give them a permit and they are held up at other markets.

PRESIDENT WISNICKY: There is a motion before the house, duly seconded, that the report be received and referred to the Executive Committee.

. . . The motion was put to a vote and carried. . . .

PRESIDENT WISNICKY: Now we have completed the subject of tuberculosis. Dr. A. W. Miller has an announcement to make.

DR. A. W. MILLER: The statement is on behalf of the Committee on Miscellaneous Transmissible Diseases and is as follows: "The Committee on Miscellaneous Transmissible Diseases has no general report to submit. The papers by Dr. Records and Dr. Crawford will be our contribution to this program. Dr. Crawford is unable to be here. His paper will be read by Dr. W. E. Cotton, superintendent of our Beltsville Research Station.

PRESIDENT WISNICKY: First is "The Epidemiology and Control of Equine Encephalomyelitis," by Dr. Edward Records, of Nevada. I present to you Dr. Records.

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

THE EPIDEMIOLOGY AND CONTROL OF EQUINE ENCEPHALOMYELITIS

By EDWARD RECORDS, Reno, Nev.
University of Nevada

In 1930, Meyer and his associates, working in California, established the relationship between a certain central-nervous-system disturbance of equines and a filtrable virus. The same
relationship has since been established over a large part of the western and north central states and along the Atlantic seaboard. There are certain minor technical differences between the western and eastern strains of virus, but as they cross-immunize, in horses at least, for our purpose they may be considered together. The designation equine encephalomyelitis has by common consent been given to this condition. This appears unfortunate, as it is descriptive of only the frank clinical manifestation of this virus and not its underlying activities.

The original discovery referred to aroused great public interest and was responsible for a large amount of research work which has continued to date. This in turn has been responsible for a large volume of published material of variable quality depending on the ability, resources, and motives of the writers.

In spite, or perhaps because, of all this there appears to be a lack of information among those most in need of it as to the fundamental principles involved in this disease complex. It is our purpose to try and clarify this condition by giving a very brief and impartial summary of what is and is not known about this so-called equine encephalomyelitis, based on the information available to us. Technical details, statistics, and references will perforce have to be omitted. Anyone interested in these can refer to the voluminous source literature available.

**EPIDEMIOLOGY**

Knowledge of the epidemiology of this condition is fragmentary and suggestive rather than conclusive. The means by which the virus is maintained and disseminated, and invades the horse under strictly natural conditions have not been established. Under experimental conditions several species of mosquitoes and at least one of ticks have been reported as capable of transmitting the virus to mammals. The virus has not, however, been demonstrated in free-living insects such as mosquitoes or flies.

Intranasal infection is readily accomplished experimentally but its rôle under natural conditions is also not proved. That natural transmission of the virus by this route may occur is to some extent supported by the fact that the nasal discharge of clinical cases is highly infectious, and by inference that of subclinical cases may be.

The simultaneous occurrence of a large number of clinical cases over widespread but new areas during late summer has not been satisfactorily explained. The rather rapid and long-distance dissemination of the virus between the active seasons of clinical cases is rather indicated but not proved. Such disseminations cannot apparently be definitely connected with the movement of
horses. In fact, the visible manifestations of this infection are apt to move against the prevailing flow of horse traffic. On the other hand, the movement of susceptible horses into an area where clinical cases have recently occurred often results in a large percentage of cases among them.

Two general theories as to the perpetuation and dissemination of this virus seem most plausible. First, that the virus is primarily one of horses maintained and spread through a constant succession of unnoticed subclinical contact infections. Second, that the virus is not primarily one of horses but of some other free-living host from which it passes over into equines under favorable circumstances, with or without producing noticeable symptoms. The closest students of the epidemiology of the disease, the virus, and similar viruses, do not seem inclined to credit the existence of chronic infectious carriers among equines.

The rather marked seasonal prevalence of clinical cases during late summer may be explainable by meteorological or other factors than the simultaneous prevalence of insect life. Age, sex, level of nutrition or exertion do not appear to be controlling factors in the occurrence of clinical cases as distinct from subclinical cases in susceptible horse groups.

Observations and blood-serum tests have shown that there is in general a rather direct relationship between the percentage of clinical cases occurring in an area and the development of subsequent cases there. A season marked by numerous clinical cases is usually followed by several years of few cases, except among colts born subsequent to the outbreak; practically all of the exposed horses having become immune through subclinical infection. The occurrence of a few scattered clinical cases in an area late in the season, on the other hand, is a fair indication that a large number will occur there the following year if conditions are favorable. There are, however, many exceptions to this rule and practically the whole horse population of large areas may acquire a natural immunity without the observance of many or any clinical cases.

**INDIRECT CONTROL MEASURES**

A consideration of the few known epidemiological factors makes it clear that they offer little of value in connection with indirect control. There appears to be no logical basis for attempting control of quarantine measures. Neither is there any basis for eradication through the elimination of proven sources of infection.

Even control by artificial immunization in advance of the usual season for clinical cases does not rest on a very secure basis,
owing to the inability to predict with any certainty where this procedure will be economically warranted in any given year.

Should it be decided to undertake the preseason immunization of the horses in a given area, two plans of procedure are now available. First, we have the use of the formalin-killed, horse-brain-tissue vaccine now on the market commercially. It is claimed that this material will produce sufficient immunity to prevent susceptible horses from developing clinical cases of the disease as the result of natural exposure. Further experience may prove that this is for all practical purposes correct. Assuming this method is effectual, it is still open to serious economic objections as far as widespread use is concerned. The cost of the material is about $2.50 per horse with no prospect of material reduction, to which must be added the overhead of administering the two successive doses considered necessary.

A second method available is the injection of a single small dose of living virus, attenuated and fixed by repeated passage through laboratory animals. Properly prepared and used in suitable doses such strains of virus are non-infective for horses but highly antigenic. A single dose will, within a short time, solidly immunize a susceptible horse so that it will withstand even intracranial injection with large doses of fully virulent virus. In addition to the high degree of immunity produced, this method has marked economic advantages. While it has not been distributed commercially as yet, the cost of the material would not exceed 25 cents per horse and only one injection and one handling of the animal are required.

We know of no valid objection to the use of this method in competent hands. If a properly modified strain of virus is used in correct doses, it will not produce any noticeable reaction even in the most susceptible horses. Neither is there any reason to suspect that it will create either spreaders or carriers. This method is merely a controlled speeding up of what appears to be the usual natural process of imparting immunity to susceptible horses without the creating of visible symptoms. There are numerous well-established precedents for this in human and veterinary medicine.

**DIRECT CONTROL MEASURES**

For the reasons cited, plus the human tendency to delay action until circumstances force it, control is apt to be deferred until clinical cases appear. There is, however, no reason for live stock sanitarians and veterinarians not being prepared in advance to act promptly when an emergency arises.
The appearance of any material number of clinical cases in an area immediately offers two problems: the handling of the sick horses and the protection of the susceptible horse population. When the clinical cases are severe enough to indicate a reasonably high death-rate but not hopelessly peracute, the use of liberal therapeutic doses of highly potent antiserum are indicated. For this use it is important that the serum used show a high titre of the virus-neutralizing fraction. Medicinal treatment as a supplement to the serum should be conservative and good nursing is essential to success. The isolation of clinical cases may be advisable for its moral effect, but probably has no scientific foundation. As sources of infection either from the virus in the blood-stream or the nasal discharge, they have presumably done most of their possible damage before recognition. Unrecognized ambulant cases are very likely potentially more dangerous than the frank clinical ones.

For the protection of the susceptible horse population, neither the use of formalin-killed, tissue-virus vaccine nor live virus alone is indicated, owing to the time required to establish immunity. Even the live virus method requires at least 15 days for this purpose, during part of which time the animal is probably rendered even more susceptible to damage from natural infection.

Prophylactic doses of patent antiserum will confer almost immediate protection but it is short-lived, not lasting over 15 or at the most 21 days. Exposure to natural infection during this period apparently cannot be relied on to produce immunity. After the period of passive protection from the serum expires, horses so treated appear just as prone to develop clinical cases as untreated ones, in fact, some observations indicate that they are even more apt to. This difficulty can be and has been overcome by repeating the serum injections at intervals of about two weeks until the active season for clinical cases is passed, but this is obviously expensive and time-consuming.

All things considered, the most economical and practical method of controlling an outbreak of clinical cases seems to be the simultaneous injection of all exposed susceptible horses with antiserum and the living fixed virus already referred to. These two agents do not appear to interfere with each other, when fully standardized serum and virus are used in properly correlated doses. Seemingly the mechanism involved is that, by the time the passive immunity from the serum wears off, it is superceded by an active immunity resulting from the reaction of the animal to the virus injection. How long this active but artificial immunity persists is not known, but it probably lasts as long as
that from a natural infection not resulting in clinical symptoms, the usual natural process.

**CONCLUSION**

No claim for finality or infallibility is made for anything which has been said here. Knowledge relative to this interesting and economically important disease of equines is still rapidly developing. Before anyone becomes unduly critical, however, certain confusing factors should be excluded.

Our remarks apply only to one specific virus, and rigid differential diagnosis is essential before any of our suggestions are applied or evaluated. What we have said about the results to be expected from biologic products applies only to those of high potency accurately standardized. Much progress in the production of these has been made, but further improvements are needed and are to be expected.

For general field use anti-serum should contain a high titre of both the protective and the virus-neutralizing fractions. Unfortunately in the past this does not appear to have always been the case, some of the serum used being low in one or both these fractions.

The formolized tissue-virus vaccine seems to be of its very nature well standardized and stable, hence it should be reliable within its field of usefulness.

The living modified fixed virus referred to is a well-standardized and quite stable product in the laboratory. Its somewhat perishable nature, when exposed to adverse conditions of temperature and dilution, have presented certain difficulties in connection with its field use. Improvements in preparation and packaging methods now under way promise to solve these so that there will be every assurance of the injected horse actually receiving a standardized dose of fully active material.

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**PRESIDENT WISNICKY:** This paper is to be discussed by Dr. Hadleigh Marsh, Montana Veterinary Research Laboratory, Bozeman, Montana. I am pleased to introduce Dr. Marsh.

**DR. MARSH:** The only reason for my being asked to discuss this paper is that last summer we tried Dr. Records' suggestion of a method of serum-virus immunization. We had a little outbreak of encephalomyelitis in several areas in Montana and in attempting to control this disease, we vaccinated about 4,500 horses by the serum-virus method. We prepared the virus in our own laboratory from a strain of virus supplied to us by Dr. Records. All I will say about that now is that we had no ill effects from the use of this method of vaccination and as far as the immediate outbreak is concerned, we apparently stopped it.
The question of lasting or permanent immunity as a result of this immunization we are not yet prepared to discuss. However, there are one or two comments I would like to make in connection with Dr. Records' paper. The impression left, possibly, after hearing Dr. Records' paper is that for a man of his experience in dealing with encephalomyelitis, the problem to a certain extent is rather simple. He recommends certain procedures and says that we may expect to get good results. But I would like to call your attention to the fact that several things have occurred which simply emphasize the fact that there is a great deal about these virus diseases that we do not know, and when you start handling an outbreak of encephalomyelitis, many things may happen that you cannot explain before you get through.

Three years ago, a condition occurred in Utah, about two months following an outbreak of encephalomyelitis, which has never been explained and this year, in Montana, we lost a good many horses about two months after our outbreak of encephalomyelitis by a disease we have not been able to name. Since I have been here, I have learned that Colorado and Wyoming have had the same experience. We had 88 cases of this condition in the same areas where we had encephalomyelitis in the summer. These occurred on 69 different ranches and only 14 had a history of previous infection. Eighteen of these 88 cases happened to be in horses which had been immunized. That may mean something and it may not, for in that particular area, nearly all the horses had been treated. In one area, where no virus was used—only serum—this condition was also present. In Colorado and Wyoming the same thing occurred, both in treated and untreated horses, and in those cases the only treatment used was serum alone.

As I said, we have not been able to name this disease. Histological examinations of their nervous systems have been negative. The symptoms have been different from any of the cases which we have in our true outbreak of encephalomyelitis. The cases have been very acute and most of them fatal and they showed evidence of cerebral disturbances. There was no rising temperature connected with this disturbance.

We hope, in the future, with close study and investigation of similar conditions, to be able to explain this disease. I want to call your attention to this because I think we shall have to be a little careful in looking forward to a satisfactory control of this disease with any of these immunizing agents. As I say, this second outbreak is apparently not the true encephalomyelitis but something has happened there to kill these horses and it may be possible that it is the mixture of viruses. I just wanted to call your attention to these things in connection with that paper. (Applause.)

DR. J. C. HARGRAVE: I plead ignorant to an extensive knowledge of encephalomyelitis. I am wondering if one were to attempt to confirm a tentative diagnosis, whether other than brain tissues might be used. Knowing you people in the States have been and are still working on this disease, I thought you might be able to give me some light.

DR. RECORDS: In a few instances, the virus has been recovered from the blood of living horses in the quite early stages of developing clinical cases. In fact, I remember one instance when we recovered it from such a horse which never was a pronounced clinical case and recovered completely without any complications. I, myself, do not have background enough of attempts of that kind, to say what the percentage of chances would be of doing that. Probably not any too good, as compared to the usual method of using central-nervous-system tissue. The usual procedure, if possible, is to destroy a horse which has shown a good classical clinical case, neither too acute nor too lingering, but well along in the disease, but not moribund. In that case, take selected portions from the brain-stem and the medulla, rather avoiding the
cortex of the brain which is apt to be virus-free and take these selected portions and inject them singly into guinea pigs rather than to pool them and introduce the factor of dilution. Virus is not likely to be concentrated in horse tissue and it is very unusual for all of those selected portions to transmit the infection in a guinea pig but in a reasonable percentage of cases they will. It occasionally can be picked up in other tissues. We captured it from a lymph-gland of one horse and it was not in the brain.

Dr. H. W. Schoening: At the meeting of this Association last year, Dr. Lee Giltner, of the Pathological Division of the Bureau, reported on the incidence and the present status of infectious encephalomyelitis in this country for the year 1935. A large part of this material was drawn from information obtained as a result of questionnaires that were sent to the various state veterinarians. This past year, a similar questionnaire was sent to the state regulatory officers and we had a very fine response in both years.

It might be interesting to tell you briefly that the compilation of the statistics of 1935 showed 23,512 cases reported in the various states, and in 1936, while all of the data are not yet in, undoubtedly there is a marked decrease in the incidence of encephalomyelitis as compared to last year. I might say that we propose to send out a similar questionnaire to the state veterinarians again next year and we hope the response will be as good as it has been in the past. We think this is a very important line of activity to get information on the disease as it exists in the field over a period of time and that information so obtained will, undoubtedly, place us in better position to solve this very perplexing question.

I think we have very much still to learn about encephalomyelitis and I want to emphasize what Dr. Marsh has said that it is well to proceed cautiously in any manner of control. I, personally, question very much the use of live virus as a vaccine until we know more about the thing. We should proceed cautiously in that respect.

We heard a discussion this morning on the method of attenuating or killing a vaccine agent—a live virus, that has been in use for many years. A live virus is potentially dangerous under certain conditions. I think that is recognized and an effort is being made to take away that hazard and I think we should perhaps be careful not to introduce the hazard of a live virus in another disease about which we know very much less than hog cholera.

PRESIDENT WISNICKY: Our next paper is on "Experimental Vesicular Exanthema of Swine," by Dr. A. B. Crawford, National Agricultural Research Center, Beltsville, Maryland, but since Dr. Crawford could not be here, Dr. W. E. Cotton will present it to you. I take great pleasure in presenting to you Dr. Cotton.

. . . Dr. Cotton read Dr. Crawford's paper. . . . (Applause)

EXPERIMENTAL VESICULAR EXANTHEMA OF SWINE

By A. B. CRAWFORD, Beltsville, Md.

Animal Disease Station, National Agricultural Research Center

In April, 1932, an outbreak of an infectious disease in hogs, characterized by vesicles and erosions on the snout and feet, occurred in a garbage-feeding ranch in southern California. As
the sites and appearance of the lesions were identical with those of foot-and-mouth disease, prompt control measures were instituted and the disease was eradicated without spreading to any other species of animals.

One year later, a similar outbreak occurred in several hog-feeding ranches near San Diego, California. Quarantine measures were instituted and again the disease was eradicated before it assumed epizootic proportions. Tests of the virus were made at this time by Dr. J. Traum, of the University of California, in cattle, hogs, horses, and guinea pigs, and it was discovered that the exanthema could be produced artificially in swine and, at times, in horses but not in cattle or guinea pigs.

Since the disease could not be transmitted to cattle or guinea pigs, it was apparent that it could not be classified as either foot-and-mouth disease or vesicular stomatitis. To this previously unreported disease, Traum gave the name of "vesicular exanthema of swine."¹ ²

Virus of the second outbreak (hereafter to be referred to as type "A" virus) from an artificially infected horse and from swine both naturally and artificially infected was sent to this Station in April, 1933, and studies have been continued intermittently up to the present in an endeavor to learn more of the nature of the disease and the points of differentiation between it and foot-and-mouth disease and vesicular stomatitis.

At this Station, transmission of the virus was made first to hogs and horses, in order to obtain a sufficient amount of material for the inoculation of other species of animals. In hogs, small areas were scarified on the snout and on the interdigital space and bearing surface of a foot, and a 1:10 or 1:20 emulsion in saline solution of affected tissue was applied to the scarified areas. In the horse, an area about one inch in diameter on the epithelium of the tongue was scarified and virus applied.

**RESULTS OF INOCULATIONS IN HOGS AND HORSES**

In hogs, the symptoms appear very rapidly. In 16 to 28 hours, occasionally a little later, the inoculated areas show reddening and slight inflammation, followed by an acute rise in temperature. The temperature may be normal at the 20th hour and two or three hours later it may have risen to as high as 107.6° F., at which time vesicles containing clear, straw-colored fluid appear on or near the scarified areas. Following the spontaneous rupture of the primary vesicles, the tem-
perature drops gradually to normal within 48 to 72 hours unless there is extension of inflammation and vesiculation. When the latter occurs, the temperature remains elevated. As is the case in most infectious and contagious diseases, there is a variation in the resistance or susceptibility of animals of the same species to the virus of vesicular exanthema, and different types of this virus, as will be discussed later, vary in their virulence.

In the most susceptible animals, the entire snout may become swollen, with erosions and vesiculation over practically the whole area and extending deeply into one or both nostrils, the latter invasions being followed by a thick, grayish, nasal exudate. Erosions sometimes develop on the lips and buccal membrane. On the scarified feet, vesiculation may spread from the interdigital space upward and around the coronary bands of both digits, and downward to the bearing surface of the pad, and around the base of the dew-claws. Secondary lesions may occur on the uninoculated feet from 48 to 72 hours after the formation of primary lesions. Occasionally in severe infection, a lesion develops on the tongue. This is primarily a circumscribed, wrinkled uplifting of the epithelium from 10 to 30 mm in diameter, turning to a grayish-yellow color and sloughing within 48 hours.

Healing of the affected areas begins soon after the rupture of vesicles. The vesicle coverings and erosions on snout and feet turn brown, become dry, and gradually slough. In some of the large hogs with badly affected feet, swelling of the whole foot takes place, leaving chronic malformations, probably due to the invasion of secondary organisms. In the majority of cases, however, seven to ten days after infection the only evidence of the disease left is cictrization in the eroded areas.

In comparison to the intensity of the thermal reaction there is an amazingly slight impairment of the appetite. In the acute cases, there is seldom apparent loss of appetite. Even severely affected animals rarely fail to come off their beds for feed, although they may eat but sparingly for a day or two. At the height of the thermal reaction, hogs prefer to lie down but they are active when handled or disturbed. Large hogs when affected in more than one foot are more apt to lose condition than smaller hogs, due to their unwillingness to place pressure on their sore feet. The mortality of hogs inoculated with the virus of vesicular exanthema at this Station has been nil.
In horses, the course of the disease is short. Between the 16th and 24th hours after inoculation, there is a rapid rise in temperature to 103-105°F. The epithelium at the site of scarification becomes thickened and turns to a grayish-yellow color. The lesion has a sharply circumscribed margin and there is no extension beyond the area of scarification. There is seldom vesiculation. Occasionally around pin-point pricks, a small, rounded yellow elevation occurs from beneath which a small drop of clear fluid exudes when ruptured. Coincident with the change in color, the affected epithelium becomes loosened and sloughs, which is followed by salivation. The temperature returns to normal within a few hours. Except for an unwillingness to eat for a day or two, due to the soreness of the tongue, the horse suffers only slightly as a result of the infection. Within a week after inoculation, the site of the lesion is recovered with new epithelium or scar tissue.

Traum reported in his letter transmitting the viruses from the 1933 outbreak to this Station, that only one of three viruses from different sources of infection was found capable of producing lesions in horses. Due to the small amount of material furnished by Traum, the three samples of virus received were pooled and the inoculum was found to be capable of infecting horses as well as hogs. It is very probable, in view of the results of later investigations, that if each of the viruses received had been inoculated individually into horses the same lack of virulence of certain of these types of vesicular exanthema virus for horses would have been found here as was reported by Traum.

Adult cows, calves, goats, sheep, guinea pigs, hedgehogs, white rats and white mice were inoculated with this virus, but each of these species appeared to be immune.

A filtration experiment was made with this virus, using a Berkefeld “N” filter, the porosity of which was controlled by Brucella abortus. About 1 gram of affected horse epithelium was emulsified in 10 cc of saline solution and passed through a filter paper. Five cc of this filtrate was added to 30 cc of normal horse serum and to this was added 1 cc of a dense suspension of B. abortus. This mixture was filtered through a Berkefeld “N” filter. Potato-agar medium and guinea pigs were inoculated with the filtrate but neither showed evidence of the presence of B. abortus in the filtrate. A horse was inoculated on the scarified tongue with the filtrate and within 24 hours had developed the characteristic lesions of vesicular exanthema, thus proving that the virus of this disease is a filter-passing organism.
EXPOSURE EXPERIMENT

On December 5, 1933, an experiment was started to ascertain the contagiousness of vesicular exanthema of hogs. A concrete barn, 28 feet by 40 feet, containing eight box-stalls each about 10 feet square, four on either side of its longer dimension, with a central passageway about eight feet wide, was used for this purpose.

On the passageway the stalls, including doors, were of tight board construction to a height of five feet. The first box-stall to the right of the entrance was divided into two hog pens by four 8-inch boards with a space of $1\frac{1}{2}$ inches between each two boards. The partitions between the first three box-stalls on the right of the entrance were removed and replaced with wire fencing. A hog pen similar in size to those in the first box-stall was constructed in stall 3. These hog pens were numbered 1, 2 and 3 (see figure 1). The entrance to the first stall was into hog pen 2 and the only way of entering hog pen 1 was by climbing the board fence.

Four healthy shotes were placed in each of hog pens 1, 2 and 3. Two of the four pigs in pen 2 were inoculated with the virus of vesicular exanthema on December 5, 1933, and at the same time...
time a horse was inoculated in the stall on the opposite side of the passageway.

In examining and caring for these animals, no effort was made to keep from spreading the infection from one pen to another, except that the pigs in hog pen 3 were examined first and those in hog pen 2 last, and the same utensils were used in feeding and cleaning without disinfection between pens.

At least two infected pigs were kept in hog pen 2 at all times. When infected pigs in pen 2 recovered, they were removed to the furthest stall on the opposite side of the stable, and replaced with healthy pigs which were then inoculated with the virus.

All pigs were examined and temperatures taken twice daily but there was no evidence of spread of infection from December 5, 1933, to January 27, 1934. On January 16, 1934, one pig each from hog pens 1 and 3 was placed in pen 2 in contact with freshly infected pigs. Neither of the pigs from pens 1 and 3, which were placed in pen 2, showed any indication of developing the disease four days later and were inoculated with virus in order to learn if they had developed immunity. The pig from pen 3 developed good lesions two days later but the pig from pen 1 proved to be immune. Three normal pigs were placed in each of pens 1 and 3 on January 16.

On January 23, another of the pigs from each of pens 1 and 3, which had been in the experiment from its beginning, was placed in the infected pen but neither developed infection.

On the morning of January 27, or eleven days after being placed in the experiment, each of the three pigs which had been placed in pen 3 on January 16, presented an unusual appearance. The tongue of each animal was protruding from its mouth, swollen and glistening, the muzzles were swollen and temperatures elevated. In the afternoon, the epithelium of the tongue was lifted on the anterior areas by large flat vesicles filled with clear, straw-colored fluid. The lesions in these three animals were much more intensive than in any of the pigs artificially inoculated.

This experiment was interrupted by the appearance of hog cholera in one pig in pen 1, from which the disease spread rapidly to practically all the animals in this barn.

Experimentally, vesicular exanthema of hogs does not appear to be an extremely communicable disease like foot-and-mouth disease or hog cholera. In its contagiousness, it resembles vesicular stomatitis more than foot-and-mouth disease. Other points of interest in this experiment are the fact that none of the pigs
in pen 1, which was contiguous to pen 2, the infected pen, picked up the infection, and the fact that the disease in pen 3 in the three pigs which had been in the pen only eleven days should be of so severe a type, and that all three developed symptoms simultaneously.

DIFFERENTIATION OF VESICULAR EXANTHEMA FROM VESICULAR STOMATITIS AND FOOT-AND-MOUTH DISEASE

On June 1, 1933, material collected from the tongues of two horses affected with type A vesicular exanthema was sent to Professor Doctor O. Waldmann,* eminent German authority on foot-and-mouth and allied diseases, who kindly consented to make comparative tests of this virus with those of foot-and-mouth disease and vesicular stomatitis at the Isle of Riems, Germany. This procedure was in accordance with the policy of the Bureau of Animal Industry in not experimenting with the virus of foot-and-mouth disease in the United States. In his hands, the virus of vesicular exanthema was also found to be communicable only to swine and horses. He inoculated the virus into swine recovered from one of each of the three known types of foot-and-mouth disease and found that vesicular exanthema developed in these animals in the same manner as in normal animals.

Waldmann passed a series of hogs through vesicular exanthema and then successively through each of the three types of foot-and-mouth disease, an interval of about six weeks elapsing between each passage. In hogs which had previously been passed through either of the two known types (New Jersey and Indiana) of vesicular stomatitis, however, he discovered a partial immunity to the virus of vesicular exanthema; seven hogs recovered from the New Jersey type of vesicular stomatitis were inoculated with the virus of vesicular exanthema but only two developed lesions; four hogs recovered from the Indiana type of vesicular stomatitis were inoculated with the virus of vesicular exanthema but only one developed lesions.

Waldmann makes use of the "realkalization" test in differentiating foot-and-mouth disease from vesicular stomatitis. In this test, the virus is buffered to pH 7.6, then acidified to about pH 2.8, and then realkalized to pH 7.6. This treatment renders the virus of foot-and-mouth disease innocuous, whereas it has no apparent effect on the virus of vesicular stomatitis. Using this test on the virus of vesicular exanthema, he found it had no effect on its virulence, thus making another point of similar-

*Thanks are expressed to Dr. Mary Dunlop for her kindness in translating the report of Professor Doctor Waldmann.
icity between vesicular exanthema and vesicular stomatitis. Waldmann concluded from his experimentation that the disease reported by Traum was not foot-and-mouth disease but might be a form of vesicular stomatitis.

**TYPE B VIRUS OF VESICULAR EXANTHEMA**

In June, 1934, vesicular exanthema of hogs appeared again in garbage-feeding establishments in California and this outbreak assumed epizootic proportions.

On July 21, material collected from affected hogs in the vicinity of San Jose was received from Traum, and two hogs and one horse were inoculated with an emulsion prepared from this material at 1:30 P.M. At 10 o'clock on the following morning, the temperatures of the hogs were 103.4° and 104.0° F., respectively, neither showing lesions other than a slight erythema at the sites of inoculation; at 2:30 P.M. the temperatures of the hogs were 107.0° and 107.4° F., respectively, and the inoculated areas showed more marked inflammation and erythema; at 6 P.M., small, unbroken vesicles were present on the scarified areas. The horse showed no rise in temperature or any lesion.

At 9 A.M., July 23, no lesion had developed on the horse. Each hog showed extensive progressive lesions on the inoculated feet and snout and four days later, one of the hogs developed a lesion on the tongue. From the material collected from these two hogs an emulsion was made and a second horse, two calves, one goat, one kid, two sheep and two guinea pigs were inoculated. None of these animals developed any reaction to the inoculation. Eight horses in all were inoculated with this virus but none showed lesions other than a pinpoint or narrow fringe of necrosis along a scarification. There was no thermic reaction. One horse (582) was inoculated daily on five consecutive days without developing lesions.

**INDIRECT EXPOSURE EXPERIMENT WITH TYPE B VIRUS**

The early 1934, or type B, virus was passed from hog to hog in small concrete barn (see figure 2). One stall was divided into two pens by 6-inch boards with a space of 1¼ inches between boards. One pen was used for infected pigs and in the other were placed two control pigs. There was no entrance to the control pen except by climbing the fence from the infected pen. The two control pigs were kept in indirect contact with infected pigs from July 21 to August 6, 1934, without contracting the disease. On August 6, one of the two control pigs was placed in the infected pen and inoculated with fresh virus; it promptly
developed characteristic lesions. One new pig was placed in the control pen on August 6 with the remaining one, and an additional pig was added September 1. The three control pigs were thus in indirect exposure until September 17 without contracting the disease. The length of exposure of the three control pigs was 16, 42, and 58 days, respectively. This result showed that the type B virus also was not of a highly communicable nature like foot-and-mouth disease virus, and was more similar in this respect to the virus of vesicular stomatitis.

**CROSS-IMMUNITY TESTS WITH TYPES A AND B VIRUS**

It will be observed that the 1933, or Type A, virus and the early 1934, or type B, virus behaved differently with respect to horses, type A virus readily causing the disease on inoculation in this species, whereas the horse was refractory to type B virus. Further experiments with these two viruses disclosed the fact that they were distinct types. Two large hogs which had passed through the type A virus infection about ten months previously were inoculated with type B virus on September 19, 1934, and 48 hours later both showed extensive lesions of vesicular exanthema with thermic reactions.
Horse 582, which had received five inoculations with type B virus without reaction, was inoculated with type A virus and promptly developed characteristic lesions with a high thermic reaction.

Four hogs, which had passed through type B virus infection 44, 49, 49, and 63 days previously, were inoculated with type A virus on September 24, 1934. All developed thermic reactions ranging from 105.2° to 107.3° F. within 30 hours but only one developed lesions. This would indicate that three of the four hogs had developed a partial immunity to type A virus as a result of having passed through the type B infection.

On September 26, 1934, two hogs, which had passed through the type A virus infection about six months previously, were reinoculated with the type A virus but both proved to be totally immune to the second inoculation.

**Types C and D Viruses of Vesicular Exanthema**

On October 27, 1934, two more samples of virus were received from Traum, one of which was later designated type C virus and the other type D virus. Two hogs, two calves, one horse and five guinea pigs were inoculated with each of these viruses.

The type C virus was found to be only mildly infective for hogs but produced a characteristic lesion in the horse. Lesions were produced on the pads of guinea pigs with this inoculum but it was proved later that these lesions were the result of a contaminating streptococcus and not the virus.

The type D virus was extremely virulent for hogs, causing gross swellings on the snout and feet, with secondary lesions. All other species of animals treated with this virus proved to be naturally immune.

**Immunity and Cross-Immunity Tests with Types A, B, C, and D Viruses of Vesicular Exanthema**

Following the receipt of the C and D viruses, immunity and cross-immunity tests were made during a period of four or five months on animals which had passed through these four respective types of infection. As the animals recovered from one infection, they were treated with the same virus or one of the other types (see table I). As a result of these tests, it was found that each virus conferred a specific immunity in hogs to itself but not to any of the other three types, that is, A type conferred an immunity to A, B to B, etc.; and that hogs that passed through A type of infection were susceptible to B, C and D viruses; likewise with each of the other types.
Table I—Results of a few selected inoculation tests with types A, B, C and D of vesicular exanthema virus, showing the susceptibility of hogs to heterologous types and immunity to homologous types.

<table>
<thead>
<tr>
<th>Hog</th>
<th>Virus</th>
<th>Date Inoculated</th>
<th>Lesions</th>
<th>Virus</th>
<th>Date Inoculated</th>
<th>Lesions</th>
<th>Virus</th>
<th>Date Inoculated</th>
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<td>+</td>
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</table>
On February 26, 1935, a specific experiment was started in which six hogs were to be passed consecutively through each of the four types of virus as soon as they had fully recovered from the previous infection. Two extra hogs were inoculated at each passage, on which their immunity to the specific virus was to be tested two months later. Six hogs were inoculated first with A virus, with two additional hogs, and all developed slight but characteristic lesions of vesicular exanthema. The two additional hogs were reinoculated with A virus on May 21 and both proved to be immune, while two normal hogs inoculated simultaneously as a control on the virus developed characteristic lesions.

On April 9, 1935, one of the six hogs died from an undetermined cause. The five remaining were inoculated with type B virus on this date, with two additional untreated hogs. All developed extensive lesions of vesicular exanthema. The two additional hogs were tested June 24 with B virus and both proved to be immune, while two normal hogs inoculated simultaneously as a control on the virus developed characteristic lesions.

On June 10, 1935, the five principal hogs were to be inoculated with the C type of virus but this virus had died in the meantime so they were inoculated with D virus, with two additional untreated hogs. All developed extensive characteristic lesions. The two additional hogs were tested with D virus on August 26, 1935, and proved to be immune, while two normal hogs inoculated simultaneously as a control on the virus developed characteristic lesions.

It was unfortunate that the "C" type of virus was lost but from other immunity and cross-immunity tests previously made it was clearly established that this too was a distinct type.

As far as is known, vesicular exanthema of hogs has appeared in no other state than California and it seems remarkable that four distinct types of this virus should appear in one locality within such a short period of time.

The four types of this virus studied produce the same general character of symptoms and lesions in hogs, namely, an acute thermic reaction followed by vesiculation and erosions on the feet and snout. It was noticed, however, that B and D types of virus caused more severe reactions than A and C. The D type differed from the B type in that it caused a swelling of the entire snout back to the eyes, giving the hogs a grotesque appearance. Horses were susceptible to the weaker A and C viruses, but not to the stronger B and D viruses.
**Table II**—Results of a planned experiment in which hogs were passed successively through types A, B and D of vesicular exanthema, and tests of specific immunity to homologous types with tests of virulence of each virus (1935).

<table>
<thead>
<tr>
<th>Hog</th>
<th>Virus</th>
<th>Date Inoculated</th>
<th>Lesions</th>
<th>Virus</th>
<th>Date Inoculated</th>
<th>Lesions</th>
<th>Virus</th>
<th>Date Inoculated</th>
<th>Lesions</th>
<th>Virus</th>
<th>Date Inoculated</th>
<th>Lesions</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>2-25</td>
<td>+</td>
<td>B</td>
<td>4-9</td>
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<td>+</td>
<td>B</td>
<td>4-9</td>
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<td>6</td>
<td>A</td>
<td>2-25</td>
<td>+</td>
<td>A</td>
<td>5-2</td>
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<td>7</td>
<td>A</td>
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<td>10</td>
<td>B</td>
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<td>+</td>
<td>B</td>
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<td>B</td>
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<td>B</td>
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<td>B</td>
<td>6-24</td>
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<td>14</td>
<td>D</td>
<td>6-10</td>
<td>+</td>
<td>D</td>
<td>6-10</td>
<td>+</td>
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<td>15</td>
<td>D</td>
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<td>+</td>
<td>D</td>
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<td>D</td>
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The lesions of vesicular exanthema in hogs are identical with those of foot-and-mouth disease and can be differentiated only by the inoculation of other species of animals. The plurality of filter-passing viruses causing exanthema seems to be the rule rather than the exception; witness, the Indiana and New Jersey types of vesicular stomatitis, and the O, A, and C types of foot-and-mouth disease virus. As only four strains of virus of vesicular exanthema were studied at this Station, and each appeared to be a distinct type, it is problematical as to the number of types of this virus that occurred during the different outbreaks.

From an immunological standpoint, according to the studies by Waldmann, it would appear that vesicular exanthema in swine is more closely related to vesicular stomatitis than to foot-and-mouth disease, since hogs which had passed through either of the two types of vesicular stomatitis showed partial immunity to vesicular exanthema, whereas hogs which had passed through foot-and-mouth disease were still susceptible to vesicular exanthema.

Studies made on the communicability of these three diseases also show a closer relationship of vesicular exanthema to vesicular stomatitis than to foot-and-mouth disease, as indirect infection apparently plays only a minor rôle in the spread of vesicular exanthema of swine and vesicular stomatitis of cattle, whereas foot-and-mouth disease in each of these species of animals is readily spread by indirect infection.

The similarity in the location and character of the lesions and the accompanying thermic reaction in the species of animals susceptible to the respective viruses of vesicular exanthema, vesicular stomatitis, and foot-and-mouth disease indicates a group relationship of the three viruses.

The striking difference in the susceptibility of various species of animals to these three diseases clearly indicates, however, that each is a separate and distinct disease, as evidenced by table III. From the tabulation, it will be seen that the hog is the only animal known to be susceptible to all three of these diseases.

A differential diagnosis requires the inoculation of cattle, horses, hogs and guinea pigs. In the case of an unknown virus, if only hogs, or hogs and horses, show characteristic lesions, the diagnosis is vesicular exanthema; if all four species of animals react, the diagnosis is vesicular stomatitis; and if hogs, cattle, and guinea pigs react and horses fail to react, the diagnosis is foot-and-mouth disease. In the last case, on account of
the seriousness of the occurrence, supplementary inoculations would also be made.

The guinea pig offers a very useful and inexpensive medium for the perpetuation of the viruses of vesicular stomatitis and foot-and-mouth disease. Unfortunately, vesicular exanthema can be carried only in hogs, or, in the case of two types, in hogs and horses, and the expense and labor involved has therefore prohibited the perpetuation of the four types of this virus.

It is felt that stress should be made at this point that the statement made in this paper to the effect that the viruses of vesicular exanthema and vesicular stomatitis do not appear to

**Table III—Differences in immunity and susceptibility of various species.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Vesicular Exanthema</th>
<th>Vesicular Stomatitis</th>
<th>Foot-and-Mouth Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>—</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Horses</td>
<td>± (a)</td>
<td>+</td>
<td>—</td>
</tr>
<tr>
<td>Swine</td>
<td>+</td>
<td>+ (a)</td>
<td>+</td>
</tr>
<tr>
<td>Sheep</td>
<td>—</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td>Goats</td>
<td>—</td>
<td>—</td>
<td>+</td>
</tr>
<tr>
<td>Guinea Pigs</td>
<td>—</td>
<td>+ (a)</td>
<td>+ (a)</td>
</tr>
<tr>
<td>Hedgehogs</td>
<td>—</td>
<td>—</td>
<td>+ (a)</td>
</tr>
</tbody>
</table>

— indicates natural immunity.
+ indicates natural susceptibility.
+ (a) indicates susceptibility to artificial infection only.

be transmitted readily through indirect exposure is the result of experimental studies. It is evident from the reports of Traum and the remarks of Hurt that vesicular exanthema of swine at times assumes the nature of a true epizootic under field conditions. This is even more apparent in the case of vesicular stomatitis, as evidenced by the extensive outbreak in Kansas in 1915, in New Jersey in 1926, and in the western portions of Maryland and Virginia and in West Virginia in 1934 and 1935. But at their worst, it will be observed that vesicular exanthema and vesicular stomatitis seem to limit themselves to relatively narrow sections before the contagiousness of the disease tends to fade, whereas in a true epizootic such as foot-and-mouth disease, the disease seems to be limited only by the absence of susceptible animals or the application of radical control measures.

**SUMMARY**

1. Results of experimental studies of an exanthematous disease in hogs similar to foot-and-mouth disease, occurring only in California, are described.
2. Four strains of virus (A, B, C and D) from different sources in the outbreaks of 1933 and 1934 were studied.

3. Each of these strains appeared to be a distinct type, causing an immunity to the homologous type but not to the other three.

4. Two of the types (B and D) were infectious only for swine, while the other two types (A and C) were infectious for horses as well as swine. Cattle, sheep, goats, guinea pigs and hedd-hogs were not found to be susceptible to any of the four types of virus.

5. Experimentally, this disease was found to be communicable as a result of direct infection, but relatively only slightly so as a result of indirect infection.

6. Hogs recovered from vesicular exanthema are susceptible to vesicular stomatitis as well as foot-and-mouth disease.

7. Studies of vesicular exanthema suggest a closer relationship to vesicular stomatitis than to foot-and-mouth disease, but definitely indicate vesicular exanthema to be a separate though closely related disease.

REFERENCES


PRESIDENT WISNICKY: If there are no questions, that concludes our program for today.

DR. EDWARD RECORD: I move that the meeting adjourn until tomorrow morning at nine o'clock.

... The motion was seconded, put to a vote and carried, and the meeting adjourned at 4:40 p.m.

ADJOURNMENT

FRIDAY MORNING, DECEMBER 4, 1936

The fifth session convened at 9:30 a.m., President Wisnicky presiding.

PRESIDENT WISNICKY: The meeting will now please come to order.

The first paper on the program is certainly one of interest and particularly so since it comes from one who has had considerable experience in the field of dairy inspection and one who can express his subject in a very effective way. I now take pleasure in introducing to you Dr. C. U. Duckworth, Chief of Animal Industry, Department of Agriculture, Sacramento, California.

Dr. DUCKWORTH: I did not prepare a paper on this subject. It was not quite clear what I was to do. I thought I was to submit a committee report.
The dairy inspection program in California is quite a comprehensive program in which the State Department of Agriculture and various health departments cooperate. We have milk divided into two major classifications—market milk and manufactured milk. The market milk is again divided into two classifications—graded and ungraded. Approximately 95 per cent of the milk consumed in the state is graded and carries a grade label and the remaining small percentage is that designated as "ungraded" and is consumed in the outlying territory where a functioning health department does not exist.

Our cities have ordinances which permit of the grading of milk. That is, a city or county or groups of cities or groups of counties may institute a milk inspection service in connection with a regularly instituted health office under the jurisdiction of a physician. They must supply laboratory facilities sufficient to take care of the necessary tests as laid down by law and regulation. They must supply a sufficient number of dairy inspectors.

When that is done, we make a survey of the area, check on their records, check on their personnel and, provided the law and regulations are complied with, a certificate of approval is granted the city or county, whichever it may be, and the producers in that area are then allowed to grade their milk.

Each grade has specific requirements that it must meet. The production itself must meet certain bacteria standards. Fats, solids and the package must meet requirements, as does the grade label. The farms must be inspected at intervals set down in state law and regulation. I will not attempt to state the frequency or infrequency of it. There would be too many figures and it would confuse you. It is sufficient to say that the law and regulations provide how often, as a minimum, each class of product or district shall be inspected. It sets forth how often recording thermometers in pasteurizing plants must be checked; how the fat samples must be taken and tested in it and the preservation of such samples may be checked by the inspectors any time they come around.

In the receiving plants, for instance, we require that all samples for butterfat determination be retained for 48 hours. The report of the test is put in sealed containers in all the plants to which only the inspector has access, so we can go into a plant any day, open their lock box, get the list of the day's work out of there—the day's fat testing—and have the man check with the sample that he has there. If it varies, we begin to wonder why.

We conduct examinations for the technicians that are doing that work. We check all irregularities at frequent intervals to know their work is right.

Now, as to inspectors. There are two types of inspectors. One is a man working for a city or for the state or for a county wherein a civil service commission exists and functions. Where that exists, we take recognition of the man's eligibility as demonstrated by civil service. In the smaller cities we determine the man's qualifications by examination. The Dairy Code sets up that procedure and it is not a difficult problem to make for uniformity because we give an examination for dairy inspectors that is comparable to the examination that the State Civil Service gives for dairy inspectors regularly employed by the state under civil service. In this way, we have a fairly uniform comprehensive plan of determining the qualifications of inspectors.

We are up against the same proposition as everyone in that no one has money enough to do the job as he would like it done. The dairy industry appreciates that and is reminded by the public that they actually demand quality. It is not a blind science any more as far as the public is concerned.
With the rating:
Check the Rendering
Final Report
Paris Reports
Ask Vito Vaitzs about many dogs.
Can I have both you.

1936

Winton
Writing a piece for Dairy Smith

Strengthen health of cows

Coordinated efforts to eliminate Bov 17

Jan 1-1954

Cooperation I

Pub. of Health

Local boards

Local farmers

He should be
We have then a general appropriation for dairy inspection work and we have trust funds that are entered into with manufacturing dairy concerns in various districts. We have an agreement that we sign with the operators in a given territory and they pay the Department so much per thousand pounds of butterfat passing through their plant monthly. We use that money to hire men and we hire regular civil service employees and the men are directed the same as those who are employed through the general fund. There are some 22 men hired under that program which is a little more than we have from the general appropriation, indicating that the industry believes in inspection and wants it carried and are willing to pay for it.

In the city and county inspection there are some 11 men, I think, at the present time, doing that kind of work, mostly in the graded areas.

We have specific standards set up for the quality of milk prior to pasteurization and after. We have those figures down where they are pretty low at the present time. We require sterilization after each use of milking equipment and our men, particularly in the market milk territory, have been accustomed to that. Competition is so keen that they do the work without a great deal of supervision. We are situated so that we do not have the same problems that some of you have in the fact that your milk comes from adjoining states. We are geographically isolated. There is practically no market milk in California that is not produced in California. The opposite holds true, however, with manufactured products. We import a great many manufactured dairy products.

I regret that our tuberculosis campaign is not in keeping with our dairy inspection and our quality campaign. The market milk in California is in good shape because of city ordinances, but that does not hold true of the manufactured products. We regret that very much and we are going to do what we can with the problem. Due to organized opposition, we are not able to progress as rapidly as we should like to.

Now, just a word as to qualifications for dairy inspection work. We have a College of Agriculture that gives courses of varying lengths in dairy inspection work. We have degrees in dairy work. The men coming out of those schools are excellently qualified for dairy inspection. We have had proposed from time to time that the veterinarians are the only men qualified for milk inspection because of the fact that it all originates with the cow and no one but a veterinarian can determine a fit subject to be producing milk. There are so many angles to it that I do not think the veterinary profession should be jumping at the job just yet because, personally, I do not think we are ready for it. I learned dairy inspection and found I had a lot to learn.

It has been within my time when dairy inspectors obtained their jobs because of some political friendship. Dairy inspectors were regarded as anything but welcome by the dairy people. Their ignorance was cloaked with authority and you could not blame the dairy people for being unwilling to see them come. However, the dairy people realize that the method of determination of a man's qualifications is largely changed and now they do not resent dairy inspectors coming because, for the most part, the inspector today knows what he is talking about, and dairy inspection is not taught in veterinary colleges. They are too busy teaching something else. Although we cannot boast that we know as much about a subject as a man who has spent two or three or four years specializing in that particular subject, yet there is the fact that the veterinarian is the only man who can determine whether or not the cow is a fit subject, but even if the veterinarian is a dairy inspector, he is not allowed to treat the
animal. All he can do is order her out of the milk stream and the dairy inspector can also do that.

This field is opening up more and more and there is getting to be a greater appreciation of the significance of intercommunicable diseases. I believe the field will expand and open to us, but, gentlemen, we must prepare ourselves for it.

I occupy, at the present, a position that enables me to appreciate that fact. Some ten years ago, I was in charge of the dairy work for the state of California and then it was my job to conduct examinations for dairy inspection work. At the present time, the man occupying my position is also on the Board of Examiners and one of the regularly assigned subjects is meat and milk inspection. While I no longer conduct the dairy inspection examinations, I have a couple of men who do that. Occasionally I sit in and I just cannot give the veterinarians who are coming there for an examination for a license the same examination that we are giving the men who are applying for dairy inspectors' examination. It is regrettable, but true. They, as a profession, are not quite ready for the job. It is not a hard thing. We all have a foundation for it. We all can do the job but we do have to study to do it. And it would please me much if the institutions that we have training veterinarians, would have a more comprehensive course in food sanitation, including milk and meat inspection, that we may be better qualified to take over this work when we are ready to do so. (Applause)

President Wisnicky: Thank you, Dr. Duckworth. I think you have given us a most splendid discussion on this dairy inspection subject. We are proud of the state of California for sending to us such an able representative to discuss that most important subject.

The next number on our program is entitled, "The Needs of National and State Unity in the Sanitary Control of Dairy Products." This subject will be discussed by Dr. I. A. Merchant, Associate Professor of Veterinary Hygiene, Iowa State College, Ames, Iowa. I am pleased to present Dr. Merchant.

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

THE NEEDS OF NATIONAL AND STATE UNITY IN THE SANITARY CONTROL OF DAIRY PRODUCTS

By I. A. MERCHANT, Ames, Iowa

Department of Veterinary Hygiene, Iowa State College

Those of us who have anything to do with the control of a milk supply often think that the use of sanitation is being adopted by the dairyman in a needlessly slow manner. We often wish we could go from farm to farm and arbitrarily say, "Do this or quit selling milk or cream!" "This" would include every wrinkle in the sanitary fabric of milk production. Yet we must pause to realize that great progress has been made in this country and that we are far ahead of other nations in protecting our milk supply. Cows are kept out of muck and mire; they are not housed in dark, dirty, non-ventilated barns; they are not fed just any sort of feed available. Cows supplying market milk are for the
most part kept in clean pens and pastures; housed in well-lighted, concrete-floored, well-ventilated barns; fed wholesome feeds which do not impart disagreeable flavors; they are milked by a mechanical milker which is kept clean.

In order that we may better appreciate the progress that has been made, let us use a more extreme picture. Visualize the swill dairies of New York. Cows were in sheds, back of the distillery, being milked by dirty, cursing milkers, slopping about in manure and slop. Tuberculosis and mastitis, no doubt, were present in every cow; yet she was milked and the milk was sold for food. If the cow was unable to stand, she was placed in a sling and milked. Now let us take a look at a modern rotolactor. The room is of glazed tile, concrete and plate glass. The trim healthy cow steps daintily onto the moving platform; she is bathed and dried; her milk is checked for mastitis; her teats are fitted with sterile cups; she ruminates dehydrated alfalfa and grain contentedly; her milk is certified.

There have been many factors responsible for changing the picture of milk production from that of the early days to the picture of today. It is rather difficult to know what influence or what group has been the most potent. The public has been educated to desire and demand a cleaner food. The medical profession has insisted on a safe, clean milk for the health of people, not only because communicable diseases were controlled, but because more milk was consumed. The dairy industry has realized that a clean product is the most remunerative and clean working conditions make a more contented and careful employé.

Missionaries have gone from the first centers of sanitary milk control throughout our country spreading the gospel of clean milk. Organized groups have formulated rules and regulations for increasing the safety and quality of dairy products. It is obvious that the jurisdictions of these organizations have overlapped in many cases and that details have been contradictory, leading to confusion in the minds of dairymen.

States have passed laws concerning the sanitary requirements of dairies; counties have established inspection systems; cities have adopted milk ordinances and many of the large dairy companies have certain minimum requirements. Each group has its corps of inspectors whose job is to enforce the regulations of its own governing body. One group will insist that manure be 50 feet from the barn; another group will require that it be away 100 feet; while the third will want it removed to the field daily. Many other examples of just as great importance may be cited. It is little wonder that the dairyman wonders which one to believe
and which one has supreme authority. The visits of these various inspectors are not spaced. It is not unusual to have a dairy inspected by two or three inspectors within a week and then not have a visit for two months. Distributing dairies may be inspected so often by so many inspectors that it has been remarked that a dairyman should install a traffic light to keep inspectors from running into one another.

The milk-shed of a large city may extend into three or four states. Each state may have its regulations governing dairy sanitation which may conflict with the ordinance of the city. Obviously this situation calls for uniformity, especially if the dairyman wishes to sell milk in the city concerned. Then, too, a number of cities may use the same milk-shed. The dairyman will build to conform with the regulations of one city; but when he may desire to sell to a dairy in another city, he finds to his amazement and chagrin that he must rebuild his dairy. This sort of situation is extremely hard to explain to the dairyman and it tends to undermine the importance of all sanitation. The large distributor is in a very difficult position, especially when he wishes to serve three or four municipalities from one plant. Unless the sanitary regulations of those cities are uniform, and they usually are not, imagine his difficulty in choosing producers who conform to all the details of construction that may be required or his difficulty in sorting out this milk for city A and that milk for city B.

The administration of milk sanitation in the different states is under a variety of agencies. This may account, in a degree, for the lack of uniformity. It is difficult to get two individuals to agree completely on any subject; therefore one may expect a wide variety of opinions from different groups on such a question as milk sanitation.

In a recent survey of the milk control situation in the various states, I found that all but three of the states maintained inspection of dairies. In 24 states the control was vested in the State Board of Health, in the Department of Agriculture in 16, in a Dairy Commission in seven and in the State Veterinarian in three. A study of the map will show that the type of administration is common to certain areas. In the South and East, control is under the Board of Health. In the Middle West and West, authority is centered in the Department of Agriculture or in a Milk Commission. It is significant to note that only three states have control under the jurisdiction of the State Veterinarian; and in one of these, Montana, the work is divided among three different groups. The opinions which would result from such a variety of control agencies would be reflected in the work done in the states of this country.
The same lack of uniformity is noted in the application of inspection in the field, no matter whether it is by the state, the county, city or dairy company. The individuals vary tremendously in their fitness to do the job. It would be very enlightening to know the training of the dairy sanitarians of this country. One might expect the following groups to be represented: physicians, veterinarians, sanitary engineers, dairy industry graduates, dairy employés, ex-policemen, ex-street car operators, ex-soda fountain clerks, ex-garage mechanics, ex-auto salesmen, the mayor's son-in-law and a host of practical men who admit they know a lot about sanitation. Is it too much to wonder whether the job of improving the quality and safety of our milk supply is not important enough to entrust it in the hands of only a trained person? One may ask why vaccination for smallpox is not done by barbers or nursing by waitresses or sanitary engineering by plumbers?

The needs of uniformity are apparent and the question which occurs to everyone is, "What can be done about it?"

Fortunately great progress has been made in spite of the handicaps mentioned. You, as live stock sanitary officials, have contributed a great deal to the improvement which has been made. You have worked at the foundation of the structure which gives us better milk. Tuberculosis eradication alone is a greater contribution than we sometimes realize. It not only takes infected animals from the herd and protects human life, but it makes dairymen aware of the importance of the healthy cow. Bang's disease eradication is doing the same thing. Mastitis control would do as much good in improving the quality and safety of the milk supply as either of the above. In this basic work we have had uniformity except in requirements for periodic testing. While individuals may vary in the interpretation of the tests used to detect infected animals, the tests themselves are practically uniform, and uniform procedures are practiced in disposing of reacting animals.

The laboratory methods used in analyzing a sample of milk are uniform in the United States. This is a great step toward the unification of a milk supply. When one is told that the bacteria count is 10,000 per cubic centimeter, he is relatively certain the count is correct if standard methods have been followed.

The United States Public Health Service Milk Ordinance is a great force in bringing about uniformity. It may be considered inapplicable to small communities which do not have enough volume of milk to submit to grading, but in large cities, it does lead to unity in the control of the milk supply. If the ordinance is not
adopted in its entirety, the grading principles should be followed so the consuming public would know that Pasteurized Grade A milk means only one thing and not half a dozen, and that the grade is based upon something more than the number of bacteria per cubic centimeter. Mr. Frank, of the United States Public Health Service, deserves the highest praise for the missionary work he has done and is doing to get a more uniform milk supply in this country.

Probably the "rugged individualism" of states prevents the milk control officials from getting together and formulating a standard state code which would be broad enough yet with sufficient detail to be adopted in every state in the union. If most progressive measures originate in the eastern states, we may infer that the trend is toward having the sanitary control vested in the State Board of Health. We must not overlook, however, the effective control in many states by the Department of Agriculture or Dairy Commission. It is unfortunate, however, for the State Veterinarian not to be in the picture of any administration of dairy sanitation. He should always be a member of the State Board of Health and should be consulted more freely than he is, I fear, in most of the states by all milk control agencies.

The real place to start in the unification of milk sanitation is in the training of the individual who does the work in the field. No matter how uniform milk ordinances become, we cannot hope for success if we allow all sorts of untrained individuals to interpret and apply them. We need cooperation among the different inspection groups so that visits will be spaced more evenly and so that insignificant details, such as method of manure disposal, the type of milk stools and the number and size of windows can be eliminated. We must constantly keep in mind that healthy cows, hygienic environment, sterile utensils and cooling facilities are the basic factors of importance in milk sanitation; that an attitude of, "Can I help you with your problem?" is more valuable than, "Do this because the regulations say so!"

Let us hope that improvement in milk sanitation may be continued in this country so the consuming public will learn to demand a product of higher quality and safety.

PRESIDENT WISNICKY: We shall now proceed to the report of the Committee on Meat and Milk Hygiene, by Dr. A. F. Schalk, Chairman. Since Dr. Schalk does not seem to be here and there is no one to present that report at the present time we shall proceed to the next number.

DR. A. E. CAMERON: Dr. Schalk informed me that they had no formal report this year but were counting on a comprehensive one next year.
PARATYPHOID INFECTION OF FOWLS

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In the present paper no attempt will be made to cover the subject of salmonellosis of fowls in a systematic manner. Not only would it be beyond the scope of this paper to make such an attempt, but it would entail the presentation of material not essential to the discussion. It is intended to present some of the newer developments in the field and to try to show briefly the direction which the study of the problem is taking. For this reason the paper may seem somewhat disjointed and fragmentary. The subject necessarily will be approached from the standpoint of the organisms involved, since it is this phase of the problem with which we are most familiar.

The work which we have done is based almost entirely on the classification and differentiation of the various types of Salmonellas. Therefore, it seems advisable to review briefly the present status of this group of organisms. While the paratyphoid group, until a few years ago, was divided into a few well-known species, today more than 50 serological types are recognized. Due largely to the work of Bruce White, in England, and Kauffmann, in Germany and Denmark, a more or less orderly arrangement of the types within the group has been attained. While the classification is by no means permanent or inflexible, and while it will undoubtedly be revised as our knowledge of the group increases, it has been most helpful to workers in this field and has aided materially in recognizing and differentiating the various types within the genus and evaluating their relative importance in the causation of human and animal diseases. This classification has been established principally by the use of serologic tests, particularly agglutination and agglutinin absorption, and by designating the many antigens occurring in the genus by symbols. While this is an arbitrary method of treatment and has been criticized, it has yielded better results than any other method. The antigens, which recur in different combinations, are used to differentiate types. The same antigen may occur in a
number of types, but in each it is in combination with different antigens. Thus two species may have two, three or four antigens in common, but the remaining factors serve to distinguish them.

The genus is divided into large groups on the basis of those factors which are resistant to the action of heat and alcohol. These factors are ordinarily spoken of as somatic antigens, since they are thought to be associated with the bacillary bodies and not with the flagella.

Each of these large groups is further subdivided on the basis of the antigens which are destroyed by heat and alcohol. These are usually called flocculating antigens on account of their method of agglutination. They are probably associated with the flagella, since they are not possessed by non-motile bacilli. The flocculating antigens are divided into two classes, specific and non-specific. These two are separated by plating cultures and picking colonies, some colonies containing one in a relatively pure state, some the other. Certain types have only specific factors in their antigenic make-up, while a few have only the non-specific.

A relatively large number of Salmonella types are found in infections of fowls. In addition to pullorum and gallinarum, which are so well known as to need no discussion, aertrycke, anatum, suifestifer, typhosus, paratyphosus A, paratyphosus B and enteritidis have been reported in domestic fowls. In addition we have identified cultures isolated from quail by Dr. Robert Graham as the Oranienburg type. This species was found by Dr. Graham to cause an extremely destructive disease of young quail, losses running as high as 60 per cent. Cultures sent to us by Dr. J. J. Black, who isolated them from infected poults, have been identified as the Senftenberg type.

The identification of the Oranienburg and Senftenberg types as causative agents of diseases of fowls is interesting, since neither species had hitherto been associated with diseases of animals. Both had been recognized by Kauffmann as etiologic factors of sporadic cases of gastro-enteritis in humans. The epidemiology of the infections was entirely unknown. The discovery of their presence in fowls will probably help in determining the origin of the infection in humans. Also their identification in fowls adds two species to the list of Salmonellas attacking both animals and man.

Aertrycke has long been known to occur in paratyphoid infection of pigeons. It is probably the most frequently encountered cause of bacterial disease in these fowls. Recently Jungherr and Wilcox described variants of aertrycke in pigeons, which failed to ferment maltose. We have also encountered such cultures. On
closer examination, these bacilli were found not to be typical aertrycke cultures. One of the heat-stable antigens in typical cultures was missing in the pigeon strains. Instead of possessing the somatic complex of aertrycke, they resembled Abortus equi and Reading in this respect. Up to the present time, 21 cultures from ten flocks of pigeons in six eastern states have been examined. All these cultures exhibited the peculiar deficiency in their heat-stable antigens. Dr. Herrmann, of Essen, informs us that the same type is being found in pigeons in Germany.

This variant of aertrycke is apparently widely distributed in pigeons yet cultures of aertrycke from canaries, chickens and turkeys do not belong to this variant type. That it is found in humans is known through the work of Kauffmann and of Zahn. It seems probable that transmission from the pigeon to the human has taken place. In addition to their distinct antigenic composition these variants often exhibit peculiar biochemical reactions such as failure to ferment maltose, negative Bitter reaction and anaerogenesis. These peculiarities add to the difficulty of their identification. Just what significance should be attributed to the widespread occurrence of this variant in pigeons and its apparent absence in other fowls remains to be determined.

Recently Emmel has reported the isolation of typhosus, paratyphosus A, paratyphosus B, suipestifer, aertrycke and enteritidis from the intestinal tract of parasitized chickens. Since nothing was published concerning the method used in the identification of the organisms and since none of them except aertrycke and enteritidis had previously been found in fowls, it seemed worth while to study these cultures, using the modern methods of antigenic analysis. Through the courtesy of Dr. Emmel, we obtained those cultures which were still available. Unfortunately no strains identified as typhosus or paratyphosus A were then in his possession. However, we were able to identify the available cultures as paratyphosus B, suipestifer, enteritidis and aertrycke. As stated above the first two species had not previously been found in fowls.

It is noteworthy that suipestifer, which usually is found only in hogs and man, should occur also in chickens. This serves to emphasize the fact that host specificity in the Salmonella group is only relative and, given opportunity, many species will thrive in an apparently unnatural host. For many years paratyphosus B was known to occur only in man. Recently it has been reported in dairy cows but it was thought that its presence was accidental and that it lacked the power to parasitize animals. Emmel's discovery of this organism in chickens is further proof that while
primarily a human pathogen, paratyphosus B may be carried by animals.

Recently there has been a good deal of discussion in the European literature concerning certain cultures isolated by Dr. Otto Müller, of Duisburg, from the feces of persons affected with gastro-enteritis following the consumption of potato salad and from the suspected salad. These organisms, commonly referred to as the Duisburg cultures, have been studied by Reiner Müller, Kauffmann and Herrmann. All agree that these cultures are very closely related to, if not identical with, the fowl typhoid bacillus. Reiner Müller demonstrated that the organisms were not only serologically related to gallinarum, but when fed to chickens were capable of causing a disease which simulated fowl typhoid. His conclusion was that the organisms in question were fowl typhoid bacilli which were present in the salad due to the use of infected eggs in its preparation. If these conclusions are correct, they are of great importance. Fowl typhoid must be considered not only as a widespread and very destructive disease of poultry but also as a public health problem. Transfers of the Duisburg cultures are in our possession and preliminary work indicates their very close relationship to gallinarum. These preliminary results also indicate that these cultures differ slightly in their biochemical properties from American strains of the fowl typhoid bacillus. This work is being continued in the hope of arriving at a definite conclusion as to their identity.

Consideration of the Duisburg cultures suggests the possible relationship of paratyphoid infection in fowls to public health. Practically all the species of Salmonella found in the fowl have been found in human disease. Aertrycke has often been reported in diseases of various fowls. It is also the most commonly occurring organism in the group in food poisoning of humans. In central Europe it has been proved beyond doubt that food poisoning in humans often results from the use of eggs containing aertrycke bacilli. Eggs of the pigeon and the duck are most frequently responsible for these outbreaks. Enteritidis is another species which occurs frequently in both fowls and man. Here again it has been definitely shown that infected eggs may act as the agent of transmission to man. Anatum, suipestifer, Oranienburg and Senftenberg have also been found to occur both in fowls and man. While cases of human disease due to these last four types have not been definitely connected with poultry or poultry products, the possible rôle of fowls in their transmission must not be overlooked.

The six species mentioned above as occurring in both fowls and man are probably all primarily animal parasites which cause
sporadic outbreaks of infection in man. Their transmission to humans is an unusual rather than the usual occurrence in the life history of the organisms. Of entirely different significance is the report of Emmel that typhosus, paratyphosus A and paratyphosus B occur in the domestic fowl. If these findings are accepted, it means that three species whose elective host is man, and whose usual mode of transmission is from man to man, have been able to establish themselves in a secondary host, thus greatly complicating their control. These three species are capable of causing serious and widespread epidemics and are of the greatest importance to public health. If the chicken acts as a reservoir of these organisms, it will be necessary to revise the measures ordinarily used in their control. It is of great importance that the question be fully investigated and not be allowed to stand as a solitary report in the literature without confirmation or denial.

Not only must the possible effect of these infections on man be considered, but their transmission to other species of domestic animals may occur. The lack of host specificity of various types within the genus is notorious. Perhaps the most widely distributed species, in a zoological sense, is aertrycke, which, according to Bruce White, may attack any species of warm-blooded vertebrate. It is known to cause losses in most species of our domestic animals. Enteritidis is also a most adaptable organism and occurs in many animal species. Our knowledge of the distribution of the other types is more meager, but they are probably able to parasitize a number of different hosts. For many years rodents were considered the great reservoir of paratyphoid infection. The time has arrived when fowls must also be regarded as possible carriers of Salmonellas.

The question of transmission of the various types of Salmonellas through the egg is of great practical importance. It has long been known that this was the most common method of transmission of pullorum infection. Evidence has accumulated gradually that indicates that other species may be transmitted in a like manner. The work of Beaudette and others has shown that fowl typhoid in young chicks may be of ovarian origin. The early work of Rettger and Scoville suggested the probability that aertrycke infection in ducks was egg-borne. That this is the case is now an accepted fact. It is also known that ovarian transmission of aertrycke occurs in the pigeon. The work of Lee, Holm and Murray indicates that such transmission of aertrycke infection takes place in turkeys. Enteritidis infection often arises through ovarian transmission in the duck. In central Europe a Salmonellosis of ducks due to enteritidis is recognized which, in
its clinical characteristics, closely resembles pullorum disease in the chicken. The disease occasions small loss in adult stock, but young ducklings die in large numbers. Reports of enteritidis infection in young chicks suggest that the infection in the chicken may also be egg-borne.

There are, then, four types of Salmonellas which are definitely known to be transmitted through the egg in several species of domestic fowls. Reasoning by analogy, there can be little doubt that other species may be egg-borne. The recent increase in commercial hatcheries and in the number of large poultry flocks maintained throughout the country encourages the perpetuation and distribution of infections transmitted through the egg. It is quite conceivable that the poultry pathologist in the future may be called upon to institute a program to control and eradicate these infections in the domestic fowl. Such a program must be based on adequate knowledge of the conditions to be met. This information can be gained only through research and it is to be hoped that workers in poultry pathology will carry on such investigations so that we may be well equipped to attack these problems when the necessity shall arise.

PRESIDENT WISNICKY: Thank you, Dr. Edwards, for your capable contribution on this subject.

Dr. Barnes, are you ready to present the report of the Committee on Rabies? With pleasure I present to you Dr. M. F. Barnes, of Pennsylvania.

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

REPORT OF COMMITTEE ON RABIES

DR. H. M. KALODNER, Chairman, Philadelphia, Pa.
Dr. Frank Breed, Lincoln, Neb. Dr. H. C. Rinehart, Springfield, Ill.

Your Committee on Rabies can report some progress.

The members of this Committee, in preparing the initial report, were chiefly concerned as to the prevalence of rabies in the United States and the proper utilization of knowledge essential in the control of rabies in animals.

Rabies is a most dreaded disease; a disease which probably has been the cause of more superstitious views than any other; a disease which many persons have refused to admit even existed in either animals or man; a disease which is fatal in practically all subjects who fall victim to it; a disease which is widespread and afflicts all species of animals and man in nearly all countries of the world; and a disease which quite frequently is not recognized, or is confused with other diseases; yet, a disease which was among the first to be recognized and described.

The subject, "Rabies," has been discussed at previous meetings of this Association. "Rabies and Its Control" was very ably presented at the 1925 meeting by the late Doctor V. A. Moore, who in his presen-
When the essential facts pertaining to its nature are recognized, the difficulties heretofore encountered in its control will disappear. People must understand the necessity for enforcement measures and the reasons for them. Physicians and veterinarians must first understand the problems confronting them.

Negri bodies, discovered in 1903, make a quick method of diagnosis possible, which permits those who have been bitten to take preventive treatment and enables sanitary officials to enforce precautionary measures before secondary cases develop.

There were little data as to the prevalence of rabies in the United States prior to 1890. Salmon, soon after 1884, showed that rabies appeared in practically every part of the country.

The 1890 census reported 143 deaths in man scattered over 30 states.

In 1908, Kerr and Stimson found that 111 people died of rabies and that 534 localities were infected. The states having the largest number of localities infected were: Wisconsin, Illinois, Virginia, Maryland, Delaware, New Jersey and New York.

In 1917, Nelson of the Biological Survey, showed in reference to predatory animals that rabies was spread from its point of origin in Oregon, to Nevada, California, Idaho and Utah.

In 1921, T. F. Sellers, of the Georgia State Board of Health, found that rabies existed in 29 states. A total of 5,558 heads were examined with 2,699 positive. There were 167 deaths in man from 1917 to 1921. Of this total, 39 died during, or after, the Pasteur treatment.

In 1925, rabies appeared to be more prevalent in the southeastern and southwestern states.

In New York State, outside of New York City, from 1898 to 1923, there were, at first, only a few cases in the Hudson River Valley. The disease gradually extended until, in 1908, there were 538 examinations with 285 positive cases. This was followed by a gradual reduction until, in 1923, there were 36 examinations with only four positive cases.

Since Doctor Moore's report, eleven years ago, the rabies situation in the United States has shown little change. There has been a shift in some cases, of the areas and districts in which rabies is the more prevalent. Some of the states which previously had the largest numbers of centers of infection and reported the largest numbers of cases, have reported few or no cases during the last two years.

An attempt was made by your Committee to obtain general information as to the prevalence of rabies in the different states, with the result that replies have been received from 45 states:

Nine states (Minnesota, Montana, Nevada, North Dakota, Rhode Island, South Dakota, Utah, Vermont and Wyoming) reported that no cases of rabies had occurred during the last two years or for a longer period of time.

Seven states reported less than 10 cases.

Six states, in addition to the above seven, reported less than 100 cases.

Sixteen states (Alabama, California, Georgia, Indiana, Illinois, Kentucky, Maryland, Massachusetts, Mississippi, New Jersey, Ohio, Pennsylvania, Tennessee, Texas, Virginia and West Virginia) reported the disease as prevalent, with 400 to 1,000 or more cases.
Seven states (Arkansas, Florida, Kansas, Missouri, North Carolina, Oklahoma and South Carolina) did not furnish any data as to the number of cases but replies from most of these states seemed to indicate that the disease was quite prevalent.

Three states (Colorado, Louisiana and Michigan) did not reply.

The above data seem to indicate that rabies is widespread throughout the United States and is more or less prevalent in approximately 75 per cent of the states, although the replies from a number of these states furnished information that the disease occurred only in certain districts and was confined to one or more counties.

A number of the replies have shown that the chief source of rabies infection is through dogs brought into the state by tourists. New centers of infection are set up through change in occupation and place of residence of persons who own dogs and move them to new locations. Some examples are cited below.

Dr. C. E. Cotton, of Minnesota, reported that no serious outbreak of rabies had occurred for a number of years. The disease occurred in 1931 in two southeastern counties. Quarantine was established in the fall of 1931 and lifted in May, 1932. The last case of rabies in Minnesota occurred in a dog brought by automobile from Texas. Symptoms of rabies developed two days after arrival. Quarantine was established, three contacts dogs were destroyed, two persons were given the Pasteur treatment and the disease was limited to one animal.

Previous to the above case, the disease occurred in two dogs, both of which were brought into the state by tourists. One of these was a dog from Omaha, which had the single treatment. The other one came from Illinois with a health certificate stating that it had been immunized with the single treatment. In both cases quarantine was established and the infection was limited to the imported animals.

Dr. W. J. Butler, of Montana, reported no rabies during the years 1935 and 1936. In previous years there were three cases, one in a coyote from Idaho and two in dogs brought in by tourists. Radical measures were used in all three cases. Hunters were put on to destroy the coyotes and all dogs in the districts involved were destroyed or vaccinated.

Dr. R. W. Smith, of New Hampshire, reported that all cases occurring during the last two years were isolated cases which probably drifted in from Massachusetts.

Dr. W. H. Lytle, of Oregon, reported cases during 1935 and 1936 in 48 dogs and five cows. These were confined to three counties. The outbreak occurred in the East Portland district and the disease was carried a distance of 35 miles by persons working in canneries who moved and took their dogs with them from East Portland. A campaign was made against ownerless dogs and approximately 600 a month were killed for a period of six months, resulting in the termination of the enzootic.

Dr. W. Wisnicky, of Wisconsin, reported seven cases in dogs during the last two years. Prior to these, no cases had occurred in the state for a two-year period. Every case which has occurred has been introduced from some other state. No cases have occurred during the last four months.

In Pennsylvania cases of rabies have occurred in different localities of the state, at least, during the last 30 to 40 years. The number of positive cases in animals, chiefly dogs, diagnosed by laboratory examinations of brain material, has increased or decreased from year to year. There were 256 positive cases in 1913, 43 in 1917, 140 in 1924, 58 in 1925, 306 in 1927, 78 in 1933, 187 in 1935 and 373 during the first ten months of 1936.

In 1935, the disease occurred in three sections of the state and was confined chiefly to a few counties in each section, although one or
more cases occurred in 29 of the 67 counties in the state. There was a total of 170 positive dog brains, and of these 48 were from Philadelphia and Montgomery counties, while twelve were from six adjoining counties; 39 were in Washington, Fayette and Westmoreland counties, while 17 were in seven adjoining counties; and 38 were in Schuylkill, Luzerne and Lackawanna counties, while 16 cases occurred in eight surrounding counties; that is, two-thirds of the cases occurred in eight counties while one-third occurred in 21 counties.

During the first ten months of 1936, there was a total of 363 positive dog brains which were from 22 of the 67 counties in the state. No cases were received from 13 of the 29 counties in which cases were found in 1935, although the disease occurred in six new counties considerable distance removed from the infected districts. One of these occurred in Cumberland County in a dog brought in by a tourist from Tennessee and from this one five additional cases have occurred. Another case occurred in Adams County, in a dog from Philadelphia, which before death fought with a dog which died of rabies three weeks later. Of the above cases 254 were from Delaware, Philadelphia, Montgomery and Bucks counties, with eleven from two adjoining counties; 28 were from Schuylkill and Northumberland counties, with 14 from five surrounding counties; 44 were from Fayette, Washington and Allegheny counties with five from two surrounding counties; and seven from four isolated sources in four different counties. Of the 363 cases 326 occurred in nine of the 67 counties in the state, that is, approximately 90 per cent of the cases of rabies occurred in 13 per cent of the counties and 50 per cent of the cases occurred in approximately 2 per cent of the area of the state.

The common belief by many persons that rabies occurs only during hot weather, especially during the so-called “dog days,” is not borne out by facts concerning the disease. Rabies occurs during every month of the year, during both the summer and winter seasons. There appears to be no condition of weather or climate unsuitable for its occurrence. Monthly records of cases diagnosed in the different seasons usually show more cases during the winter than during the summer season. In Pennsylvania, during the last two years, the lowest numbers of cases were diagnosed during the month of August, the month of the so-called “dog days.” In the reply from Texas a table showed that the highest average numbers of cases for a five-year period occurred in January and February, while the lowest numbers occurred in June and August.

Prevention and Control

In spite of the fact that rabies, from the prevalence standpoint, has fluctuated upward and downward from year to year, sanitary officials are confronted with the fact that the general trend, for a long period of time, has been upward and at the present time seems to be continuing in the upward direction.

Thus, the subject of prevention and control of rabies should constitute the most important part of this report. This would be a much less difficult task for the sanitary official if he could get the full cooperation of the public; if the public person would realize that the enforcement of laws in the prevention and control of this disease are for the purpose of protecting his dog, his own health, the health of his children, giving insurance to their lives and the lives of dogs and other animals, as well as other human beings, in the community.

In this connection, Doctor Moore, in his 1925 report, stated that control should be considered from the standpoint of two methods:

1. Keeping the virus away from susceptible animals.
2. Immunizing against the virus.
He stated that quarantine, along with disposal of infected and exposed animals and stray or ownerless dogs, constitutes the usual method of control in this country. Doctor Moore briefly summarized something as follows:

1. Early diagnosis is essential.
2. The normal small incidence of rabies does not justify compulsory vaccination when the success of the present measures are considered.
3. In rabies communities vaccination would be an additional measure to enforce.
4. The experience in this country does not warrant sole reliance on vaccine.
5. Encouraging results experimentally point to the possibility of the future development of a suitable vaccine.

In the survey made by your Committee, of the methods of control of rabies used in the different states, it was found that most of the officials in these different states rely upon quarantine which usually includes the killing of dogs which have been bitten by animals with rabies, or an extended period of quarantine and vaccination; and the disposal of all ownerless and stray dogs.

In accordance with the replies received, no states are opposed to vaccination but many of the states do not officially endorse its use; a number of states recommend its use in susceptible dogs in infected districts in addition to quarantine measures and the killing of stray or ownerless dogs; none were willing to place sole reliance in vaccine as a substitute for sanitary police measures; the only suggestion of harm which might be done by vaccination was that it may be the cause of a feeling of false security; vaccination is compulsory in a few states but of the officials in this group from whom replies were received none believed that the vaccine could be used as a sole means of rabies control and prevention.

The state veterinarian (Dr. Wm. Moore) of North Carolina reported that there is a compulsory law on vaccination but that it is unsatisfactory. There has been considerable rabies in many sections of the state for several years. Rabies cannot be effectively controlled without a satisfactory quarantine law. Reports from certain towns in the state seem to indicate that the annual use of vaccine helps to reduce the number of cases of rabies.

South Carolina (Dr. W. K. Lewis) reported a compulsory law on vaccination but that it was not effective. During the two fiscal years 1934 to 1936, there were ten human deaths in South Carolina from rabies; five received the Pasteur treatment and five did not.

The Vermont reply showed that no cases of rabies occurred in Vermont during the years 1935 and 1936, and that a previous outbreak was stamped out by quarantine and vaccination of all dogs in the state. The opinion was expressed that the disease could not have been stopped had they not required vaccination of all dogs in the state and that, in the case of another outbreak, vaccination of all dogs would be required before granting a license. All unlicensed dogs would be killed.

Alabama (Dr. I. S. McAdory) reported that dogs are required to be inoculated annually, with disposition of unvaccinated dogs running at large and confinement of bitten dogs and dogs which have bitten other dogs or humans. During the year October 1, 1935, to September 30, 1936, there were 1,811 heads examined; 914 were positive, 789 were negative and 108 were unsatisfactory for a diagnosis.

California Department of Health (Doctor Dickie) reported that vaccination is not required but that its use is recommended. There were 926 cases of rabies in animals in 1935 and 837 cases in 1936.
The total numbers of cases of rabies in animals in California, 1922 to 1935, was 9,707.

Connecticut (Dr. W. T. Corwin) reported that strict quarantine is rigidly enforced, the use of vaccine is not prohibited, dogs vaccinated ten days prior to the quarantine order are not subject to the requirements of the quarantine. There were three cases of animal rabies during the fiscal year 1935-1936.

Georgia Department of Health (Dr. T. F. Sellers) reported 618 positive heads in 1935 and 336 during the first six months of 1936. There is no law requiring vaccination; passage of such a law was vetoed by the Governor in 1935. The report expressed doubt as to whether they are in favor of a law placing the burden of rabies control on vaccination alone, that enforcement would be almost impossible, that vaccine is not so efficient as it should be and that a sense of false security would develop from its compulsory use.

Indiana (Dr. J. L. Axby) reported no law requiring vaccination; thought best not to introduce vaccine bill yet. In 1935, there were 597 positive cases and for ten months in 1936 there were 658 cases.

Kansas (J. H. Mercer) reported no mandatory law on vaccination; has authority to quarantine—also to require vaccination; does not think enough of vaccine to issue such an order; has experimented with vaccine—not satisfactory.

Illinois (Dr. H. C. Rinehart) reported that the control of rabies is by strict quarantine and sanitary police measures. Dogs must be confined in an enclosure from which escape is impossible or restrained on a leash of chain or other indestructible material. All other dogs are required to be eliminated by killing. Vaccine is recommended but vaccinated dogs are granted no privileges not enjoyed by unvaccinated dogs. The opinion was expressed that rabies cannot be controlled by vaccine alone. Illinois has approximately 800,000 dogs which, it is estimated, cause an annual live stock loss of $200,000.00. There were 327 positive heads in 1935 and 437 for ten months of 1936, plus 473 in Cook County. There were five human deaths in 1935 and eleven in 1936 to date. In Chicago 1,600 persons had Pasteur treatment during the first seven months of this year and during a twelve-day period, November 13 to 25, there was $3,300.00 spent for Pasteur treatments.

Maine Health Department (Doctor Coombo) reported: Have no mandatory law on vaccination; in 1933 and 1934, a good portion of the dog population in infected area was vaccinated. Reported cases as follows: 1933—62, 1934—32, 1935—4, 1936—3.

Minnesota (Dr. C. E. Cotton) reported: Quarantine is necessary; health certificate for imported dogs is required; vaccine is not officially recognized; do not have faith in one-injection method; could not recognize any form of vaccination in lieu of quarantine; there is no way of identifying dogs; tags can be procured and used by unscrupulous persons; vaccination could not be completely carried out; the stray and ownerless dog—the most dangerous—would be missed. No rabies occurred during 1935-1936.

Ohio reported, through its health news of August 15, 1936, that the City of Columbus has a quarantine order in effect which requires that dogs must not run at large unless in an inclosed yard of the owner; when on streets must be on a leash and be accompanied by a responsible person; exception—if owner can show proof that dog is immune, it is not so curtailed—but, the opinion was expressed, that it is futile as far as the public health is concerned. Efficacy of vaccine has not been determined. It is admittedly of some value. At its best, immuniza-
tion is not proved to be effective for more than one year, and the Department has found heads positive of dogs immunized only six months before. Misplaced sympathy for the dog is responsible for the prevalence of rabies. Owners should realize that necessary regulations are as much for the benefit of the dog as for the safety of humanity. The protection of both man and dog are dependent upon a few simple factors which should be given full cooperation. Most owners are bitterly opposed to muzzling and quarantine. England requires a six-month quarantine on entering dogs. We should have such a requirement here in Ohio; stray and ownerless dogs should be killed. In 1935, 410 positive cases were reported in Ohio. In 27 years, 1909 to 1936, there were 139 human deaths from rabies in Ohio and one to ten or more occur annually.

Texas (Dr. T. O. Booth) reported that rabies is handled by quarantine. There is a cooperative agreement of the Live Stock Sanitary Commission with the Department of Health. The latter furnishes the single-dose vaccine treatment for treating dogs of indigent persons. The Live Stock Commission furnishes the veterinarian to do the vaccinating. Dogs and cats, if vaccinated, are released from quarantine in a period of 30 days; otherwise not. Officials of the Live Stock Commission are now trying to get a law authorizing county officials to kill all unvaccinated and ownerless dogs. Do not consider it practical to vaccinate all dogs of the state, as the disease is confined to certain areas.

Virginia Department of Health (Doctor McGinnis) reported two deaths; one was in a person who began the Pasteur treatment within 36 hours after being bitten; the other one was not treated.

Wisconsin (Dr. W. Wisnicky) reported that there is no law on vaccination and that on account of the scarcity of the disease there is less inconvenience to eradicate when it occurs than to vaccinate.

Wyoming (Dr. H. D. Port) reported there is no law requiring vaccination in the state. Dogs entering the state must be accompanied by health certificates and must have been vaccinated not less than 30 days nor more than six months prior to entry.

In Pennsylvania there is no law prohibiting vaccination and, at present, vaccines do not receive official recognition. Experimental work on vaccination which has been published showed that no harm is done from the use of the single-dose vaccine. After the initial exposure of dogs vaccinated with phenol-killed vaccine, 43.6 per cent of the vaccinated dogs died of rabies, as compared to 56.3 per cent deaths in the controls. After the initial exposure in the group treated with chloroform-killed vaccine, 35 percent of the vaccinated dogs died of rabies as compared to 65 percent deaths due to rabies in the controls. In the subsequent exposures of dogs in both of the above experiments, the vaccinated groups showed no more resistance than the controls. At the present time, a natural exposure experiment is being conducted, which should be of value after a sufficient number of animals have been used, in determining the usefulness of the vaccine.

CONCLUDING STATEMENTS AND RECOMMENDATIONS

The above data clearly indicate that rabies can be controlled, that the number of cases in infected areas has been reduced and the disease has been eliminated from certain areas by quarantine and sanitary police measures alone; that the same end has been reached by vaccination along with quarantine and sanitary police measures; that sole reliance on vaccine alone has not accomplished this end.

Your Committee has no definite recommendations to make. However, a few suggestions may not be considered out of order. It might
be well to remember that the average owners of animals are frequently more willing and ready to use vaccines, bacterins, serums, etc., than any other method of disease treatment or control, and are prone to consider them infallible in accomplishing the intended purpose. This is likely to create a feeling of false security with neglect of other necessary measures including sanitary police measures.

The dog and his owner, in addition to stray and ownerless dogs, are chiefly responsible for the perpetuation and spread of rabies. If rabies is to be controlled, principles involved in the execution of a prevention and control program must be directed at the dog; and the owner must be made to realize the importance of transporting dogs from one place to another or must be required to confine transported dogs over a period of time sufficient to cover the usual incubation period, unless it is known with certainty that the transported dogs have not been in contact with dogs or other biting animals having rabies.

The vaccination of all dogs in a state when the disease exists only in certain sections and is confined to a few counties would be an unnecessarily expensive procedure unless it were known beyond doubt that the vaccine was practically 100 percent efficient in conferring a lasting immunity. There would be just as much reason for vaccinating all dogs in the United States on account of the movement of dogs from one place to another by hunters and tourists and persons changing their place of residence.

Every disease is best controlled by keeping the cause and susceptible animals apart. If this can be done we need not resort to any other means of control. However, this is often difficult to accomplish and does not furnish the most practical means of control of all diseases, but, in all diseases, its advisability and practicability should be of first consideration, either before a disease has entered a community or after prevailing cases have been eliminated.

We are not prepared to make any statement on the single-dose vaccination method except that there is no evidence that any harm comes from its proper use and that there is some evidence that it does a certain amount of good when used in combination with properly executed quarantine and sanitary police measures. Its practical use and properly controlled experiments under conditions giving exposure similar to the natural should, after sufficient numbers of vaccinated and control dogs have been used, determine its practical value. No vaccine should be relied upon as the sole means of the control of rabies or any other disease.

In our attempts to prevent, control and eliminate rabies, we should combine our efforts, and utilize and properly execute every means or method at our disposal, which will tend to reduce the number of cases of rabies in the United States. We should not rely on a single weapon if other useful weapons which can be used in combination are available. Among suggested weapons, in addition to vaccination if desired, are long periods of quarantine, proper public attitude and the elimination of stray and ownerless dogs.

The fact that rabies is widespread in this country at the present time and causes the loss of human lives and an economic loss in domestic animals; and the fact that dogs are the chief disseminators of the cause, indicates that the elimination of rabies from among dogs and other biting animals, including predatory animals, is essential to the prevention of this disease in humans; it also points to the importance of this disease to live stock sanitary and public health officials.

Your President, Doctor Wisnicky, has suggested that monthly rabies reports be assembled into a condensed report and a copy sent to the
sanitary official of each state so he may be familiar with the rabies situation in adjoining states and the country as a whole. Possibly the United States Bureau of Animal Industry should furnish this information.

In conclusion, the work of this Committee is only begun, and the necessity is indicated for the continuance of a committee in this Association to make a more detailed study of the rabies situation in the United States, including the best methods of control.

We recommend that the incoming president appoint a special committee on rabies to function during the ensuing year and render a report at the next annual meeting of this Association.

PRESIDENT WISNICKY: This has been a most interesting report. I think that I should mention that Dr. Barnes and his coworker, Dr. Kalodner, have contributed a lot of time and effort to the collection of the data which they reported in this presentation and those of you who know Dr. Barnes and know the interest of long standing that he has taken in this subject, perhaps, can recognize that he had made a very major contribution to this report although, in his modest way, he would not want to indicate that. What is your pleasure with respect to accepting this report?

DR. A. E. CAMERON: I move that the report be accepted and referred to the Executive Committee.

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

PRESIDENT WISNICKY: This report is now open for discussion. Dr. Breed, would you like to make any comments?

DR. FRANK BREED: I should like to extend my appreciation to Dr. Barnes in particular, who helped so ably to get together the information contained in this report. The point which I believe Dr. Barnes has been exceedingly fair on is the vaccination problem. He has presented only the information gained from various state authorities, their observations and the results obtained and I believe, as he does, that in the control of this disease we cannot rely on any one means. I do believe that following vaccination, particularly where there is an epizootic, the quarantine of vaccinated dogs should be in effect for 20 to 60 days. I take pleasure in concurring in the report.

PRESIDENT WISNICKY: Thank you, Dr. Breed. I know that you cooperated splendidly in preparing that report.

Dr. Rinehart, would you like to speak on the subject?

DR. H. C. RINEHART: In Illinois we have something like 800,000 dogs. In Cook County we have possibly 350,000 and of that number we have in Chicago about 24,000 dogs that are assessed. It seems impossible to get a full quota of our dogs assessed.

You understand, in this state we have quite a good law. We feel that our law has teeth in it. In fact, we have tested it out. We had one occasion where a policeman in the southern part of the state shot a dog in a quarantined area. It was in the J. P. Court on two occasions and then went to the Circuit Court and each time was cleared. The Department of Agriculture has the right to state what it wants done in a quarantined area.

Personally, I feel there are only two ways in which a quarantine should be handled. Dogs must be confined in an enclosure from which there is no escape possible or on a leash of chain or other indestructible material. Of course, our law speaks of muzzling and prophylactic treatment but we have decided that prophylactic treatment is not practical and that muzzling is not satisfactory. When you place a muzzle
on a dog sufficiently tight to make him safe, he is so uncomfortable that he will tear it off. Therefore, we ask only two things—strict confinement or quarantine or a leash of indestructible material.

We encourage vaccination in all cases as much as possible but we do not give a vaccinated dog any privilege over any other dog for the reason that if we did, it would be taken advantage of by officials. You understand the law is in the hands of the Department of Agriculture and the police department, and the sheriff or police authorities of any community must enforce it, and if they do not, we have the power to impose a fine of not less than ten dollars and not to exceed fifty dollars.

If an owner fails to quarantine his dog, he is liable to a fine of twenty-five dollars and not to exceed one hundred dollars and then we can destroy his dog besides.

We have a bad situation from the standpoint of politics in the control of rabies. We have too many policemen who have friends whom they want to take care of. Occasionally you will find a case where somebody has received a small fee for a dog. That is, the owner wants him back. If you are going to soft pedal like that, you cannot handle rabies and I have decided that here in Chicago we are going to have a quarantine from now on. I may catch a lot of hell but we are either going to have a quarantine here and get rid of rabies or else this police department will get some advertisement because, for your information, I might state that we have had five human deaths from rabies during the year 1935 and eleven so far in 1936. Another thing that might be of interest to you is that a number of these people had proper treatment after they were bitten. I think five, if I remember correctly, were treated at the proper time with 21 treatments and still they died from rabies. It sort of places a person in a position where he feels he does not want to be bitten by a rabid dog under any consideration.

The cost to the live stock industry and the taxpayers as a whole in this state is enormous. I have checked up on a number of counties, some 35, and the average cost to the county will run more than $2,000 in the way of claims that have been turned in to the county board and we have 102 counties, so that means over $200,000 in the way of loss from live stock; not saying anything about the cases that were not reported.

Then we have a lot of damage to shrubbery and I am inclined to believe that unless the veterinary profession and the people as a whole do not attempt to stamp out rabies, it is going to be hard on the veterinarians, the dog-food manufacturers and breeders, because I do not believe the live stock industry will stand for this always. It is too great a load to expect them to carry. When you figure $200,000 for our state in the way of live stock loss, it is too much. Those claims are paid as far as the money will go from the county dog-tax fund and as long as they do not assess many dogs, it is usually prorated. A lot of counties will pay 20 per cent, some 50 per cent, but that is about all the man gets who has a loss among his live stock from dogs.

Now we also have a law to cover the loss of sheep. When a sheep is lost from the attack of dogs, the owner has a perfect right to put out bait for the dogs and for that reason I feel that some of these live stock men are apt to do that. They have a right to put out strychnine if they care to. In fact, we had one case down state where a man had a flock of sheep torn up and a lot of them killed, so he told his man on the farm to get strychnine and put it out. The man put the poison
on a carcass and put it in an old abandoned well. The farmer found his man burning some dogs and he said, "I thought I told you to put the bait in that old well." The man said, "I did, but it is full and now I am burning the dogs." The thing is getting desperate when a man has to do a thing like that.

Most veterinarians like dogs and there are very few men who do not like dogs but when you size it all up there is just one thing to do. You take care of your dog and I will take care of mine for 80 or 90 days and there would not be any rabies in our state or any other.

As to vaccination, to the best of my knowledge, it works fairly well but we have had in this rabies work possibly three cases which I can call to mind where a dog developed rabies which had been treated for a period of four or five years annually. So there is a question in my mind as to the efficiency of the anti-rabies treatment, although we encourage it. We have not, however, definitely decided that rabies can be controlled by vaccination; in fact, we have definitely decided you cannot control an outbreak of rabies by the vaccine treatment.

DR. D. E. WESTMORLAND: We have rabies quite extensively in Kentucky but I have made no preparation to give you any information on it.

DR. C. E. COTTON: How many counties are involved?

DR. WESTMORLAND: About 120 counties are involved—we have 120 counties in Kentucky.

DR. BARNES: May I make a further statement on rabies? Just as I sat down I was handed a letter that had the following enclosure from the Philadelphia Inquirer:

Heading: "Rabies Causes Death of Girl Awaiting Cure. Little Mary Mallon died yesterday afternoon. She was only five years old—not quite that. Convulsive gasping for breath, pleading for water and unable to drink, the tiny miss succumbed to rabies."

That head was sent to our laboratory and diagnosed.

With reference to the report of the Committee on Meat and Milk Hygiene, Dr. Schalk had to go home and he asked me to report that there is no report this year. Last year's report was considered sort of a foundational report and the committee has been collecting data during the last year on the meat inspection service departments in different municipalities and the accumulation of that data has not been completed. Dr. Schalk asked for a continuance, so he could complete his job.

PRESIDENT WISNICKY: I know I express a common thought when I say the next paper, entitled "Chicago's Milk Control—What Does It Mean?" has been looked forward to with a great deal of interest. Dr. Herman N. Bundesen, president of the Board of Health of the City of Chicago is an outstanding figure in the field of public health. He is recognized as having made an outstanding contribution to the high standing of the Chicago milk supply. As you all know, he has taken a leading part in providing tuberculin test requirements on cattle supplying milk to this city. He has, likewise, taken a leading part in raising the milk standard so that Chicago is getting all Grade A milk. In addition to that, he has also put into effect a system of pasteurizing which is properly supervised and in which one can have confidence that this system is functioning well and giving to the people of Chicago the type of milk they desire.

It is with great pleasure that I present to you Dr. Herman N. Bundesen, president of the Board of Health, Chicago, Illinois. (Applause.)

... Dr. Bundesen read his paper. ... (Applause)
Over a decade ago, it was my privilege to appear before your organization and discuss the elimination of tuberculosis among dairy animals. At the time, many predicted that the program was impractical and could not be carried out. But all of you are aware of the success of the undertaking all over the United States, and what it has meant.

However, the production of milk by healthy cows, important as it is, is but one of the factors which are essential in a well-developed milk control program. Other factors include the employment of healthy employes in the production and processing of the milk supply; inspection of dairy farms and milk plants to determine whether or not necessary public health precautions are being observed; laboratory tests of the milk and milk products, and proper pasteurization of the milk and milk products. The enforcement of any one of these items alone will not insure a pure, safe milk supply at all times.

Physical examinations and tests made of both the dairy animals and the individuals handling the milk supply are not infallible and cannot be done at frequent enough intervals to insure the absence of infection at all times.

Sanitary inspections are extremely valuable, but cannot always insure proper sanitary conditions in the absence of the inspector.

Laboratory examinations of milk furnish the health officer with valuable information as to the quality of the product, but they are not sufficiently thorough to enable us to determine the presence or absence of possible contamination.

The proper pasteurization of milk is one of the best safeguards a community may have against unsafe milk, but here we have human frailty and error of judgment to consider, which may permit of possible contamination.

It is evident, therefore, that thorough protection must be given in the production and handling of our milk supply from the cow to the doorstep, if we are to believe that a community's milk supply is assuredly safe and wholesome at all times. We must follow such procedures as shall guarantee that all of these measures will be properly enforced, if we are to assume that a community's milk supply is being properly safeguarded.

The legal means by which a city may carry on this most important health activity is through the enforcement of properly designed ordinances. Prior to 1935, Chicago's milk improvement
work was carried out under an ordinance of a type common in many of our larger American cities today. This was originally drafted many years ago and, from time to time, enlarged and amended. The result was that it did not include many modern phases of milk control. Parts of it were contradictory and, in many places, it was so worded as to be possible of several interpretations.

After a great deal of intensive study of the various milk ordinances in effect in the United States today, it was decided to adopt an ordinance which we felt embraced all of the essentials of milk control. The Standard Ordinance and Code of the U. S. Public Health Service did just that. In addition it had many other distinct advantages to commend it. It had been tested out in various courts and had been upheld. It included those modern practices for the control of milk supplies which had been, by experience, found reliable and practical. It was believed to be flexible enough to easily permit changes necessitated by modern development but, at the same time, not so flexible that it could not easily be enforced. It was found to be complete in all details, so that enforcement could be uniform, an extremely important consideration in a milk-shed the size of Chicago's.

The Standard Ordinance was found to lend itself readily to modern bookkeeping systems so that the enforcement officials could determine, at all times and at a glance, whether or not the ordinance was being properly enforced. Not only are definite requirements placed upon the producer and the distributor but the Board of Health also is required to perform its duties in a prescribed manner. This latter feature was of special attraction to the milk industry, in that it was secure so long as it complied with the provisions of the Ordinance and Code.

The Mayor Kelly Milk Ordinance was passed on January 4, 1935, and the rules and regulations of the Board of Health, to be used in the interpretation of that ordinance, were adopted on January 8, 1935. It provided that all milk and milk products sold in the city of Chicago, including the ingredients of ice cream, should be limited to Grade A pasteurized and certified milk and milk products.

Chicago's ordinance is patterned after the Standard Milk Ordinance of the U. S. Public Health Service, and includes all of the requirements of the Standard Ordinance and Code for Grade A and certified milk and milk products, with certain upward revisions. In addition, a time limit was placed on the sale of milk and cream to insure the freshness of such products, and a schedule of license fees was included.
Directly after the adoption of the ordinance and code, a school was held for all of the Board of Health inspectors. This was attended, also (on invitation), by those employed in a similar capacity by the producers and distributors. Attendance at the school insured uniform enforcement of the various requirements by the industry, as well as by our own inspectors. This we knew to be of extreme importance, in that, from our experience, we have noted that in most instances where violations of the existing requirements are found, the cause may be traced to ignorance of the provisions or to improper interpretation of the requirements.

Demonstrations were included in connection with the school to acquaint the enforcement officials with the most practical and least expensive ways in which the provisions could be complied with. Immediately following the school of instruction, the Board of Health's representatives visited each milk plant and dairy farm, and went to great length to describe, first of all, what the new requirements consisted of; and secondly, how the requirements could be met in the most practical and least expensive manner.

The Chicago Board of Health had prided itself for many years upon the fact that Chicago citizens were being furnished a fine milk supply. However, in examining the reports of the first inspections made, it has found that a tremendous improvement still remained to be made in the methods of milk production and milk plant operation.

This first inspection rating of the Chicago pasteurized milk supply, based on the survey standards of the U. S. Public Health Service, showed us that, instead of having a rating of 90 per cent or better, as we had supposed, our rating was considerably lower.

As soon as it was determined what corrections were necessary to be made, as well as to find out at all times just how successfully the enforcement procedures are followed, a complete up-to-date record-keeping system was developed and put into use, patterned closely after the ledger system of the U. S. Public Health Service and set up as a visible card system. (It is hoped that as many of those present as possible may find it convenient to step across the street to the offices of the Board of Health to see how efficiently this system performs.)

Reinspections were made following the initial visits of the inspectors, and all those who indicated a willingness to comply were given every consideration to make the necessary improvements in a practical manner. The permits of the small number who flatly refused to comply were, of course, revoked.
Approximately one year following the original inspections, a second thorough survey was made of the dairy farms and milk plants supplying the city with milk, at which time it was found that sufficient compliance with the Grade A requirements had been secured. And, since that time, all milk sold in Chicago has been labeled with the Grade A label, with no increase in price to the housewife. The Grade A label was later extended to cream.

It may be said, at this time, that the Mayor Kelly Milk Ordinance is now in full force and effect in the city of Chicago, and that the milk and milk products sold comply with the requirements of that ordinance. At the same time it cannot be said that our work has been finished, for constant inspection and reinspection work is necessary to insure the purity, safety and wholesomeness of our milk at all times.

Now, suppose we consider some of the questions that have been raised in connection with the adoption and enforcement of the Standard Milk Ordinance and Code. Perhaps the one question that has been answered in Chicago has been that oft-repeated phrase, "It may be successful in a small community, but will it work in a large community?" That most definitely can be answered in the affirmative: that, regardless of the size of the community, it is practical and enforceable.

A second argument frequently raised has been that it may work in certain sections of the country, such as the South, or it may work in certain sections of the country because of the habits and character of the individuals residing in those communities, but it cannot be universally accepted throughout the country. That, also, may now be definitely answered in the affirmative that, whether the ordinance is in effect in the North or the South, it is effective and reliable.

A criticism often raised against the ordinance has been that it is directed against the small producer and the small distributor, and that it will put him out of business in favor of the large producer and the large distributor. Our experience, in this connection, has been that one of the greatest advantages of this ordinance to the industry is that every one is treated alike. The person having a large volume of business is required to do everything that is required of those having a small volume.

No farmer or milk plant in the Chicago milk-shed was forced out of business because he could not, in a practical manner, comply with the requirements. In fact, at the present time, the number of producers and distributors under inspection by the Board
of Health is greater than it was at the time of the adoption of the ordinance.

It is true that the dirty and inefficient producer and distributor have been kept from doing business in the city of Chicago, but such operators are not limited to size, and their places have been taken by many others who are more efficient and who are glad to comply with these requirements.

Another argument brought up against the Standard Ordinance is the fact that it is expensive to enforce. This has not been our experience in that we believe, to carry on the necessary work, the personnel and expenditure are but slightly greater than that required a number of years ago under the old ordinance.

Another alleged disadvantage often cited for this program has been the fact that the cost of milk has been increased to the consumer. That may be simply answered by stating that the cost of keeping clean is the same, whether it be under one ordinance or another.

If proper attention has not previously been given to or enforcement has not been had of the necessary requirements, then, perhaps, this cost will be slightly increased; but, certainly, dirty, unsafe milk is expensive at any price.

The price of milk to the consumer was not increased in Chicago because of the enforcement of this program. The Standard Ordinance was found to be sufficiently flexible to permit modern improvements and changes whenever necessary.

When, for example, it was found necessary to have all milk and milk products pasteurized in Cook County, it was found that this could readily be done without amending the ordinance. In the same way, the elimination of bulk milk and milk products, except those used for manufacturing purposes, was also readily accomplished, without amending the ordinance.

It should be emphasized that a distinct advantage of the Standard Ordinance is the fact that it makes necessary the changing of existing conditions in accordance with modern methods of control, which is distinctly apart from those ordinances which are drawn up in accordance with conditions as they exist locally, and not to the end of proper health protection.

It must be remembered, of course, that no matter what type of ordinance is adopted, to be effective it must be thoroughly and impartially enforced. The reason the ordinance was a success in Chicago is unquestionably due to the fact that it has been equally and impartially enforced, and that when it was adopted we knew we were going to enforce it.

Most important of all—the health officer must have enough intestinal fortitude to have the courage of his own convictions,
and must be backed by a chief executive who is equally interested in only one consideration and that—the health of the citizens. Chicago's Mayor is that kind of executive.

With the help of the record system kept in connection with the enforcement procedure, it is possible, at all times, to determine whether or not the work being done is effective, and whether or not the milk supply may be assuredly pure, safe, and wholesome at all times.

With our present methods of production, pasteurization and control, we feel that our milk supply is pure, safe and wholesome. And we owe a debt of gratitude to the milk producers and the milk dealers for their patience and wholehearted coöperation. Without their help, the task would have been difficult, indeed.

PRESIDENT WISNICKY: Thank you, Dr. Bundesen, for your splendid address.

DR. COTTON: I move that we extend to Dr. Bundesen a rising vote of thanks.

... The motion was seconded, put to a vote and carried, and the audience rose and applauded...

PRESIDENT WISNICKY: I think this Association is truly grateful for an address of that character. It carries the atmosphere of determination that is so essential to do a good job and to provide a wholesome, safe milk supply for a city like Chicago and Dr. Bundesen has truly done a good job. I think this address will inspire those of us who have to carry on duties of this kind.

We shall now have the report of the Committee on Transmissible Diseases of Poultry, and I take great pleasure in introducing to you Dr. Leo F. Rettger, Chairman, who has given a great deal of thought and attention to this report. Dr. Rettger.

DR. RETTGER: The report has the approval of four of the five members of the Committee. The fifth member had not communicated with me by the time I left New Haven, in response to the letter I wrote him, and I am sending him a copy of the report for his approval.

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

REPORT OF COMMITTEE ON TRANSMISSIBLE DISEASES OF POULTRY

DR. LEO F. RETTGER, Chairman, New Haven, Conn.

Dr. J. R. Beach, Berkeley, Calif.  Dr. Hubert Bunyee, Washington, D. C.
Dr. E. L. Brunett, Ithaca, N. Y.  Dr. E. P. Johnson, Blacksburg, Va.

We propose to present as the main theme of this report, "Poultry Sanitation," keeping before us all the while a broad interpretation of the term "sanitation."

Twenty-five years ago, "hygiene," "public health" and "sanitary science" were little more than mere names. To day they are buried deep in the minds and hearts of all civilized peoples, and systematic training in this general field of human welfare constitutes a large part of college and university curricula. Indeed, it is a foundation stone in modern medicine and in the science of society.
Will the next 25 years reveal similar progress in the study and prevention of diseases of domestic animals, particularly poultry, and will the terms “hygiene” and “sanitation” have the same forceful meaning when applied to our barnyard winged friends as they do for us?

The annual losses from animal diseases are enormous, perhaps incalculable. Transmissible infectious diseases form the large bulk of this waste. Science and veterinary medicine should reduce these losses on a very much larger scale than is possible even for human infectious diseases, because of the inviolability of the inherent and traditional rights of the human individual in any program of disease eradication which includes elimination of the carrier individual. That effort and monetary cost justify the end sought has already been amply demonstrated in certain well-known fields of animal disease control.

Prevention of infectious disease promises infinitely more than attempted cure, notwithstanding the marvelous cures that are effected with so-called specific remedies, like quinine for malaria and arsphenamine for spirochetal infections. But how the importance of quinine treatment fades into relative insignificance when its merits are compared with the present-day system of malaria prevention by eliminating the infected mosquito.

Pasteur's well-known fight against anthrax in cattle and sheep by the injection of attenuated anthrax vaccine was epoch-making. Yet, in spite of the enormous benefit derived from this system of prophylaxis, repeated efforts have been made in various countries to produce a more effective vaccine or an anti-anthrax serum. Anthrax is still a world problem.

How different were the far-reaching results of Pasteur's untiring work on silk-worm disease. Here he struck at the root of the evil by devising a system of prevention which rested entirely on the recognition and elimination of infected silk-worm eggs.

Dorset's anti-hog cholera serum promised to revolutionize the swine-raising industry. Millions of dollars have been saved by it annually. Yet, so definitely have its limitations been recognized that investigators have sought an advance over this method, and for a time seemed to have found it in combining the serum treatment with live virus inoculation. Although hailed in many quarters as the real solution, the use of live virus has introduced the hazard of promiscuous spread of the virus, and has not in any appreciable measure furnished the ultimate solution of the hog cholera problem. Does not the real solution lie in sane and systematic sanitary preventive measures, however difficult and remote such a system may appear to some of us? This subject was ably touched upon some five or six years ago by one of your presidents, Dr. J. W. Connaway, in his annual address to the Association.

Smith's famous research on Texas fever of cattle struck at the roots of the problem of control in that it led the way to the elimination of the infected tick. The present system of tuberculin testing of cattle and the removal of all reacting animals from cattle herds also rests upon a firm foundation. We may visualize entire states and countries as ridding themselves eventually of this highly destructive animal disease, providing the fight against it is not relinquished before the victory is actually won.

Let us now turn our attention to transmissible poultry diseases, which constitute the theme of our meeting here today. No branch of veterinary medicine offers more promising results than it does to those who attack the problem of poultry disease control with the weapons which modern sanitary science is putting at their disposal. It is perhaps safe to say, at the same time, that no other group of
animal husbandmen has been and still is so viciously bombarded with proprietary agents of all descriptions as are poultry producers.

**Nostrums for Poultry Exposed**

A glance at the list of so-called poultry remedies against which the U. S. Food and Drug Administration has instituted legal action for violation of the Food and Drugs Acts will convince one of the magnitude of the problem which confronts official control agencies. We read quite recently official records of some 60 cases of misbranding of so-called poultry disease "preventives" and "cures" which were brought to trial during the past three or four years and adjudged violations of the Pure Food and Drugs Act.

The poultry diseases for which cures were claimed on the packages included limberneck, roup, cholera, gaps, bronchitis, worms, coccidiosis, diarrhea, enteritis and catarrh. The following claims were carried on the container of a certain widely advertised tonic: "Effective as preventive of poultry disease; effective to regulate the liver and digestive organs and having a special beneficial action on the egg-producing organs of the hen; effective to cure cholera in poultry; to promote growth and fatten poultry; to insure good health and a strong and vigorous body; etc." Needless to state, this tonic was among those which were found violating the Food and Drugs Act.

Some single drug preparations are claimed to cure all of the more serious well-known diseases of poultry, diseases which are still baffling medical science and for which no known chemical treatment has as yet been found efficacious.

A review of the Food and Drug Administration's activities reveals that its intensive drive against the scores of so-called "cures" for pullorum disease (bacillary white diarrhea) has been highly instrumental in eliminating these from the market. Those who are at all familiar with the history of the present country-wide system of pullorum disease eradication by the elimination of pullorum carriers can appreciate how these nostrums which flooded the market interfered very materially with the real solution of the pullorum disease problem. Thousands of poultry-owners throughout the country were the victims.

**Valuable Service Rendered**

The Committee on Proprietary Pharmaceuticals, of the American Veterinary Medical Association, is performing a good service to the veterinary profession and to animal industry, through its efforts to combat nostrums and misbranding, and by its eager cooperation with the Food and Drug Administration.

No serious-minded intelligent persons or groups of persons can question the harmfulness of the many still-existent worthless so-called "preventives" and "cures," and the high-powered salesmanship behind them. They operate to lower the most effective barriers against transmissible disease which sanitary science has set up, by instilling a feeling of false security in the proprietary agents, and drawing attention away from the things that should be, namely, sane measures of prevention. These statements are not meant to cast doubt or reflection on the many drugs, including disinfectant agents, which have been established and accepted as meritorious in their own sphere. These have their proper places, of course.

**Biological Products of Merit**

Let us pause now to give due credit to another group of agents which deserve serious consideration, namely vaccines and antiserum. Who will question the merits of anti-smallpox vaccine and diphtheria
anti-toxin, of specific antipneumococcic serum or anti-hog cholera serum, or of anti-anthrax vaccine? Unfortunately, master biologicals like these, which have received general scientific and medical acclaim, are indeed still very few, particularly in relation to poultry diseases.

Two of those which have attracted an unusual amount of attention in the poultry world are laryngotracheitis and fowl-pox vaccines. When these are properly prepared and administered, they confer at least relative immunity, as even their most bitter opponents must admit. There appears to be no doubt that much good is accomplished by the use of these agents. There is much disagreement, however, among poultry disease authorities as to when such treatments should be given, and the criteria on which they should be based.

Some states require permission from the regulatory officials for the application of the laryngo-tracheitis vaccine on any given flock or flocks, in order to prevent indiscriminate use of the agent, and its possible introduction into flocks where no infection already exists. Permission is based on definite evidence of the pre-existence of the virus on the given premises.

There is a strong tendency in some quarters to advocate the use of fowl-pox vaccine on all flocks of fowl in a given area or state, irrespective of whether or not they already harbor the pox virus in the flocks; and this in some states in which fowl-pox is not in reality a serious problem.

Irrespective of whether birds which have been treated with laryngotracheitis and fowl-pox vaccine may become carriers, the mere handling and use of the virus vaccines on poultry premises must constitute a hazard to hitherto uninfected flocks. The danger of introducing infection is recognized in some states by regulations requiring that the sale of birds from vaccinated flocks for breeding purposes is permissible only when the vaccination status of the flock is known to the prospective buyer.

**Emergency Measures Only**

Vaccination and serum treatment quite often have an important place in our armamentarium against disease, but they are only emergency measures, or more or less temporary supplements to sanitary measures which have as their ultimate aim eradication of the disease in question.

In spite of the remarkable results that are obtained in man with diphtheria antitoxin, and by active immunization with diphtheria toxin and toxoid, what would the situation be if we relied on these alone for present and future protection against diphtheria? The discontinuance of the hygienic practices which have been in existence for almost 40 years would soon lead to near-consternation. Take away systematic clinical and bacteriological diagnosis and the identification of carriers, isolation of diseased and of carrier individuals, proper disinfection of exposed objects, and education of the public in the art of sanitation prevention, and where would we be?

A few short years ago, the voice of Dr. Cary, another of your revered presidents, rang out in this room, "Vaccination has never eradicated a disease except temporarily." He referred particularly to smallpox, hog cholera, and anthrax vaccine and anti-serum. Dr. Cary might have added, "and it never will," and most of us would have agreed with him.

Vaccination often appears as the shortest and most economic course to pursue. The various efforts to devise an effective vaccine against Bang's abortion disease in cattle, for example, have been motivated by such a premise. That no acclaimed satisfactory method of vaccination has as yet been established for this disease is no cause for worry of cattle-owners who have the long view and seek but one real, ultimate goal, namely eradication.
DIRECT EFFORTS AGAINST SPECIFIC AGENT

In any well-regulated program of transmissible poultry disease eradication our main effort must be directed against the specific infectious agent, and the surest way of doing this is to devise and adopt methods of recognizing this agent and, wherever it is possible, ridding the flock of it by eliminating birds from the flock which carry the disease organism either actively or passively. Proper cleaning of houses, yards, feed and water containers, and the liberal use of efficient disinfectants are important adjuncts. With all this accomplished, further safeguards must be thrown around the flock to prevent reinfec-
tion from the outside by exclusion of all infected and suspicious birds from the premises, including birds which are returned to the flocks from laying contest plants and show rooms. All birds that are intro-
duced or reintroduced into a sound flock must be looked upon with suspicion until they have been held in quarantine and proven them-
selves free from the infection in question. Specific diseases call for specific methods and measures, as a rule.

All this has been done and is being done over a large part of the country in an organized fight against pullorum disease, and with a remarkable degree of success in quite a number of the states, where the tests are made by proficient veterinarians or trained laboratory technicians, under official supervision. This is no apprentice's task, and requires time and patience.

The way has been laid out for pullorum disease control by scientific and sanitary measures. For other poultry diseases some links are still missing in the chain of evidence, but even then astounding progres
can and will be made in the direction of eradication by making use of the information already at our disposal. For example, much still remains to be known about blackhead in turkeys; but turkey raising has been placed back on the map by the discovery that chickens constitute a serious and constant menace to turkeys when the two are allowed to intermingle and to occupy the same ground.

Fowl cholera and avian tuberculosis are preventable, and have been prevented from spreading significantly in some sections of the country, particularly in the northeastern states where, while both diseases are recognized as existent, they do not constitute a serious problem. One thing must appear quite evident to all of us, namely, that chickens, turkeys, swine and cattle cannot be herded together on the same grounds or in the same barn, without serious consequences to the health of the animals and the pocketbook of the owner.

MORE RESEARCH NEEDED

In closing this report, we wish to emphasize the need of continued effective research on the causes of poultry diseases whose etiology is still unknown or little understood; on the paths of infection from diseased to hitherto uninfected birds; and on methods of identifying diseased and carrier birds, and of creating efficient barriers against the spread of infection within flocks and into sound poultry communities from the outside.

It is only by seizing upon information gained in this way that we can hope to free the poultry industry of diseases which demand such a heavy toll. Sanitation in its broadest aspect, that is, elimination of infected birds, and the maintenance of sound flocks by constant vigilance against new infections; cleanliness, proper feeding and general care, must be the bulwark of defense. Vaccination may have its merits, but the use of even the most firmly established vaccines must be regarded as temporary or emergency measures, and should not be given such prominence in any program of permanent control as to draw attention from, and seriously cripple, the major program.
Only the briefest reference has been made so far in this report to the feed problem in poultry disease control. An enormous amount of research has been conducted in recent years on nutritional disturbances in poultry, especially the avitaminoses, in which specific infectious agents apparently play no part. However, infectious diseases may have their inception and course determined or affected to a large extent by faulty or inadequate nutrition. It is for this reason largely that proper feeding is included in this report as one of the subjects which must be given serious consideration in the problem of control of transmissible diseases by sanitation, in the word's broader and modern sense.

Dr. Rettger: Now I should like to depart from this committee report to make some personal remarks for which I only am responsible and which are not a part of this report.

I wish it to be understood that I have not been in the least opposed to the principle of the area testing method, but I was a little alarmed about some of the mistakes made, particularly by two members here when they suggested that in practically free area there should not be a tuberculin test made more than once in six years. Now, I do not know whether they meant just what I thought they meant or whether they had certain exceptions in mind. I can see how the individual and his herd are still just as important as an area. He is an integral part of an area. If you throw him in with a whole area and that area has a tuberculosis history of 0.5 per cent infection, and there are a few in that area who are perfectly free, should we not recognize that? Then, if no testing is done for more than six years, should that percentage apply to the individual negative herds and not to all herds in that area. I think it is the same as testing in abortion. I have been interested in Bang's disease study for more than 20 years and we feel that we have laid a good foundation for this work.

I have been interested a great deal in Bank's abortion disease and what I have said about tuberculosis area testing would apply here. I would not make this mention if it were not for the fact that area testing for pullorum disease is anticipated. There again, I would like to apply the same principle. We get over-confident. It has been true always. I remember, not many years ago, that some of the leading cattle-owners and even a member of the Connecticut legislature were determined that the State Veterinarian should not get into his herd to test his cattle for tuberculosis. Today, I believe, that same man is one of the most vigorous supporters of the methods. So let us not slow up in our aggressiveness to try to obtain full eradication. I think I can see signs of letting up in our present rigid system of both Bang's disease testing and tuberculosis testing.

I said before the Northeastern Producers' Council, in a meeting in New York two years ago, that we would not tolerate one rattlesnake in our nursery any more than we would a dozen and I believe that still. We cannot always interpret that in the present problem under consideration but I believe it is worth while in not only area testing to try to reduce the area test but get the last rattlesnake out if possible and do not let the few herds color the area as a whole. Give the ones who are apparently free a special inducement to continue to be free and do not take anything away from them that they have.

President Wisnicky: Thank you, Dr. Rettger, for that splendid committee report. Has anyone any questions?

Dr. A. E. Cameron: I think this Committee is to be commended for the comprehensive report they have given and particularly the warning they have given in regard to indiscriminate use of live vaccine. I think the sooner we recognize this, the sooner we will save ourselves a whole lot of trouble.
FRIDAY AFTERNOON, DECEMBER 4, 1936

The sixth session convened at 1:30 o'clock, President Wisnicky presiding.

PRESIDENT WISNICKY: The meeting will now come to order.

First on our program this afternoon we have a paper on "Fowl Cholera," by Dr. L. Van Es, but since Dr. Van Es is not here at the present time we shall call upon someone to present the paper on "Fowl-Pox Vaccination of Day-Chicks." I understand that Dr. W. H. Boynton will present this paper for Drs. R. E. Lubbehusen and J. R. Beach, neither of whom could be here. I am pleased to introduce Dr. Boynton.

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

FOWL-POX VACCINATION OF DAY-OLD AND OLDER CHICKS

Second Report

By R. E. LUBBEHUSEN and J. R. BEACH

Veterinary Science Division, University of California
Berkeley, Calif.

During the spring of 1934, we were afforded the opportunity of participating in and observing the results of vaccination of 36,691 day-old chicks in 45 groups on twelve farms. These data, as well as those of controlled laboratory experiments on small groups of chicks, were contained in a preliminary report1 presented before this Association a year ago. In this report, it was brought out that secondary lesions of pox and post-vaccination mortality from this cause could be virtually eliminated by an improved vaccination technic. However, the occurrence of a high post-vaccination mortality in groups free from secondary pox lesions but subjected either to unfavorable environment or concurrent disease and uneven development and rate of growth in other groups which were not subjected to such factors strongly suggested a lowered vitality following vaccination. Using the weight gain and mortality data of vaccinated as compared with
non-vaccinated controls as an index of lowered vitality, the preliminary trials on limited numbers of chicks indicated that a vaccination take was accompanied by a systematic reaction which, at times, contributed to excessive mortality under unfavorable environment or concurrent disease. It became apparent, therefore, that additional study must precede the recommendation or condemnation of fowl-pox virus vaccination of day-old chicks as a routine procedure.

The experimental studies of fowl-pox virus vaccination of day-old and older chicks to be reported at this time were conducted during the past year on 9,107 chicks, in 20 groups, on two poultry farms which are designated A and B.

Farm A was operated by a hatchery for the purpose of rearing males for use in flocks which supplied hatching eggs. The brooding conditions may be described as not above the average but fairly satisfactory. The chicks were brooded under gas hovers on concrete floors in open-front houses, and were removed to range at the age of 14 to 16 weeks. Previously, fowl-pox vaccination at this age had been practiced and was followed by an excessive mortality and the development of a too-high percentage of culls. This hatchery owner was, therefore, interested in day-old vaccination as a possible solution of this post-vaccination mortality problem.

Farm B represented a new poultry farm enterprise of rather large proportions, operated by an experienced poultryman. The brooder houses and equipment were new and above criticism. For several years this poultryman had vaccinated birds at the age of approximately four months with what he described as satisfactory results, but was sufficiently interested in day-old chick vaccination to give every assistance in securing experimental data.

The vaccination technic: The vaccination technic developed last year was adopted as a standard procedure. It consisted, briefly, of making the virus inoculation by puncturing the loose fold of skin in the region of the flank with a needle which, when dipped in vaccine, carried away a tiny bead of virus material between its two points which were 1 mm apart. This vaccinating instrument, which delivers a constant amount of virus to the cutaneous tissues without leaving an excess on the skin surface, has never failed to produce a satisfactory vaccination take when a potent vaccine, having a virus concentration of 10 mg per cc, was used. Less than 0.6 per cent of the chicks showed secondary pox lesions, and no mortality could be attributed to this cause.
The vaccines: In our work reported last year, vaccines with the virus concentration of commercial vaccines (10 mg per cc) had been uniformly used for the reason that in two earlier field trials in which a vaccine of greater virus concentration had been used, the takes healed more slowly and appeared to cause arrested development of the chicks. In order to procure more information on this point, three groups of approximately 300 day-old chicks each were vaccinated with vaccines having virus concentrations of 10 mg, 20 mg and 30 mg, respectively, per cc of diluent. The results indicated that the 30-mg virus-concentration vaccine tended to cause more extensive and persistent takes a greater, but temporary, retardation of growth than vaccines of lower virus concentration. With potent vaccines, however, there appeared to be no difference between these virus concentrations with respect to their certainty to produce takes. Consequently, the use of the 10 mg virus concentration was continued in these experiments. The diluent was 25 per cent glycerin in phosphate buffer solution of pH 7.4. To avoid repetition in the description of experiments which follow, it is stated here that a satisfactory take was produced on all chicks which were vaccinated and that an insignificant number of them developed secondary pox lesions.

Criteria of effects of vaccination: As in previous experiments, differences in the weight gains and mortality of vaccinated and non-vaccinated chicks of the same age and exposed to the same environmental conditions were regarded as the best criteria for evaluating the effect of vaccination. Accordingly, each group of chicks as weighed when placed in the brooder and periodically thereafter for as long as it could be maintained as a unit. An accurate account was kept of birds that died or were removed from a group for other reasons.

Trial 1 (Farm A). A COMPARISON OF THE EFFECTS OF VACCINATION OF CHICKS AT THE AGES OF 1 AND 27 DAYS

Three groups of approximately 300 male chicks of nearly equal average weight were used in this trial. Group 1 was vaccinated at the age of one day, group 2 at the age of 27 days, and group 3, the controls, were not vaccinated. The chicks were weighed when placed under the brooder and on the 27th and 55th days, after which it was impossible to obtain observations and data concerning them.

As shown in table I, on the 27th day the average weights of vaccinated group 1 and none-vaccinated (up to this time) group 2 were nearly equal, but significantly (16.8-19.0 gm) less than
control group 3. The mortality in the three groups thus far was not significantly different. A possible explanation for the retardation of growth of group 2 as compared with group 3 is that cecal coccidiosis, which was detected in all groups, five days later, had been present but not detected earlier in group 2. The same could also apply to Group 1, and, therefore, the data up to this point cannot be said to show that vaccination at the age of one day had, in itself, retarded growth in this group.

Table I—Trial 1, form A. A comparison of weight gains and mortality of chicks vaccinated at the ages of 1 and 27 days with those of non-vaccinated controls.

<table>
<thead>
<tr>
<th>Group</th>
<th>Age When Vaccinated</th>
<th>Birds</th>
<th>Average Weight and Percentage of Mortality at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 Day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weight (gm)</td>
</tr>
<tr>
<td>1</td>
<td>1 day</td>
<td>270</td>
<td>45.6</td>
</tr>
<tr>
<td>2</td>
<td>27 days</td>
<td>297</td>
<td>45.6</td>
</tr>
<tr>
<td>3</td>
<td>Controls</td>
<td>300</td>
<td>44.3</td>
</tr>
</tbody>
</table>

Note: Cecal coccidiosis (E. tenella) appeared in all groups on the 32nd day.

Cecal coccidiosis was recognized in all groups on the 32nd day. All were given 40 per cent milk mash for five days and the litter changed. The disease dealt much more harshly with the day-old vaccinated chicks of group 1 and those of group 2 vaccinated at 27 days than with the non-vaccinated controls of group 3, as was indicated by differences in weight gains and mortality up to 55 days. The birds of group 1 averaged 135.7 gm (20 per cent) less than the controls, those of group 2, 30 gm (5.5 per cent) less than group 1 and 165 gm (24.3 per cent) less than the control group. The mortalities of 12.2 per cent, 5 per cent and 2 per cent, respectively, for the three groups give additional evidence that the non-vaccinated controls had greater resistance to cecal coccidiosis than those which had been vaccinated.

Comparing the two vaccinated groups on the basis of weight gains, group 2 appeared to be more severely affected than group 1, and on the basis of mortality, group 1 more severely than group 2. It is impossible to evaluate truly the relative importance of these differences at this stage. It would appear, however, that group 2, which was subjected simultaneously to vaccination and coccidial infection, exhibited as much, if not more,
vitality and resistance to the infection as group 1, which had been vaccinated a month earlier. It is unfortunate that removal from the brooder houses to open range and mixing of the groups precluded additional observations after the eighth week.

**TRIAL 2 (FARM A). A COMPARISON OF WEIGHT GAINS AND MORTALITY OF CHICKS VACCINATED AT THE AGE OF 1 DAY WITH THOSE OF NON-VACCINATED CONTROLS TO THE AGE OF 10 WEEKS**

At the conclusion of trial 1, three additional groups of day-old chicks were made available for further experiments on farm A. Two groups, comprising 298 and 300 chicks, respectively, were vaccinated when one day old; the third group of 265 chicks constituted the non-vaccinated controls. Each of the three groups was made up of male chicks from the same source as those of trial 1. Weights were taken on the 1st, 13th, 28th, 42nd and 70th days. From the data presented in table II, it will be observed that at 13 days, the average weight of the vaccinated birds slightly exceeded that of the controls. During the third and fourth weeks, the vaccinated birds showed a partial inhibition of weight gains which were 8 per cent less than those of the controls at the 28th day and 4.8 per cent less at the 42nd day. At the 70th day, the average weight of the vaccinated birds slightly exceeded that of the controls. This latter difference in weight can perhaps be accounted for by the fact that chick bronchitis was present in all groups between the 55th and 70th days. This infection was most severe in group 2, which had previously exhibited the greatest retardation of weight gains, causing the loss of 6 per cent more birds among the vaccinated than among the controls, and thereby presumably removed from the former the smaller and less resistant chicks which, if present at the final weighing, would have decreased the average weight. These data lend support to previous observations that the rate of growth and resistance to disease of chicks are adversely affected by vaccination at the age of one day. While comparison of the post-vaccination mortality with that of the controls may have indicated a significant difference in relative resistance to disease, the vigor of the surviving birds at 70 days was apparently equal.

**TRIAL 3 (FARM B). FOWL-POX VACCINATION OF CHICKS AT THE AGES OF 1, 13 AND 28 DAYS COMPARED ON THE BASIS OF WEIGHT GAINS AND MORTALITY WITH NON-VACCINATED CONTROLS**

On January 18, 1936, five groups of from 811 to 816 day-old chicks were placed on experiment on farm B. These were straight-run chicks and were the progeny of pullorum disease-
A comparison of the weight gains and mortality of chicks vaccinated at the age of 1 day with those of non-vaccinated controls to the age of 10 weeks.

<table>
<thead>
<tr>
<th>Age of Birds when Vaccinated (1 day)</th>
<th>Average Weight (gm)</th>
<th>Percentage of Mortality (%)</th>
<th>Average Weight (gm)</th>
<th>Percentage of Mortality (%)</th>
<th>Average Weight (gm)</th>
<th>Percentage of Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>298</td>
<td>3.6</td>
<td>244.4</td>
<td>5.0</td>
<td>442.3</td>
<td>6.3</td>
</tr>
<tr>
<td>1 day</td>
<td>300</td>
<td>3.0</td>
<td>251.3</td>
<td>3.0</td>
<td>421.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Controls</td>
<td>265</td>
<td>3.4</td>
<td>288.0</td>
<td>3.4</td>
<td>454.2</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Note: Chick bronchitis prevalent in all groups between the ages of 55 and 70 days.
free flocks. Groups 1 and 2, each comprising 813 chicks, were vaccinated when one day old, as they were taken from the delivery boxes. Group 3 (816 chicks) was vaccinated when 13 days old; group 4 (811 chicks) was vaccinated when 28 days old, and group 5 (811 chicks) was left as the non-vaccinated control group. Daily mortality and feed consumption records were maintained for each group. At the age of 13 days (table III-A), when group 3 was vaccinated, the average weight of all non-vaccinated chicks (groups 3, 4 and 5) was essentially the same and exceeded that of the day-old vaccinated groups by 9.3 per cent. At the age of 23 days, the average weight of day-old vaccinated groups 1 and 2 was 8.4 per cent, and that of group 3 (10 days after vaccination) 4.6 per cent less than the non-vaccinated controls.

On the 40th day, groups 1 and 2 had shown an acceleration of growth and had approached to within 3 per cent of that of the controls. At the same time, the 27th day after vaccination of group 3 and the 12th day after vaccination of group 4, the former weighed 5.7 per cent less and the latter 2.1 per cent less than the non-vaccinated controls. A comparison of the deviation from normal growth trends during comparable post-vaccination periods indicates that the systemic reaction following vaccination at the ages of 13 or 28 days was of slower onset and much less severe than that observed in the day-old vaccinated groups. There was no essential difference in mortality between the vaccinated and the control groups to the age of six weeks. It should be pointed out that group 2 contained a number of weak chicks which died during the first week, after which the mortality in this group was proportionate to that of the others.

During the seventh week, all of the vaccinated groups began to show a perceptible increase in mortality and, according to the owner, appeared to be slightly "off condition," which he attributed to crowding. All birds were weighed on the 48th day and the males were removed from each of the five groups and from the experiment. At this time, it was determined that an acute infection with coccidia (Eimeria tenella) was present in all groups. It is probable that this previously undetected infection was the factor responsible for the downward deviation of weight gains in the vaccinated groups during the seventh week and more particularly in group 4, in which coccidiosis occurred simultaneously with the systemic post-vaccination reaction. It was apparent that the vaccinated groups had not maintained weight
TABLE III-A—Trial 3, Farm B. A comparison of the weight gains and mortality of chicks vaccinated at the ages of 1, 13, and 28 days with those of non-vaccinated controls.

<table>
<thead>
<tr>
<th>AGE WHEN VACCINATED</th>
<th>13 DAYS</th>
<th>23 DAYS</th>
<th>48 DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIRDS</td>
<td>NUMBER</td>
<td>WEIGHT (GM)</td>
<td>MORTALITY (%)</td>
</tr>
<tr>
<td>Controls</td>
<td>437</td>
<td>1015.5</td>
<td>314.2</td>
</tr>
<tr>
<td>1 day</td>
<td>813</td>
<td>866.8</td>
<td>2.2</td>
</tr>
<tr>
<td>1 day</td>
<td>813</td>
<td>866.8</td>
<td>2.2</td>
</tr>
<tr>
<td>13 days</td>
<td>816</td>
<td>820.5</td>
<td>5.8</td>
</tr>
<tr>
<td>13 days</td>
<td>816</td>
<td>820.5</td>
<td>5.8</td>
</tr>
<tr>
<td>28 days</td>
<td>811</td>
<td>926.2</td>
<td>2.9</td>
</tr>
<tr>
<td>28 days</td>
<td>811</td>
<td>926.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Controls</td>
<td>811</td>
<td>933.8</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Note: Males removed on 48th day. Acute coccidiosis appeared on 48th day.

TABLE III-B—Trial 3, Farm B. A comparison of the weight gains and percentage of mortality or culls in pullets from groups vaccinated at the ages of 1, 13, and 28 days, with those of non-vaccinated controls between the ages of 48 and 100 days.

<table>
<thead>
<tr>
<th>AGE WHEN VACCINATED</th>
<th>63 DAYS</th>
<th>99 DAYS</th>
<th>100 DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIRDS</td>
<td>NUMBER</td>
<td>WEIGHT (GM)</td>
<td>MORTALITY (%)</td>
</tr>
<tr>
<td>Controls</td>
<td>437</td>
<td>1015.5</td>
<td>314.2</td>
</tr>
<tr>
<td>48 days</td>
<td>437</td>
<td>314.2</td>
<td>3.2</td>
</tr>
<tr>
<td>48 days</td>
<td>437</td>
<td>314.2</td>
<td>3.2</td>
</tr>
<tr>
<td>1 day</td>
<td>410</td>
<td>322.2</td>
<td>6.3</td>
</tr>
<tr>
<td>1 day</td>
<td>410</td>
<td>322.2</td>
<td>6.3</td>
</tr>
<tr>
<td>13 days</td>
<td>358</td>
<td>307.8</td>
<td>2.5</td>
</tr>
<tr>
<td>13 days</td>
<td>358</td>
<td>307.8</td>
<td>2.5</td>
</tr>
<tr>
<td>28 days</td>
<td>380</td>
<td>396.5</td>
<td>3.7</td>
</tr>
<tr>
<td>28 days</td>
<td>380</td>
<td>396.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Controls</td>
<td>387</td>
<td>345.2</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Note: Males removed on 48th day. Acute coccidiosis appeared on 48th day.

(437)
gains proportionate to non-vaccinated controls when subjected to adverse conditions.

With the removal of the males, the observations were continued on the pullet population of the respective groups (table III-B). The average weight of the pullets of the four vaccinated groups was 10.1 per cent less than that of the controls on the 48th day. During the two-week period between the ages of 48 and 63 days, the vaccinated groups showed increasing numbers of culls which were removed from the flock. Their average weight and percentage as compared with the control group give a rather accurate index of the vitality of the birds in the respective groups. It will be observed that the average weight of the culls at nine weeks was approximately that of the group averages three weeks earlier. Although the percentage of culls in groups 3 and 4, vaccinated at 13 and 28 days, respectively, equalled or slightly exceeded that of the day-old vaccinated groups, the percentage of mortality in the former was very much less. If we were to consider the merits or demerits of vaccination at the various ages solely on the basis of total mortality and percentage of culls as compared with non-vaccinated controls, vaccination of chicks younger than four weeks would appear to be contraindicated and vaccination of day-old chicks discredited.

The vitality of the surviving birds as they approached maturity was a matter of no less importance, however. Although the percentage of mortality and culls in the vaccinated groups was unusually high, the surviving pullets, particularly those of the day-old vaccinated groups, were vigorous, with average weights that approached or even exceeded those of the controls. The date of first egg and the rate of lay were approximately the same in all groups, but, with the onset of production, the mortality in the non-vaccinated control group has exceeded that of the vaccinated groups by a 2 to 1 ratio. After being in production for a period of five months, the control pullets are, in the opinion of the owner, the inferior of the five groups.

**Trial 4 (Farm B.) Fowl-Pox Vaccination of Chicks at the Ages of 1, 21 and 42 Days**

On February 15, 1936, 1,998 day-old, sexed pullet chicks on farm B were divided into three groups, 6, 7 and 8. As in trial 3, these chicks were the progeny of pullorum disease-free breeding stock. Seven hundred chicks, designated as group 6, were vaccinated at the age of one day; 600 chicks (group 7) at 21 days, and 698 chicks (group 8) at 42 days of age. The data
<table>
<thead>
<tr>
<th>Group</th>
<th>No. of W.G. (gm)</th>
<th>No. of Mort.</th>
<th>Mort. (%)</th>
<th>W.G. (gm)</th>
<th>Mort. (%)</th>
<th>W.G. (gm)</th>
<th>Mort. (%)</th>
<th>No. of Birds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>66</td>
<td>6.36</td>
<td>43</td>
<td>5.88</td>
<td>38</td>
<td>6.66</td>
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</tr>
<tr>
<td>2</td>
<td>108</td>
<td>80</td>
<td>7.41</td>
<td>49</td>
<td>6.94</td>
<td>43</td>
<td>8.57</td>
<td>7</td>
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<tr>
<td>3</td>
<td>135</td>
<td>103</td>
<td>7.61</td>
<td>58</td>
<td>6.93</td>
<td>47</td>
<td>9.56</td>
<td>8</td>
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<tr>
<td>4</td>
<td>162</td>
<td>124</td>
<td>7.64</td>
<td>70</td>
<td>7.45</td>
<td>50</td>
<td>11.28</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>189</td>
<td>148</td>
<td>7.86</td>
<td>79</td>
<td>8.56</td>
<td>59</td>
<td>12.89</td>
<td>10</td>
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</tbody>
</table>

**Average Weight and Percentage of Mortality at Ages of 1, 3, and 4 Days**

TABLE 1A—Tabel 1B. A comparison of the weight gains and percentage of mortality of chickens vaccinated at the age of 1, 3, and 4 days.
concerning these are given in table IV. At the 13th day, the average weight of group 6 chicks was 5.6 per cent less than that of the non-vaccinated chicks of groups 7 and 8. This difference in weight had increased to 7.7 per cent on the 21st and to nearly 12 percent on the 30th day, and was still 8.9 per cent on the 42nd day.

Prior to vaccination at the age of 21 days, the population of 581 chicks of group 7 was increased to 631 by the addition of 50 chicks from group 8. The average weight of group 7, which, at the time of vaccination on the 21st day slightly exceeded that of the controls, was 4.7 per cent less than that of the controls on the 9th day and 5.5 per cent less on the 21st day after vaccination. It will be noted that, as in trial 3, vaccination of day-old chicks caused a systemic reaction of sufficient intensity and duration to result in a marked retardation of growth and increased mortality. In order to relieve the crowded condition of the pens, groups 6, 7 and 8 were subdivided at the age of six weeks.

Group 6 was continued as 6-A after the removal of 190 culls which showed a 34.5 percent loss in normal weight gains. These culls (group 6-B) were given identifying leg-bands and maintained in a unit with 176 culls (group 7-B) from group 7. It should be observed that the culls of group 7 carried more weight and appeared to possess more vigor than those of group 6. Groups 8-A and 8-B, representing the population of group 8, were vaccinated at the age of 42 days. Six days later, definite evidence of acute coccidiosis was noted in each of these groups. The culls of groups 6 and 7 showed a mortality of more than 3 per cent four days after the appearance of coccidiosis.

The relative vigor of the cohabiting groups of culls from groups 6 and 7 is reflected in the subsequent mortality which was 48 per cent in group 6-B as compared with 10 per cent in group 7-B during the following month. During the same interval, representing the period of post-vaccination reaction in groups 8-A and B, these groups suffered a mortality of 13 per cent. This mortality, while high, was not excessive as compared with mortalities during the same period of 9.4 per cent and 6.8 per cent, respectively, in the more vigorous selected birds of groups 6-A and 7-A which had been vaccinated earlier. In this, as in the previous trial, the average weight of the survivors, after 100 days, of the day-old vaccinated group, exceeded that of those vaccinated at the other early-age periods inasmuch as only the most vigorous birds had survived a mortality which reached 30.3 per cent up to the age of 15 weeks.
The farm records (not including those of the culls of groups 6-B and 7-B) show that the pullets of group 6 came into lay about two weeks earlier and to date have maintained a higher production rate with slightly less mortality than those birds which were vaccinated at the ages of 21 and 42 days. On the basis of chicks purchased, the percentage of producing pullets in the latter groups is still much higher than in the former.

**TRIAL 5 (FARM B). FOWL-POX VACCINATION OF GROUPS OF CHICKS AT THE AGES OF 1, 75, 89, 103 AND 117 DAYS**

Two thousand one hundred fifteen day-old female and 101 pedigreed male chicks were used for an experiment which was designed to compare the results of day-old vaccination with those of vaccination at age periods of from eleven to 17 weeks, the age range at which the owner had previously vaccinated with what he considered as satisfactory results.

Four hundred three sexed pullets and 101 pedigreed male chicks, designated as group 9, were vaccinated when one day old. For convenience in brooding and handling, the chicks which were not vaccinated at this time were maintained as two groups until the age of 40 days, when they were subdivided into four groups, designed as 10, 11, 12 and 13, with populations of 392, 366, 373 and 381 chicks, respectively. The mortality charged to each of these four non-vaccinated groups up to the 40th day was their proportionate share of the total 40-day mortality of the original group. Ten days after vaccination, at the age of one day, the average weight of group 9 exceeded that of the controls.

This apparent lack of evidence of a systemic reaction up to this time may have been due to either one or both of two factors, namely, that 20 per cent of these chicks were males and may have increased in weight enough more than the pullets to affect materially the weight average of the group; and secondly, that this group was less crowded than the non-vaccinated groups and, therefore, made faster growth. At ten days and until the 36th day, the vaccinated and control groups showed no essential difference in mortality. On the 36th day, each of the groups showed evidence of acute coccidiosis, with a prompt increase in mortality as indicated four days later, when group 9 and the two pens of non-vaccinated chicks (groups 10, 11, 12 and 13) showed a mortality increase of 5.8 per cent, 1 per cent and 4.2 per cent, respectively.

Approximately 30 per cent of the mortality in combined groups 12-13, however, was due to cannibalism and was a reason for their immediate subdivision. On the 40th day, the average weight
of the day-old vaccinated group was 8.4 per cent less than that of the non-vaccinated controls. The comparative vitality of the vaccinated and non-vaccinated chicks is reflected in the mortality, following the onset of coccidiosis which, between the 40th and 73rd days, caused a mortality of 18 per cent in the vaccinated as compared to less than 1 per cent in the non-vaccinated groups.

Comparative weight gains, showing an average of 681.5 gm for the controls and 850.7 gm for the vaccinated birds, indicate that, although the coccidial infestation had not resulted in any appreciable mortality, it had caused a definite inhibition of weight gains. At the age of 73 days, 285 of the more vigorous birds from each of the non-vaccinated groups were transferred to laying pens. The number of birds classified as less vigorous was, therefore, dependent upon the respective group population of that date. After the removal of 76 pedigreed males and 25 culls, 240 pullets remained in the laying pen of group 9. These birds were as vigorous as those of the other groups but the mortality had been excessive.

The birds of group 10 were vaccinated at the age of 75 days. Their average weight gain during the ensuing two-week period was 69.2 gm as compared to a 165.4-gm average for all non-vaccinated birds, a difference of approximately 12 per cent. This difference was slowly overcome during the next four weeks and the average weight of this group exceeded all of the other groups when the last weights were procured on the 152nd day.

Group 11, comprising 285 birds, was vaccinated at the age of 89 days. At vaccination, the average weight of the birds in this group was slightly above that of the non-vaccinated controls. Unfortunately, we were unable to procure the weight of this group on the 14th day after vaccination, but the average weight at the 4th and 9th weeks after vaccination indicates definite subnormal trends.

Two hundred eighty-three birds of group 12 were vaccinated at the age of 103 days. Since their selection 30 days previously, the average weight of these birds had exceeded that of the other groups. Nevertheless, these birds suffered a severe post-vaccination shock, as was indicated by a sharp retardation of growth during the first 14 days of the post-vaccination period. However, at the last weighing on the 152nd day, the average weight of this group equalled or exceeded that of any other.

Group 13, comprising 283 birds, was vaccinated at the age of 117 days. At this time, the average weight of the birds was from 24 to 92 gm greater than that of any other group. When
Table V—Trial 5, farm B. Comparison of weight gains and mortality of chickens vaccinated at the ages of 1, 75, 89, 103 and 117 days.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>AGE WHEN VACCINATED (DAYS)</th>
<th>BIRDS</th>
<th>WGT. (GM)</th>
<th>MORT. (%)</th>
<th>WGT. (GM)</th>
<th>MORT. (%)</th>
<th>WGT. (GM)</th>
<th>MORT. (%)</th>
<th>NO.</th>
<th>WGT. (GM)</th>
<th>WGT. (GM)</th>
<th>MORT. (%)</th>
<th>WGT. (GM)</th>
<th>MORT. (%)</th>
<th>WGT. (GM)</th>
<th>MORT. (%)</th>
<th>AVERAGE WEIGHT AND PERCENTAGE OF MORTALITY AT 10 DAYS 40 DAYS 73 DAYS</th>
<th>AVERAGE WEIGHT AND PERCENTAGE OF MORTALITY OF SELECTED PULLETS AT 89 DAYS 103 DAYS 117 DAYS 152 DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>1 day</td>
<td>504</td>
<td>95 5 1 78</td>
<td>250 1 7 54</td>
<td>850 7 25 4</td>
<td>25</td>
<td>318 4</td>
<td>928 9</td>
<td>836 3</td>
<td>0 83</td>
<td>1086 2</td>
<td>5</td>
<td>1403 4.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10–11</td>
<td>1 day</td>
<td>504</td>
<td>95 5 1 78</td>
<td>250 1 7 54</td>
<td>850 7 25 4</td>
<td>25</td>
<td>318 4</td>
<td>928 9</td>
<td>836 3</td>
<td>0 83</td>
<td>1086 2</td>
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<td>1403 4.16</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>75 days</td>
<td>392</td>
<td>284 3</td>
<td>714 8 3 3</td>
<td>93</td>
<td>609 9</td>
<td>285</td>
<td>766 5*</td>
<td>835 7</td>
<td>0 35</td>
<td>1095 1</td>
<td>75</td>
<td>1505 2.46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>11</td>
<td>89 days</td>
<td>366</td>
<td>284 3</td>
<td>714 8 3 3</td>
<td>93</td>
<td>609 9</td>
<td>285</td>
<td>766 5*</td>
<td>835 7</td>
<td>0 35</td>
<td>1095 1</td>
<td>75</td>
<td>1505 2.46</td>
<td></td>
<td></td>
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<tr>
<td>12</td>
<td>89 days</td>
<td>807</td>
<td>284 3</td>
<td>714 8 3 3</td>
<td>93</td>
<td>609 9</td>
<td>285</td>
<td>766 5*</td>
<td>835 7</td>
<td>0 35</td>
<td>1095 1</td>
<td>75</td>
<td>1505 2.46</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>12</td>
<td>103 days</td>
<td>373</td>
<td>266 4</td>
<td>666 77 34</td>
<td>97</td>
<td>559 1</td>
<td>285</td>
<td>703 6</td>
<td>825 0</td>
<td>—</td>
<td>1183 1</td>
<td>0.5</td>
<td>1503 0.05</td>
<td></td>
<td></td>
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<tr>
<td>13</td>
<td>117 days</td>
<td>381</td>
<td>266 4</td>
<td>666 77 34</td>
<td>97</td>
<td>559 1</td>
<td>285</td>
<td>703 6</td>
<td>825 0</td>
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<td>1503 0.05</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: Cecal coccidiosis in all groups on 38th day.

*Vaccinated.
weighed five weeks later (152 days), the average weight was from 13 gm to 115 gm less than that of the other groups. This marked slowing up of weight gains indicated that a rather severe and prolonged systemic reaction had resulted from vaccination.

In considering the post-vaccination reaction results in these older age groups as compared with the day-old vaccinated birds, it should be borne in mind that over 25 per cent of the original number had been culled and only the more vigorous appearing birds had been vaccinated. Despite their pre-vaccination stamina as indicated by weights in excess of the normal average, each succeeding group showed a more pronounced vaccination shock, as was indicated by the degree and duration of the inhibition of normal increase in weight. The mortality in all groups of selected pullets was nominal, but was highest in group 9, which had been vaccinated at one day of age. Just what the effects of vaccination would have been had the groups been maintained in their entirety, without removal of less vigorous birds, is problematic. It may be assumed that the evidence of post-vaccination shock might have been even more pronounced.

IMMUNITY STUDIES

During the past two years, representative birds have been selected for immunity tests from laboratory and field trial groups at variable periods up to 18 months after vaccination. These birds were exposed to fowl-pox by cage contact with artificially infected birds. Their resistance to infection was compared with that of similarly exposed non-vaccinated controls. Studies thus far have indicated that a satisfactory vaccination take in day-old chicks results in an immunity sufficient to protect against fowl-pox infection by contact exposure for a period of at least 18 months (the longest tested). These immunity test results are supported by field observations that chicks, vaccinated at the age of one day or later, have not become infected when exposed to chicken-pox on poultry farms.

SUMMARY

Fowl-pox virus vaccination of day-old chicks resulted in a systemic reaction sufficient to cause a temporary inhibition of growth gains and a lowering of vitality for variable periods thereafter. During this period of lowered resistance, exposure to unfavorable environment or concurrent disease may result in an excessive mortality. This was exemplified in these trials by the fact that infection with acute cecal coccidiosis caused a nominal loss of from 2 to 6 per cent in non-vaccinated controls, but
resulted in a mortality of from 10 to 30 per cent in groups of chicks vaccinated at the age of one day. It should be recalled that this mortality occurred under favorable brooding conditions and, with the exception of chick bronchitis in trial 2, in the absence of any other concurrent disease.

The data also indicate that a systemic reaction followed vaccination at the ages of 13, 31, 28 and 42 days, but that it was of slower onset and progressively less severe as the age increased than that observed in the day-old vaccinated groups. This systemic reaction in these older groups was evidenced more by retardation of growth than by excessive mortality when the chicks were exposed to unfavorable conditions, such as cecal coccidiosis. Vaccination of groups of birds between the ages of six and eleven weeks was not included in these comparative studies because the data of previously reported experiments \(^1\) have indicated that vaccination during this period does not result in a perceptible shock.

The data of trial 5 confirm the previously reported observation \(^2\) that fowl pox virus vaccination of birds after the twelfth week, even though they exhibit evidence of high vigor, is followed by a systemic reaction which causes a temporary inhibition of growth gains.

If the practicability of chick vaccination was evaluated solely on the basis of total mortality and percentage of culls among vaccinated birds during the growing period as compared with non-vaccinated controls, the vaccination of chicks younger than four to six weeks would appear to be contraindicated and vaccination of day-old chicks discredited. The vitality of surviving birds as they approach maturity, however, is a matter of equal importance. Although the percentage of mortality and culls in groups of chicks vaccinated when between one day and six weeks old was unusually high, the surviving pullets, those of the day-old vaccinated groups particularly, were vigorous and their average weight approached or exceeded that of the controls, at the age of 4 months.

With the onset of production, however, the mortality of the non-vaccinated controls (farm B) exceeded that of the vaccinated groups by a 2 to 1 ratio. These observations have caused the owner to conclude that the controls, at the age of ten months, are inferior to those vaccinated as chicks. This raises the question of whether the chicks lost as a result of early age vaccination may not have been the weaker members of the flock which would not have survived long enough after attaining the age of
production to have returned a profit to the owner and, there-
fore, should have been removed early in life. The answer to this 
question might be obtained if separate records of each of the 
groups of birds in this experiment could be secured throughout 
the first year of lay, which, unfortunately, cannot be done. If 
we find it possible to arrange for future studies of chick vaccina-
tion, an effort will be made to provide for observation over a 
longer period than has been done in the past.

ACKNOWLEDGMENTS

To J. Murray Davison, Assistant County Farm Advisor, U. S. 
D. A., Santa Rosa, California, and E. R. Temperli, Rio Linda, 
California, for their assistance and coöperation in obtaining 
some of these experiment data.

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PRESIDENT WISNICKY: I wish to thank you, Dr. Roynton, for com-
ing before this body and reading abstracts from that paper. The 
complete paper will be printed in the proceedings.

Dr. Van Es is here now and it gives me great pleasure to announce 
Dr. Van Es to discuss the subject of "Fowl Cholera."

FOWL CHOLERA

By L. VAN ES, Lincoln, Neb.

Department of Pathology, University of Nebraska

I am sorry that I come before you on this subject without a 
prepared manuscript. I received notice of the fact that it was 
desired that I discuss this subject when it was already too late 
to be writing long articles, so if you will bear with me, I shall 
make a few remarks on some of the more outstanding features 
of fowl cholera which we have met with in experimental work 
and field observation we have made on the subject.

I should like, first of all, to say something about the cause 
of fowl cholera and some of its peculiarities without going into 
any bacteriological detail. We find that the fowl cholera bacillus 
has a marked invasive power. We have seen in the cases where 
we injected animals with fowl cholera bacilli that all the birds
were dead in 24 hours and that 24 hours after that the birds that were exposed to those injected animals were involved in a rather marked outbreak. We all know that, but a thing less known is the fact, aside from this invasive power, that it has another tendency and that is to localize itself in parts of the body; so it is not uncommon, in postmortem examinations of fowls taken from flocks where fowl cholera was apparently not a problem, to find lesions in which the fowl cholera bacillus is localized—notably bruises on the breast bone. It is very often found that cultures are endowed with a high degree of pathogenicity. We have always found that the organism recently removed from the bird, whether the fowl presents the septicemic form of the disease or not, shows a marked capacity for disease production, but in the case of cultures this pathogenicity has disappeared in a short time and, curiously, the same culture three or four months later, would again kill the animals. Why, I do not know. Some things, you know, are pretty well on the borderline between knowledge and faith and I hate to climb across that borderline and probably get my shins kicked.

Another point to which I wish to call attention is that we have frequently found the cholera bacillus in the eggs of the bird. Not once or twice, but frequently, yet we have never seen, up to this time, fowl cholera in chicks of less than two months old and I think I could safely say, three or four months, but I want to be safe and not overestimate.

It has also been found that the organism is apt to persist in environmental situations outside of the animal body. I think that is true, although I have some doubt that it will exist very long outside of the animal body, but you have to reckon with it, particularly because of the birds dead with the disease that remain in the environment. After a fowl cholera outbreak, go back to the farm where it occurred and peep under the corn-crib or in the brush and you may find a dead bird and that supplies the organisms that will persist.

There is one observation that I can cite of our own and that is the thing that I am telling you about very largely. We found in yards, in fact two yards, in which cholera had been maintained for three years, that after the last bird was removed, within two weeks the disease had apparently disappeared from that environment. You say, "How do you know that?" Our method may be rather crude but I think we have a pretty accurate reactor agent on fowl cholera and that is the goose. In order to test the safety of that environment we put a flock of geese in
there and when the geese do not die we know the cholera is not there.

The dissemination of cholera from yard to yard and from farm to farm is often attributed to flying birds and to flies even. I want to say, on theoretical grounds at least, it can be accepted. We know that pigeons may be carriers. We know that practically every bird is susceptible to cholera to a greater or lesser degree, so the possibility is there. This is probably of rather rare occurrence and this pertains also to carrying by flies. It would seem that flies having access to the excreta of fowl involving disease would be a good means of transmission, yet I want to say that for three years we maintained cholera infection in yards in which we were studying the influences of environment on disease. We had two yards populated with 125 birds a piece, and these yards were placed in the midst of ten other yards—twelve yards, all in one encompassment—and we have never found the transmission of the disease from the cholera yard to the others, although those birds could rub noses. Ordinary chicken-wire fence proved to be a very effective barrier. Only when one transmits healthy birds from the infected yard to some of the other yards, as we did by mistake, will cholera spring up among those other birds.

On the other hand, our observation indicated that the introduction of adult birds, or any bird for that matter, I should say, to be inclusive, may precipitate an outbreak of cholera. We started an outbreak in our experiment yard by introducing birds we had injected with a drop of blood from a rabbit infected within 48 hours. Those injected birds were dead in 24 hours and 24 hours after that a hot outbreak of cholera was going. That is not always the case, because sometimes one does not get any such results and we do not know exactly why, but take it as one of the natural phenomena of cholera.

The conclusion is warranted that if the nature of an environment, that is, as far as sanitation is concerned, exercises any influence at all on fowl cholera morbidity, it is greatly overshadowed by the intensity and virulence of direct contact infection. We found, in maintaining flocks in different environments—one with a reasonable degree of sanitary provisions and one an ordinary farm yard—that morbidity and mortality ran almost parallel after an equal degree of exposure. So it is not surprising that outbreaks of fowl cholera so frequently follow the introduction of newly purchased birds, especially adult birds, a thing I shall not mention again but I recommend that it be kept in mind if we want to protect flocks against cholera because, with-
out any such introduction I think the risk of flocks becoming involved is relatively slight.

Outbreaks of fowl cholera are apt to assert themselves suddenly, causing a heavy mortality for a few days and then subside, either without further death losses or with the periodic occurrence of single cases in the course of several months. Cholera has a bad reputation and very often the flock-owners expect to lose the whole flock. However, most outbreaks are stopped before 30 or 40 per cent of the flock has been lost. There is no guarantee of that—it is just an observation. In some cases the outbreak comes suddenly to a stop without any further loss and then an outbreak will come to a stop and perhaps two or three or four months later, it will show up again until the losses amount to 60 or 80 per cent of the total of the birds.

We have come to the conclusion that in fowl cholera the infection-carrying fowl is of pivotal importance in the epizootiology of the disease. Such animals not only account for the appearance of the disease in hitherto exempt flocks, but also for the occurrence of isolated cases and flare-ups after the termination of the initial outbreak. On several occasions could certain phases of the earlier work of Webster, Pritchett, Hughes and Beaudette, at the Rockefeller Institute, be confirmed. In other words, we found frequently, when we made swabs from the nasal mucus of birds after they were exposed to cholera, that they harbored the fowl cholera bacillus. So we think that the carrying bird is the principal factor in the distribution and maintenance of cholera in a poultry population.

We have repeatedly checked up on fowls which came safely through one or more outbreaks and found the bacillus in their nasal mucus. Not uncommonly, but frequently, we make it a practice, when we close out the population, always to check up, checking fowl for fowl and each fowl has a rabbit by itself and the rabbit very commonly was dead in 24 hours after injection. This is not our discovery. It was worked out in 1930 at the Rockefeller Institute. Adequate and dependable measures of prophylaxis have thus far not been developed to the extent that they can be recommended with any degree of confidence. The vaccines and bacterins of commerce were tried in controlled experiments and were found to be totally worthless. In similar experiments with the alleged aggressions of the biologic trade, the results were not any better. Their use may even be accomplished by a distinct disadvantage. It was found that the aggressin-treated fowl showed a greater tendency to become
virus carriers than the non-treated controls. Examined one month after exposure to the virus, 50 per cent of the aggressin-treated birds still harbored the bacillus in the nasal mucus, whereas in the controls only 23.8 per cent showed the nasal mucus to be still infective. The use of a specific anti-serum made a slightly better showing, although not sufficiently marked to deserve any confidence whatever. In fourteen flocks, prior to serum treatment, not less than 642 birds had died of fowl cholera. One thousand eight hundred eighty-four birds were treated with doses of 5 to 8 cc of anti-cholera serum and 902 fowl were not treated with serum at all, and kept as controls. The treated birds, following the injections, showed a death-rate from cholera of 6.9 per cent and the controls 9.86 per cent, or only 3 per cent in favor of serum treatment.

In a number of these flocks a second treatment was given with about the same results. In the case of others, the owners became discouraged and disposed of their birds.

In the light of present-day evidence, it appears that the crux of the problem lies with the recognition and elimination of the healthy infection carriers among fowls to be added to a flock or among the survivors after an outbreak.

Certain attempts are being made in that direction but are not sufficiently advanced to permit conclusions as to the validity of any method in live stock sanitary practice.

This address, Mr. Chairman, is a rather broken-up one but includes the more essential features of what we found in our observations. It may answer the purpose of certain people, especially in this group, as it may set them thinking as to what cholera is like.

PRESIDENT WISNICKY: I think it can be said that Dr Van Es has given us the really essential information on fowl cholera.

That concludes the papers on the program. We have some committee reports yet to present to the membership. The remaining committee reports have already been acted upon by the Executive Committee so they will be read merely for the information of the membership. The first report is from the Committee on Legislation, by Dr. Westmorland.

. . . Dr. Westmorland read the report. . . .

REPORT OF COMMITTEE ON LEGISLATION

DR. D. E. WESTMORLAND, CHAIRMAN, Frankfort, Ky.

Dr. Charles E. Cotton, St. Paul, Minn. Dr. Wm. Moore, Raleigh, N. C.
Dr. R. W. Smith, Concord, N. H.

During the past year, several states have passed legislation or have promulgated regulations for the control of the movement of live stock
through "local sales yards." These efforts are a step in the right direction and should be encouraged in the interest of the control of live stock diseases.

The information at hand, indicates that in a majority of the states in which these laws and regulations are in force, supervision is inadequate. This is due in most instances to the lack of funds to maintain the proper inspections. However, we think that in the future a studied cooperative effort should be made by the live stock sanitary officials of the various states, to encourage uniformity in these laws and regulations as far as may be consistent with local conditions.

PRESIDENT WISNICKY: Next we have a report of the Committee on Resolutions. The Chairman has left those resolutions with our Secretary who will read them to you.

. . . Dr. Day read the resolution. . . .

REPORT OF COMMITTEE ON RESOLUTIONS

DR. M. JACOB, Chairman, Knoxville, Tenn.
Dr. D. M. Campbell, Chicago, Ill. Dr. H. E. Curry, Jefferson City, Mo.
Dr. Ward Giltner, East Lansing, Mich.

RESOLUTION 1

WHEREAS, There is pending before the Foreign Relations Committee of the United States Senate an agreement executed by officials of a foreign country and the United States, and

WHEREAS, That country harbors within its boundaries infectious diseases of live stock, and particularly foot-and-mouth-disease, which do not now exist in the United States, and

WHEREAS, Said agreement would modify the present embargo against that country which harbors foot-and-mouth disease within its borders and would permit importations of dressed meat products, and

WHEREAS, The importation of such products would seriously jeopardize the welfare of our live stock industry; therefore, be it

Resolved, That this Association go on record as vigorously opposing any modification of the existing federal laws governing the movement of live stock or live stock products from any foreign country harboring foot-and-mouth disease or any other transmissible animal disease of serious economic importance which does not now exist in the United States; and be it further

Resolved, That a copy of this resolution be forwarded to the chairman of the Foreign Relations Committee of the United States Senate and to the Secretary of State of the United States.

RESOLUTION 2

WHEREAS, The progress which, at great cost and sacrifice, has been made toward the control and eradication of animal disease in the United States may be protected and may continue uninterrupted, we urge that stringent regulations and restrictions be maintained to prevent infection of our domestic herds and flocks with contagious diseases now present in foreign countries; and

WHEREAS, Recognizing the rapid development and increasing use of auction or community sales in the movement of live stock, we recommend that adequate and specific uniform state laws and sanitary regu-
lations be enacted and enforced by the various states with respect to all such sales, for the purpose of protecting the live stock industry and more effectively controlling the spread of infectious diseases and that such present laws and regulations be made uniform, and simplified, as far as possible, in order to facilitate and promote efficiency in administration and enforcement with respect to interstate as well as intrastate movement; and

WHEREAS, In consideration of the importance of the live stock industry as a major phase of Agriculture, we urge and recommend the enactment of national legislation, either in the form of amendments to the present Packers and Stock Yards Act, or in the form of such new legislation as may be necessary to render effective and beneficial to live stock producers federal supervision of the movement of live stock through the channels of interstate commerce; and be it further

Resolved, That the Congress be urged to appropriate adequate funds at the coming session to make possible the carrying out of the provisions of this Resolution.

RESOLUTION 3

WHEREAS, Information as to the location, prevalence and rate of extension of disease among domestic animals is essential in formulating intelligent and effective plans for animal disease control; and

WHEREAS, Comprehensive information concerning the location, prevalence, seasonal incidence, source and extension of diseases of live stock can be obtained only through systematic reports by veterinary practitioners, field men, postmortem examinations and other dependable sources of information concerning the presence of diseases of live stock; and

WHEREAS, The Director of Agriculture of the State of Illinois has recently inaugurated a plan for the collection and compilation of data concerning live stock diseases from the licensed veterinarians of the state; therefore, be it

Resolved: That we endorse and commend the action of the Director of Agriculture of the State of Illinois in this matter; and be it further

Resolved: That we urge upon the directors of agriculture, the live stock sanitary authorities or other appropriate officials in all other states in which such information is not now being collected, the desirability and necessity for the collection and compilation of data concerning the occurrence, location, prevalence and economic importance of diseases of live stock in their respective states.

PRESIDENT WISNICKY: That concludes the reading of the resolutions as accepted by the Executive Committee. Now, will the Secretary read the report of the Committee on Policy?

. . . Dr. Day read the report. . . .

REPORT OF COMMITTEE ON POLICY

Dr. W. J. Butler, Chairman, Helena, Mont.
Dr. A. Eichhorn, Pearl River, N. Y. Dr. J. R. Mohler, Washington, D. C.
Dr. L. Van Es, Lincoln, Neb.

The policy of the United States Live Stock Sanitary Association has been outlined by previous committees, and the present committee has no desire to alter that policy.

We would suggest, however, that in the presentation of papers, special emphasis be given to practical application of known methods for the control of disease as submitted by competent authorities.

And we would further suggest to the Program Committee that a special time be set aside for the meeting of the Executive Committee
in order to avoid interfering with the attendance of members of the Executive Committee at the regular sessions of the Association. It is suggested that the committee chairmen consult with the Program Committee so that meetings of the various committees may not conflict with the sessions of the Association.

The report of the Committee on Tick Eradication was called for but was not read. It had been approved by the Executive Committee and is as follows:

REPORT OF COMMITTEE ON TICK ERADICATION

Dr. T. O. Booth, Chairman, Fort Worth, Texas

Dr. J. V. Knapp, Tallahassee, Fla. Dr. W. M. MacKellar, Washington, D. C.

Dr. W. K. Lewis, Columbia, S. C. Dr. Charles E. O’Neal, Jackson, Miss.

UNITED STATES DEPARTMENT OF AGRICULTURE

Bureau of Animal Industry

Washington, D. C.

Progress in Tick Eradication—July 1, 1906, to December 1, 1936

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Totals: 985 28 6 951 6 728,565 33,571 694,994 95

Area released December 1, 1936.................28,150 square miles.
No area requarantined December 1, 1936.
(309 square miles were released in Texas, June 1, 1936, making a total of 28,359 square miles released during calendar year 1936.)

TICK ERADICATION IN 1936

The systematic drive to eliminate the cattle fever tick from infested areas in the United States was continued throughout the year, the net
results for the season's work being a reduction of 28,160 square miles located in the states of Florida, Louisiana and Texas. This action is covered by B. A. I. Order 360, effective December 1, 1936, which order releases from federal quarantine two counties in Florida (De Soto and Seminole), eight counties and parts of two counties in Texas; and 22 parishes and parts of two parishes in Louisiana, or all of the area that remained in quarantine in that state. This order also continues the quarantine in four counties and parts of two counties in Florida; 24 counties and parts of four counties in Texas; and in the territory of Puerto Rico.

During the year, tick eradication in Florida, Louisiana and Texas continued to receive assistance by the allotment of funds made under the Emergency Relief Appropriation Act, and it was largely due to this assistance that the state of Louisiana was able to conduct a systematic eradication campaign this year in all of the remaining quarantined area in that state, resulting in Louisiana joining the list of states completely released from federal quarantine.

Reinfestations in the released area were not so numerous this season as reported a year ago. Those reported were found mostly in states adjacent to quarantined area, namely, Arkansas, Louisiana, Mississippi and Texas. The state of Georgia, in which reinfestation occurred a year ago, has again succeeded in joining the 100 per cent tick-free column.

PRESIDENT WISSICKY: This concludes the reports of the committees. The next order of business is the election of officers. We shall now have the report of the Nominating Committee, of which Dr. E. T. Faulder is the Chairman. Dr. Faulder, will you please make your report?

. . . Dr. Faulder read the report. . . .

ELECTION OF OFFICERS

DR. FAULDER: Mr. President, members of this Association. In accordance with the procedure of this organization, the United States Live Stock Sanitary Association, your Nominating Committee respectfully makes the following recommendations:

For President, Dr. R. W. Smith, Laconia, New Hampshire. For First Vice-President, Dr. D. E. Westmorland, Frankfort, Kentucky. For Second Vice-President, Dr. J. Leonard Axby, Indianapolis, Indiana. For Third Vice-President, Dr. H. D. Port, Cheyenne, Wyoming.

Mr. President, I ask the approval of these recommendations.

PRESIDENT WISSICKY: In order that we may keep this as democratic as possible, I wish to say that nominations from the floor may also be made for these respective offices. What is your pleasure in regard to the report of the Nominating Committee?

DR. C. C. HISEL: I move that the report be accepted and that the organization support the Committee's choice for the officers for this Association for the ensuing year.

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

DR. C. P. FITCH: I move that the Chair cast the unanimous ballot of this Association for each of the officers who have been recommended by the Nominating Committee.

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

INSTALLATION OF OFFICERS

PRESIDENT WISSICKY: I hereby cast the unanimous ballot of this Association for each of the officers presented to this Association by the Nominating Committee.
We shall install these officers now. If those who are in the vicinity of the men who have been elected will kindly escort each officer to the rostrum, we shall make the installation.

It is with great pleasure that I transfer the presidency to Dr. R. W. Smith, of New Hampshire. I transfer this high duty to you in the symbol of this gavel which represents both authority and responsibility.

DR. SMITH: Dr. Wisnicky and Members of this Association: I certainly consider this a great honor. I have been coming here attending the meetings I believe, since 1920 with one exception and I am satisfied that no man can contribute to this Association nothing to compare with the benefits which it bestows upon him if he so desires.

I shall endeavor, during my term of office, to render the same efficient service and administration as has my predecessor. I appreciate that I have something to shoot at but with the help of the Secretary-Treasurer and these gentlemen on my left, we shall endeavor to conduct the meetings of this Association so that you will not be ashamed of us. I thank you again for your support. (Applause)

DR. WISNICKY: We shall hear now from our newly-elected first vice-president, Dr. D. E. Westmorland.

DR. WESTMOORLAND: Dr. Wisnicky, Members of the Association: I appreciate this honor that you have conferred upon me and I wish to say that I shall try, at all times, in my humble way, to assist the President in carrying out the duties of his office. I thank you.

DR. WISNICKY: Now we come to our newly elected second vice-president, Dr. J. Leonard Axby.

DR. AXBY: Mr. President, Mr. President-elect, my friends: I do not know why I had this thought but the processes of mind are rather peculiar. Some way or other, as I stood there, I thought of my boyhood days when we used slates and pencils and we played the game of "tit-tat-toe." And through the association of ideas, I said to myself, last year I was "toe," this year I am "tat," so I certainly must be making some progress.

Now, I know that vice-presidents, other than the first vice-president, are to be seen and not heard but nevertheless, under the Constitution and By-laws, events can arise where they may, by virtue of necessity, be heard. If that condition should ever arise and I am called upon to act, I wish you to know I shall not forget these past years. I have felt my limitations very much, especially in view of the fact, that I, this year, along with others, have had a very pleasing experience in coming here and witnessing my and your friend Wisnicky in action as President. It was a very, very great pleasure to me, as I know it has been to you. Then to have him followed by the President-elect just now is still more pleasure. I will say to you that if anything should happen, I would do my very best to take his place in some measure.

I appreciate this honor. I wish you to know that on all occasions that are presented to me, and I do have a good many of them, I will not lose sight of the fact any place to make it known that I am a member of the A. V. M. A. and a member of the United States Live Stock Sanitary Association. When I do that I always try to impress my listeners what the units are that compose this whole United States Live Stock Sanitary Association of which you and I are so rightly proud. (Applause)

DR. WISNICKY: Now, just because this is the last vice-president, it does not mean that he is not one of the important ones. We shall hear now from Dr. H. D. Port, of Wyoming.

DR. PORT: Mr. President, fellow members: Dr. Axby just remarked that vice-presidents should be seen and not heard but apparently he
does not practice what he preaches. I wish to say that I consider this a real honor and I sincerely appreciate having the opportunity to serve as your third vice-president and to assure you further that I shall do everything in my power to assist the officers and help the Association in every way possible. (Applause)

... Dr. Wisnicky retired. ...

PRESIDENT SMITH: I think the next order of business is new business. Is there any new business to come before the meeting at this time? If not, a motion for adjournment is in order.

DR. A. E. CAMERON: I move that the meeting adjourn.

... The motion was seconded, put to a vote and carried, and the meeting adjourned at 2:40 o'clock. ...

AJOURNMENT
41st Annual Meeting
United States Live Stock Sanitary Association
Hotel La Salle, Chicago
December 1-2-3
1937